

THE RIVER PLAN  
NORTH REACH

RECOMMENDED DRAFT

NOVEMBER 2009



VOLUME 3A:  
NATURAL RESOURCES INVENTORY:  
RIPARIAN CORRIDORS AND WILDLIFE HABITAT



City of Portland Bureau of  
**Planning and Sustainability**  
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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 and along the Willamette River in Portland.

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 Willamette River corridor with a focus on the North Reach. Detailed inventory information for the Central and South Reaches will be developed in the future and documented in separate report volumes.

The following is a brief summary of the material contained in each chapter of this document:

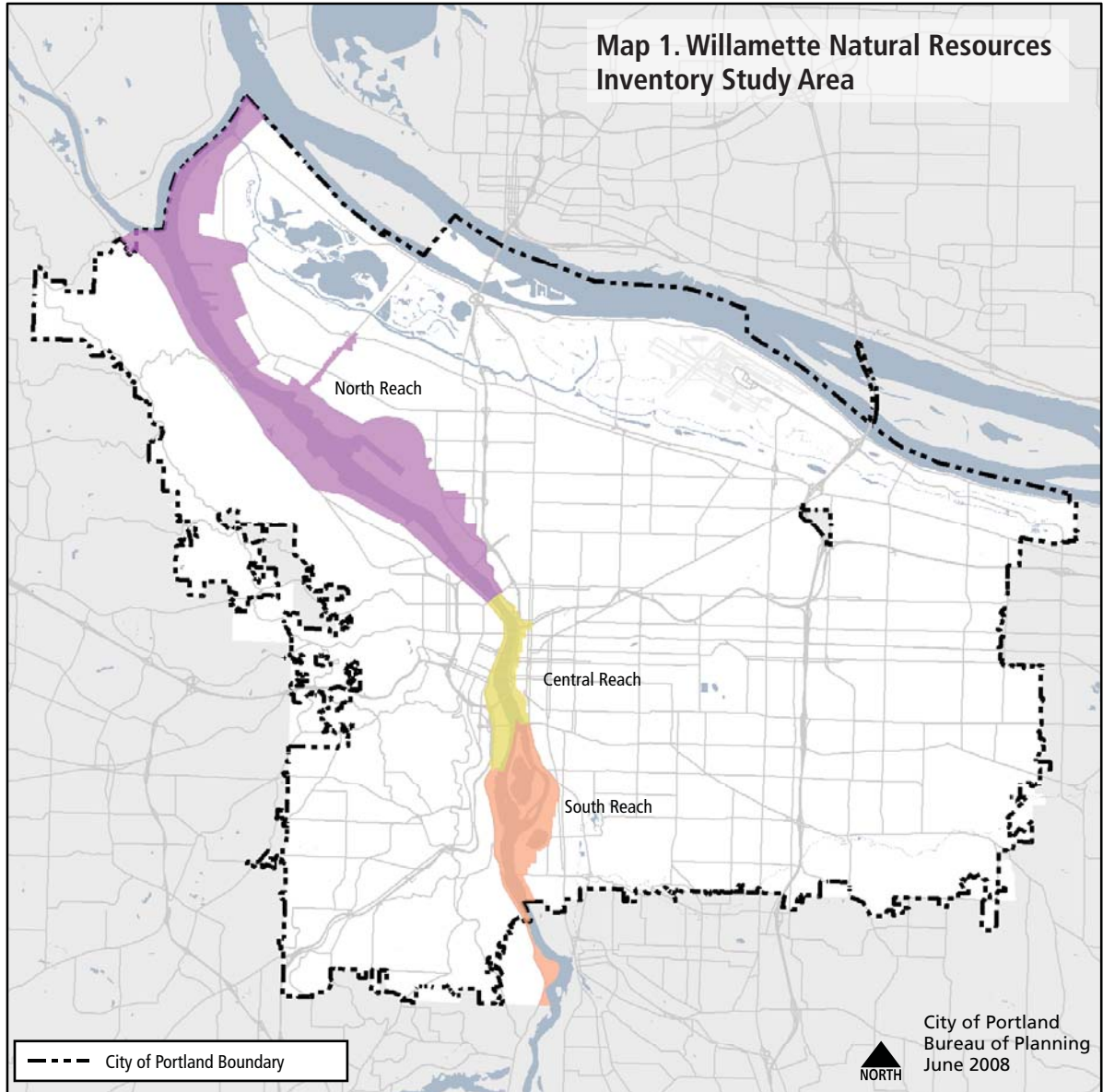
**Chapter 2: RELATIONSHIP TO FEDERAL, STATE AND REGIONAL REGULATIONS** — This chapter describes the regulatory context for the inventory.

**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 Willamette River Natural Resources Inventory.

**Chapter 4: THE WILLAMETTE RIVER NATURAL RESOURCES INVENTORY** — This chapter begins with a general overview of the Willamette River basin. Following the overview, a summary of Willamette River 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 North Reach of the Willamette River in Portland (the Central and South Reaches will be included in future volumes of the report). Finally, the North Reach is split into subareas called 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 invasive species and contamination, is also discussed. An evaluation of current riparian corridor functions and wildlife habitat is presented for each 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 to the Willamette River corridor in Portland. Such activities include implementing and updating city programs to manage natural resources, identifying priority areas for restoration, enhancement, and public acquisition, designing development and redevelopment projects, and meeting regional, state, and federal regulatory requirements.

Over the long term, this inventory can help the City achieve its River Renaissance Vision for 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 River Plan, including an update of the Portland's Willamette Greenway Program. 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 Willamette River channel as it flows northward through Portland to its confluence with the Columbia River. The inventory also includes lands adjacent or proximate to this portion of the river. The boundary of the inventory study area is shown on Map 1. The study area encompasses, and is somewhat larger than, the area currently contained within the City's Willamette Greenway Overlay Zones, and is generally coincident with the boundaries of the River Plan project currently underway.

For the purposes of planning, the River Plan and this inventory are divided into three reaches: North, Central and South Reach (see Map 1).

The North Reach includes 12 miles of the river, extending from the Broadway Bridge to the Columbia River. The North Reach is characterized by heavy industry through the Portland Harbor, river-dependent land uses, and significant natural resources set in the regional context of the Lower Columbia River and Tualatin Mountains.

The Central Reach extends from the Ross Island Bridge to the Broadway Bridge and is characterized primarily by commercial/mixed use development on the west side of the Willamette and industrial uses on the east side of the river. The Central Reach also contains downtown Portland, Waterfront Park, the inner eastside industrial area and the East Bank Esplanade.

The South Reach extends from the southern city limits to the Ross Island Bridge and is characterized primarily by commercial and residential uses, moorages and parks and open spaces such as Oaks Bottom, Powers Marine Park and Willamette Park. Ross Island provides both an important industrial site and an important natural resource area.

## Background

Starting more than 30 years ago, the City began developing natural resource inventories pertaining to portions of the current study area. The first Willamette River inventory was completed in 1975 for the Lower Willamette River Management Plan. It was the first of 10 inventories the City completed citywide to meet state land use planning goals. The Willamette inventory provided generalized information about relative wildlife habitat values.

The second Willamette River inventory, adopted by the City in 1986, provided more detailed information about specific habitat sites along the river, including information about existing conditions and potential restoration options. A Wildlife Habitat Assessment (WHA) methodology was used to document and rank existing conditions, and identify potential opportunities for habitat improvement. The inventory was divided into 24 segments or zones along the Willamette River in Portland. Each zone included anywhere from 2 to 14 habitat sites depending on the complexity of the zone. Highly ranked habitat sites received a high value (numeric) and were identified as Rank I, with lesser value habitat sites identified as Rank II, III, IV, or V. The 1986 inventory correlated directly to the area referred to as the Willamette Greenway, and has been used since 1987 as part of the Willamette Greenway Plan to provide guidance for protection and restoration opportunities along the river.

Both the 1975 and the 1986 Willamette River inventories were developed as the basis for the City's emerging Willamette Greenway program. The Greenway program was established primarily to meet requirements of State Land Use Planning Goal 15, Willamette Greenway. The program includes policies, design guidelines, overlay zone maps and regulations to meet multiple objectives along the Willamette River.

Between 1991 and 2002, the City adopted natural resource inventories for other areas in the city as part of a program to comply with State Land Use Planning Goal 5. The following documents address small portions of the inventory study area addressed in this report:

- Inventory and Analysis of Wetlands, Water Bodies and Wildlife Habit Areas for the Columbia Corridor–Industrial/Environmental Mapping Project (1989)
- Balch Creek Watershed Protection Plan (1991)
- Northwest Hills Natural Area Protection Plan (1992)
- Southwest Hills Resource Protection Plan (1992)
- East Buttes and Terraces and Wetlands Conservation Plan (1993)
- Inventory of Natural, Scenic and Open Spaces, the sources for Multnomah County Unincorporated Urban Areas (2003)

Resource values were determined based on a number of factors, including quality, quantity, diversity, interspersion, and uniqueness. The inventories informed the completion of an Economic, Social, Environmental and Energy Analysis, and the establishment of environmental overlay zoning maps and regulations to protect important resource areas identified in the inventories.

The information presented in this report incorporates updated information including current natural resource data, recent field assessments, and resource evaluations that build on the approach used to produce new draft natural resource inventory information citywide. The citywide inventory is a refinement of Metro's inventory of regionally significant fish and wildlife habitat, which was adopted in September 2005 as part of the regional Nature in Neighborhoods program. Additional refinements to the citywide inventory approach have been made specifically to reflect current conditions in the Willamette River study area.

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 Willamette River Natural Resources Inventory will inform City strategies to achieve and maintain compliance with the state, regional, and federal regulations described below.

### Section 2a. STATE AND REGIONAL REGULATIONS

#### State Land Use Planning Program

Comprehensive land use planning was mandated by the 1973 Oregon 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.

State planning goals that relate most directly to Portland's natural resources 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 it, or establish a balance between protecting and allowing uses that conflict with the resource.
- **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 air quality, 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.
- **Goal 15, Willamette River Greenway** – Goal 15 sets forth procedures for protecting the diverse qualities of the 300 miles of land along the Willamette River. Multiple uses and functions are to be conserved, enhanced, and maintained, including significant habitat, and economic and recreational uses.

To address Goals 5, 6, and 7, cities and counties must use inventories to inform development of their local compliance programs. Goals 5 and 15 require 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 Goal 5 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.

Goal 15 requires some similar types of resources be inventoried:

- Fish and wildlife habitats;
- Hydrological conditions;
- Ecologically fragile areas;
- Significant natural and scenic areas, and vegetative cover;
- Areas of annual flooding and floodplains;
- All current public recreation sites, including public access point to the river and hunting and fishing areas;
- Recreational needs as set forth in Goal 8;
- Historical and archaeological sites;
- All current aggregate excavation and processing sites, and all known extractable aggregate sources.

Additional resources that are unique to Goal 15 also need to be inventoried:

- Land currently committed to industrial, commercial, and residential uses;
- The ownership of property, including riparian rights;
- Other uses of land and water in or near the Greenway; and
- Acquisition areas, which includes identifying areas suitable for protection or preservation through public acquisition of lands or an interest in land.

The Goal 5 Administrative Rule requires local governments to follow a three-step planning process. 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, followed by development of a protection program for significant resources.

The Goal 15 Willamette River Greenway inventory is used to determine which lands are suitable or necessary for inclusion within the greenway boundary, and to develop the greenway management plan and acquisition program. There is no determination of significance, and no conflicting use analysis. However, jurisdictions are instructed to consider competing or conflicting uses when determining the best use of a public resource (e.g., the Willamette River).

Cities and counties may choose to meet the requirements of Goal 15 instead of Goal 5 for areas within the Willamette Greenway. The City of Portland addressed these inventory requirements while developing the Willamette Greenway and Environmental Overlay Zoning programs that now apply to some of the natural resources that are addressed by this inventory. The inventory presented in this report focuses on riparian corridors and wildlife habitat areas. It also 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, 7, and 15. However, because the inventory focuses on riparian corridors and wildlife habitat areas, it can be used to update only those parts of the City's Goal 5 program.

## **Metro Urban Growth Management Functional Plan —Titles 3 and 13**

The 1973 Oregon 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 interrelationships between housing, employment, clean air and water, natural resources, 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 of Portland submitted to Metro a detailed report titled the *Title 3 Water Quality Compliance Report*. The report explains how the City complies with Title 3 requirements through the existing environmental overlay zoning program and newer regulations established through adoption of the *Willamette River Title 3 Water Quality Compliance Project* 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 within Metro's jurisdiction. Metro area cities and counties have until January 2009 to show that their local programs meet the requirements of the regional program.

Most of the natural resource areas addressed in this inventory are also identified by Metro as providing important water quality, riparian and wildlife habitat functions during development of Titles 3 and 13. 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.

## **Section 2b. 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 and streams are water quality limited with the exception of Balch Creek. Most of Portland's waterways, including the Willamette River, do not meet water quality standards for temperature and bacteria. The Willamette mainstem also does not meet standards for dioxin and mercury. Some of the City's waterways do not meet standards for parameters such as biological oxygen demand, nutrients, pH, and pesticides.

The City has developed a draft Local Implementation Plan to meet TMDL requirements for the Willamette River and its tributaries in Portland. This inventory is being used to help identify priorities for resource protection, restoration, and ecologically-friendly development approaches.

### **Endangered Species Act**

In 1998, National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), proposed listing a number of Pacific Northwest salmonid species under the Endangered Species Act (ESA). Portland's Willamette and Columbia rivers, Columbia Slough, Johnson, Tryon and Fanno creeks, and several smaller tributary streams are used by several of these species (i.e., Columbia River steelhead trout, Columbia River Chinook salmon, and Pacific lamprey).

After the 1998 listing of steelhead trout in the Lower Columbia ESU (Evolutionary Significant Unit), the City of Portland began developing a comprehensive, coordinated citywide response for City Council adoption (Resolution No. 35715). The City's response is intended to avoid "take" of a listed species (i.e., harming individuals 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 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 salmonid habitat conditions 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 bat species and others). Efforts to conserve at-risk species could prevent and minimize further decline and potentially preclude the need to list them in the future.

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

In 2000, a six-mile stretch of the Lower Willamette River – the Portland Harbor – became a designated federal Superfund site due to the discovery of contaminated sediments. Elevated levels of polychlorinated biphenyls (PCBs), heavy metals, polycyclic aromatic hydrocarbons (PAHs), pesticides such as DDT and other contaminants are present in river sediments from Swan Island to the southern tip of Sauvie Island.

In September 2001 an agreement was established between the Oregon Department of Environmental Quality (DEQ) and a coalition of businesses and public agencies – including the City of Portland – to participate in investigation and cleanup of the site. The DEQ is working on the cleanup of approximately 100 upland sites along the banks of the Willamette River. Federal, state and tribal governments serve as the Natural Resource Trustees. The Trustees are conducting a natural resources damage assessment to determine how the release of hazardous substances have harmed natural resources such as fish and wildlife since CERCLA was established in 1980. The Trustees can recover damages from parties who have caused injury, and can mandate restoration and mitigation actions. The Trustees can use this inventory to inform the identification of restoration opportunities to address past damages.

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. It is important to note that many areas along the Willamette, particularly in the North Reach, have some level of contamination and also have important natural resources.



## 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 Willamette River inventory study area, including the delineation of inventory sites, completion of wildlife habitat assessments for portions of the study area, and observations from additional field visits. The following chapter describes the key information pieces that make up this inventory, and how the information was developed.

### Section 3a. BACKGROUND AND RELATIONSHIP TO METRO'S REGIONAL INVENTORY

The Bureau of Planning has recently produced substantial new inventory information for riparian corridors and wildlife habitat in Portland. Products include natural resources descriptions, 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 updated and adopted as part of the Title 13 Nature in Neighborhoods program in September 2005.



The Nature in Neighborhoods Program establishes regional requirements that Metro area cities and counties must meet to remain in compliance with State Planning Goals 5 & 6. The development of Metro's inventory is documented in several reports: the *Technical Report for Fish and Wildlife (Metro 2005)*; *Metro's 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 inventories 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, 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, 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 but can impair channel dynamics and other functions.
- *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, riparian wetlands, floodplains and large trees and woody vegetation contribute to changes in location and configuration of waterway channels over time.
- *Wildlife movement corridors* – Rivers and streams 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, breeding 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. Larger, rounder patches provide interior habitat that is needed by certain species.
- *Connectivity between habitat patches (including distance and edge effect)* – Patches located closer together generally facilitate species dispersal and migration, and provide access to food, cover, nesting sites, and reproduction opportunities.
- *Connectivity/proximity to water* – Access to water is vital to wildlife survival. Habitat that is connected or close to rivers, streams and wetlands is valuable for all types of wildlife.
- *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, designated critical habitat for threatened or endangered species, and urban structures such as the Willamette River bridges that Peregrine Falcons use for nesting.

## Section 3b. INVENTORY METHODOLOGY

Below is a summary of the steps the Bureau took to produce the citywide inventory of riparian corridors and wildlife habitat (also see Figure 1).

### 1. Compiled GIS Data and mapped key natural resource features, including rivers, streams, wetlands, flood areas, vegetation and topography.

Natural resource feature data are the primary inputs to the GIS inventory models for riparian corridor and wildlife habitat. The Bureau improved Metro's regional natural resource feature GIS data for the City of Portland by:

- Remapping more than 180 miles of stream centerlines; adding 86 miles of open stream channel to the maps.
- Mapping smaller vegetation units (1/2 acre minimum), and classifying forest, woodland, shrubland and herbaceous vegetation (based on the National Vegetation Classification System) over a wider area. Land that is either not vegetated or sparsely vegetated is not mapped as part of the inventory.<sup>1</sup>
- Updating the City's flood area data for use in the inventory, including incorporation of the 2004 FEMA 100-year floodplain.

### 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," or "low" to natural resource features that meet certain criteria. 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 riparian and wildlife habitat functions described above. The City's model criteria focus on the presence, type and extent of specific natural resource features. More detailed information on natural resources (e.g. vegetation assemblages) and disturbances (e.g. development, contamination and invasive species) are provided in narrative inventory site descriptions.

The City's inventory models apply criteria that are similar to criteria Metro developed for the regional inventory. The Bureau has refined some of the regional criteria to reflect additional detail, more recent studies, and local conditions. For example, the City's riparian corridor model assigns a lower value to herbaceous vegetation than Metro's models to reflect the predominance of cultivated landscapes and lawn in Portland's urban watersheds. The riparian corridor model criteria were further refined for the Willamette River inventory to reflect the extent of development and hardened riverbanks in the North Reach (discussed further in the next section — *Development of the Willamette River Inventory*). The City's wildlife habitat model assigns higher relative function scores to somewhat smaller habitat patches. The refined patch size scoring thresholds are based on additional scientific studies including recent wildlife studies conducted in Portland natural areas.

The Bureau of Planning 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 coordinated a technical review process in 2006 to address potential refinements to the regional methodology. For more detail see Appendix E — *City of Portland Natural Resource Inventory Update: Project Report - Discussion Draft July 2008*.

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

## Riparian Corridor Model

The City's 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 adjacent, contiguous forest vegetation, can occur up to several hundred feet from a water body.

The primary and secondary scores for each function are combined to produce aggregated relative riparian corridor rankings of "high," "medium," or "low."

**Table 1: Riparian Corridor GIS Model Criteria**

<b>Microclimate and Shade</b>			
<b>Primary Feature:</b>	<b>Footnotes</b>	<b>Secondary Feature:</b>	<b>Footnotes</b>
River, stream/drainageway or wetland	2, 5	----	
Forest or dense trees 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 or dense trees contiguous to and within 100 feet of a river, stream or wetland	1, 2	Forest or dense trees contiguous to primary forest vegetation and within 780 feet of a river, stream or wetland	1, 2
----		Woodland vegetation contiguous to and within 100 feet of a river, stream or wetland	1, 2
----		Shrubland vegetation contiguous to and within 50 feet of a stream or wetland	1, 2
<b>Stream Flow Moderation and Water Storage</b>			
<b>Primary Feature:</b>	<b>Footnotes</b>	<b>Secondary Feature:</b>	<b>Footnotes</b>
River, stream/drainageway or wetland	2, 5	----	
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
----		Forest or dense trees, woodland or shrubland vegetation within 300 feet of a river, stream or wetland	1, 2
----		Forest or dense trees contiguous to flood area or starts within 300 feet of a river, stream or wetland, and extends up to 780 feet of a river, stream or wetland	1, 2
----		Herbaceous vegetation within 100 feet of a river, stream or wetland	1, 2
----		Where the slope is at least 25%: Herbaceous vegetation that starts within 100 feet of a river, stream or wetland, and is within 200 feet of a river, stream or wetland	1, 2
<b>Bank Function, and Sediment, Pollution and Nutrient Control</b>			
<b>Primary Feature:</b>	<b>Footnotes</b>	<b>Secondary Feature:</b>	<b>Footnotes</b>
River, stream/drainageway or wetland (except Willamette River North and Central Reach)	2, 5	Willamette River North and Central Reach	5
Land within 50 feet of a river, stream or wetland, except where the bank is hardened and non-vegetated (exception applies in the Willamette River North and Central Reach)	1, 2, 7	Land within 50 feet of a river where the bank is hardened and non-vegetation (applies in the Willamette River North and Central Reach)	7
Forest or dense trees, 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 or dense trees and natural/semi-natural woodland or shrubland vegetation within 100 feet of a river	1, 6, 8	Cultivated woodland or shrubland vegetation within 100 feet of a river	1, 6, 8
Forest or dense trees, woodland and shrubland vegetation within 100 feet of a stream or wetland	1, 2	Herbaceous vegetation within 100 feet of a river, stream or wetland	1, 2
Where the slope is at least 25%: Forest or dense trees, and natural/semi-natural woodland or shrubland vegetation within 200 feet of a river	1, 6, 8	----	
Where the slope is at least 25%: Forest or dense trees, woodland or shrubland vegetation within 200 feet of a stream or wetland	1, 2	Where the slope is at least 25%: Forest or dense trees, woodland and shrubland vegetation that is contiguous to primary vegetation (limited to the contiguous area of 25 percent slope)	1, 2
----		Where the slope is at least 25%: Herbaceous vegetation contiguous to primary vegetation and within 200' of a river, stream or wetland	1, 2

**Large Wood and Channel Dynamics**

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River or stream/drainageway	2, 5	----	
Willamette River beaches		----	
Land within 50 feet of a river or stream (except land within 50 feet of a river in the Willamette River North and Central Reach)	1, 4	----	
Forest or dense trees within 50 feet of a river in the Willamette River North or Central Reach		Woodland, shrubland, herbaceous vegetation or non-vegetated land within 50 feet of the river within the Willamette River North and Central Reach	
Forest or dense trees 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 or dense trees contiguous to and within 150 feet of a river or stream (except within a drainage district)	1, 3, 4	Within a drainage district, forest or dense trees contiguous to and within 150 feet of stream	1, 3, 4
----		Where the slope is at least 25%: Forest or dense trees contiguous to primary forest vegetation and is within 260 feet of a river or stream (except within a drainage district)	1, 4
Forest or dense trees contiguous to and within 150 feet of a wetland located completely or partially within the flood area or 150 feet of a river or stream (except within a drainage district)	1, 2, 3, 4	Where the slope is at least 25%: Forest or dense trees contiguous to primary forest vegetation and within 260 feet of a wetland located completely or partially within the flood area or 150 feet of a river or stream (except within a drainage district)	1, 2, 3, 4
Wetland located completely or partially within the flood area or within 150 feet of a river or stream (except within a drainage district)	1, 2, 3, 4	----	

**Organic Inputs, Food Web and Nutrient Cycling**

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
Flood area with forest or dense trees and natural/semi-natural woodland or shrubland vegetation (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 or dense trees and natural/semi-natural woodland or shrubland vegetation within 100 feet of a river	1, 2, 6	Forest or dense trees and natural/semi-natural woodland or shrubland vegetation that is contiguous to primary vegetation and is within 170 feet of a river	1, 2, 6
----		Cultivated woodland or shrubland vegetation within 100 feet of a river	1, 2, 6, 8
Forest or dense trees, woodland or shrubland vegetation within 100 feet of a stream or wetland	1, 2	Forest or dense trees, woodland or shrubland vegetation that is contiguous to primary vegetation and within 170 feet of a stream or wetland	1, 2

**Riparian Wildlife Movement Corridor**

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
Vegetation that is contiguous to and within 100 feet of a river, stream or wetland	1, 2	Vegetation that is contiguous to primary vegetation and within 300 feet of a river, stream or wetland	1, 2

Footnotes:

- All search distances are measured from either a) the edge of the mapped water body, or b) the stream/drainageway centerline.
- "Wetland" refers to all mapped regional wetlands fully or partially within 1/4 mile of a river or stream/drainageway, unless otherwise specified.
- "Flood area" is comprised of the combined FEMA 100-year floodplain (2004), the adjusted 1996 flood inundation area, and additional adjustments to reflect more recent permitted activities affecting site elevation.
- Portland-area drainage districts: Peninsula Drainage District #1, Peninsula Drainage District #2, and Multnomah County Drainage District #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.
- Data classifications that differentiation between natural/semi-natural and cultivated vegetation has been assigned for the Willamette River Corridor only.
- Hardened 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.
- Criteria relating to natural, semi-natural and cultivated vegetation are currently applied only to the Willamette River corridor and to flood area. Criteria made be modified, if warranted, in the future during area-specific planning efforts.

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. Table 2 shows the formula used to establish the aggregate relative ranks. The formula is consistent with the formula Metro used to evaluate and rank riparian corridors in the region.

**Table 2: Riparian Corridor Aggregated Relative Ranking Formula**

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

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

- **High** – Rivers, streams and wetlands; forest or woodland vegetation within a flood area, 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 North and Central reaches of the Willamette River

### Wildlife Habitat Model

The wildlife habitat GIS model assigns scores to mapped habitat patches based on their size, shape, and connectivity to other patches or water bodies as shown in Table 3 below. For purposes of the inventory, habitat patches are defined as areas of forest vegetation and wetland that are at least two acres in size, plus adjacent woodland vegetation.

**Table 3: Portland Natural Resource Inventory – Wildlife Habitat GIS Model: Attributes and Summary of Scoring Criteria**

Habitat patches receiving a “high” relative score (3 points)	Habitat patches receiving a “medium” relative score (2 points)	Habitat patches receiving a “low” relative score (1 point)
<b>Attribute: Habitat Patch* Size</b>		
Habitat patches* 585 acres or larger.	Habitat patches at least 30 acres and less than 585 acres.	Habitat patches at least 2 acres and less than 30 acres.
<b>Attribute: Interior Habitat Area**</b>		
Interior habitat is 500 acres or larger.	Interior habitat area is at least 15 acres and less than 500 acres.	Interior habitat area is at least 2 acres and less than 15 acres.
<b>Attribute: Connectivity/Proximity to Other Habitat Patches***</b>		
Core forest/wetland portion of the patch is at least 2 acres and receives a patch proximity index value of 100 or more.	Core forest/wetland portion of the patch is at least 2 acres and receives a patch proximity index value of at least 30 and less than 100.	Core forest/wetland portion of the patch is at least 2 acres and receives a patch proximity index value of less than 30.
<b>Attribute: Connectivity/Proximity to Water****</b>		
At least 75% of the habitat patch is within 300 feet of a river, stream or wetland.	At least 25% and less than 75% of the habitat patch is within 300 feet of a river, stream or wetland.	Less than 25% of the habitat patch is within 300 feet of a river, stream or wetland.

**Footnotes:**

- \* 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.
- \*\* “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.
- \*\*\* 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>.
- \*\*\*\* 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.

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

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



A habitat patch can receive up to 12 points if it receives a high rank for each of the four attributes. Features that receive scores for one or more attributes provide significant wildlife habitat functions. Individual scores for each attribute are combined to produce an aggregated relative ranking of “high,” “medium,” or “low” for each wildlife habitat patch. As with the riparian corridor model, the formula used to generate the aggregate wildlife habitat rank is similar to those Metro used for the regional inventory (see Table 4).

**Table 4: Wildlife Habitat Aggregated Relative Ranking Formula**

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, Tryon State Park, and Riverview Cemetery.
- **Medium** – Moderate sized forest and wetland areas such as those at Oaks Bottom, portions of Powell Butte, and the South Rivergate Corridor.
- **Low** – Numerous smaller forest and wetland areas through out the city.

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

The Bureau of Planning worked with Portland’s Bureau of Environmental Services and Parks and Recreation to update the documentation and mapping of the regional Habitats of Concern identified in Metro’s inventory. 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. The Willamette River and portions of the Columbia Slough, Johnson Creek and Tryon Creek are 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 E – *City of Portland Natural Resource Inventory Update: Project Report - Discussion Draft July 2008*



**Picture 1: Peregrine Falcon on the St. Johns Bridge**  
 Courtesy of Bob Sallinger, Audubon Society of Portland

Special Habitat Areas include certain resource features that are not addressed by the wildlife habitat model criteria, such as the grasslands at Powell Butte. 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 lists have been culled to include only those species that would be found in Portland. The current species lists are found in Appendix D.

#### **4. Produced combined ranks and maps based on GIS model results and information on Special Habitat Areas.**

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

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. This situation is especially prevalent in highly developed areas such as portions of the Willamette River Corridor.

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 ranks, for each inventory site in the Willamette River North Reach.

#### **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.

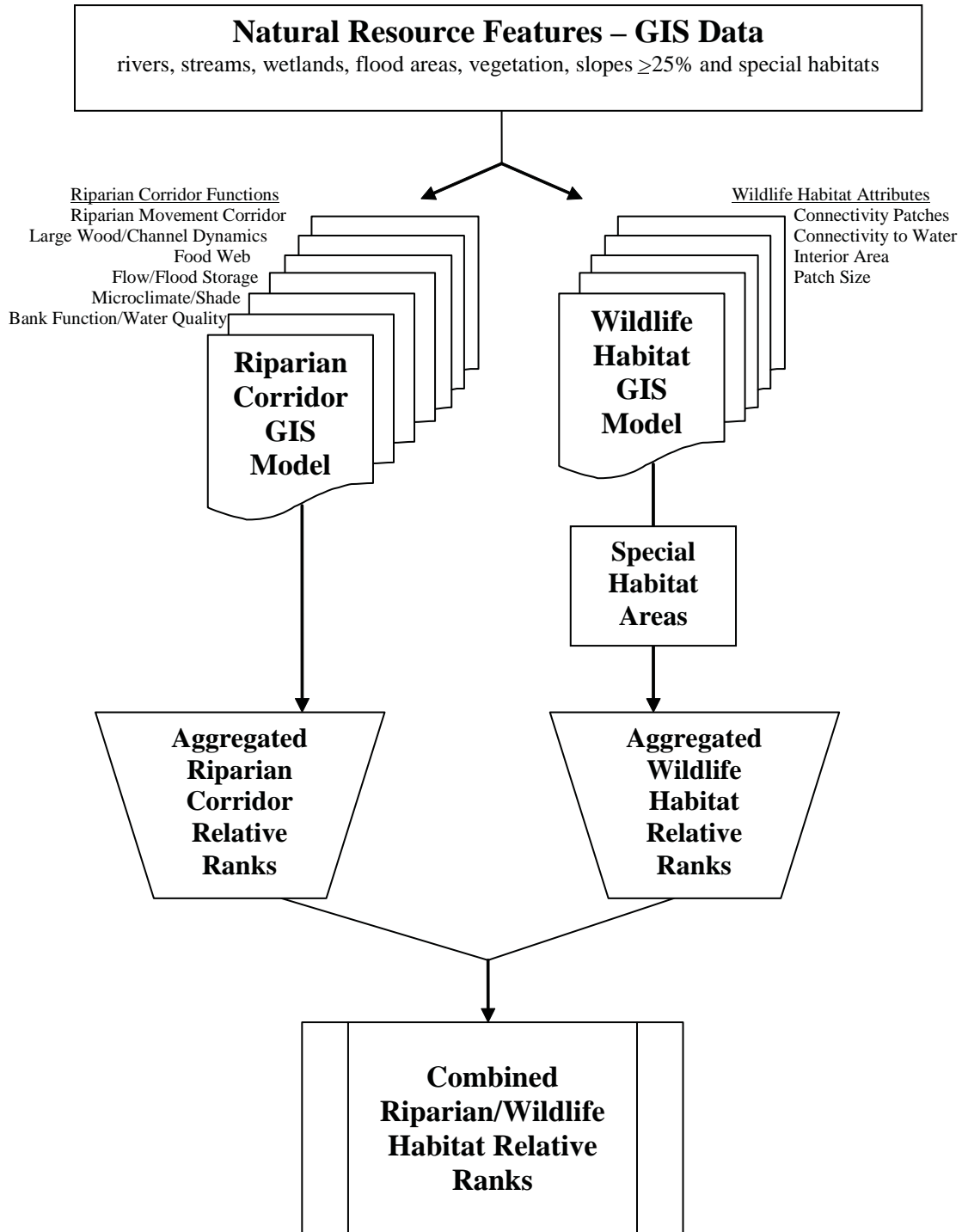
The City's inventory is based on the science and approach Metro used to develop the adopted inventory of regional riparian corridors and wildlife habitat. The City's inventory reflects updates and refinements to the regional inventory, and relates more closely to the current relative quality and functions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

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 significant. Official determination(s) of significance will take place at the time of adoption by the City Council.

Figure 1: Natural Resources Inventory Flow Diagram



## Section 3c. DEVELOPMENT OF THE WILLAMETTE RIVER NATURAL RESOURCES INVENTORY

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

### Delineating Inventory Sites

The Bureau of Planning delineated 13 new inventory sites for the Willamette Inventory. Consistent with more recent City inventories, the Willamette inventory sites are contiguous to each other and include significant natural resources and the surrounding land uses.

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 – i.e., no gaps between inventory sites in the Willamette River study area, or between Willamette River inventory sites and inventory sites established for other adopted inventories.
- 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 coincident 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 if possible.
- Topography – The intent is to use topography as a boundary where it forms a natural break between inventory sites, such as relatively flat riparian areas and more steeply sloping uplands or bluffs.
- Vegetation – The intent is to include contiguous vegetation in the same inventory site, except when vegetation types differ significantly or other landscape features such as steep slope indicate a distinction in resource character
- Willamette River Centerline – The intent is to include the river, near-shore areas and river bank within the same inventory site as the adjacent riparian corridor.

The term “inventory site” or “site” is used, rather than “resource site” or “habitat site” which are used in other City inventories, including the 1986 inventory produced for the Willamette Greenway. This is because the Willamette River inventory sites contain resource areas and surrounding land uses; much of this area is developed.

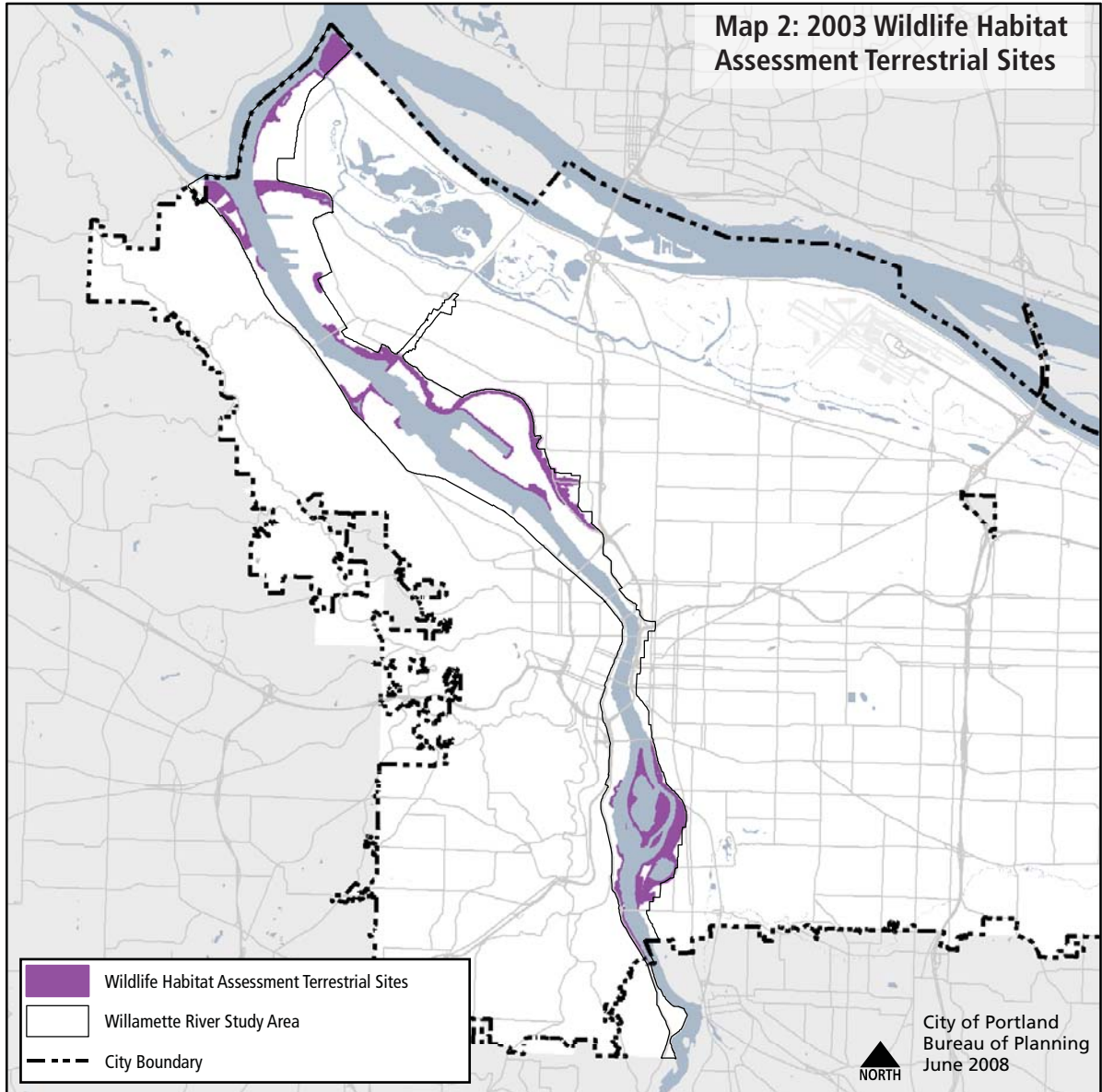
## **Incorporating information from the draft Lower Willamette Inventory: Natural Resources (Adolfson Associates, Inc. 2000, updated by City staff, 2003)**

The Bureau of Planning contracted with Adolfson Associates, Inc. to produce habitat inventory information for the Willamette Corridor. An initial draft Willamette River Inventory: Natural Resources report was produced in 2000. The report identified 24 “habitat sites” throughout the study area – 15 terrestrial and nine aquatic (Willamette River) sites. Site boundaries were generally concurrent with the natural resources themselves and did not encompass surrounding developed areas.

The study involved extensive field visits conducted on land and by boat on the Willamette River itself. Wildlife Habitat Assessments (WHAs) were performed for each site. These assessments involved evaluating the presence and availability of water, food, and cover for wildlife. Observations regarding water quality, riparian vegetation, wildlife use and habitat connectivity were recorded, as well as disturbance impacts, and connection with other natural areas. Unique or rare occurrences of plant and animals were also noted. A Riverine Habitat Assessment methodology, adapted from the WHA, was developed to assess the riverine habitat of the Willamette River. Habitat sites received a numeric score, which provided a relative rank as compared to other sites within the Willamette River Inventory study area.

The *Lower Willamette Inventory: Natural Resources* report contained habitat descriptions, including observational data collected using the WHA, and the numeric score for each site.

In 2003, the *Lower Willamette Inventory: Natural Resources* report was updated by the Bureau of Planning to reflect input from other bureaus and key stakeholders, including information about recent development that altered the presence and condition of natural resources. Site boundaries have been modified slightly, but the habitat descriptions and WHA scores were not updated. Terrestrial sites are shown in Map 2.



The data and information from the updated *Lower Willamette Inventory: Natural Resources* (2003) has been incorporated into the inventory site habitat descriptions presented later in this report. The numeric scores were not used to develop the relative rankings because they do not address the full array of riparian functions evaluated in this inventory, and they were not developed for all identified resources in the inventory. The WHA forms and numeric scores can be found in Appendix D.

### Supplemental Site Visits

In the fall of 2005 and the spring of 2006, City staff teams from the Bureaus of Planning and Environmental Services conducted site visits to address areas that were not addressed in the Adolfson study, and to revisit some areas Adolfson had addressed. Site assessment forms, similar to the WHA forms, were produced to record natural resources and functions including water quality, presence, type and diversity of vegetation, wildlife use and limiting factors. Like the information from the Adolfson work, the natural resource information recorded during the supplemental site visits has been included in the natural resource descriptions provided for each inventory site. The completed site visit forms are found in Appendix D. Additional field visits were conducted in the winter and spring of 2008 to verify vegetation data and assess potential Special Habitat Areas.

## Criteria Refinements

The August 2007 discussion draft Willamette River Natural Resource Inventory report was made available for public comment through October 2007. Comments included expressions of support for and concerns about the inventory methodology. Comments also included suggestions for inclusion of additional information. A number of comments expressed interest and concerns about how the inventory would be used to update regulations affecting development and natural resources in the North Reach.

Staff convened a group of technical experts on January 10, 2008 to discuss comments pertaining to the inventory methodology, specifically the GIS model criteria. Participants included staff from the Port of Portland and SWCA Environmental Consultants, Ellis Ecological Services, Windward Environmental, Oregon Department of Fish and Wildlife, US Fish and Wildlife Service, Metro, NOAA Fisheries, Audubon Society of Portland, and the Portland Bureau of Environmental Services.

Based on the input from these experts and additional staff analysis, refinements were made to several of the GIS model criteria used to evaluate riparian corridor functions and wildlife habitat attributes in the Willamette Corridor. Most of the refinements are specific to the Willamette River North Reach and Central Reach. Some of the refinements are applicable to natural resources throughout the city. Ultimately, the decisions were to:

- Update the mapped Willamette River channel to include beaches. -Continue to highlight the role of beaches and shallow-water areas as special habitats for fish and wildlife by depicting and describing these areas in the Willamette River Special Habitat Area.
- Provide additional information about the river, such as water quality, in the revised inventory report.
- Recognize the extent of hardened, non-vegetated banks and sediment contamination in the North Reach, by downgrading value assigned to the river for bank function, and control of sediment, nutrients and pollutants (likely applicable to the Central reach as well).
- Downgrade the value assigned to seawalls, pilings and non-vegetated riprap within the North Reach to recognize the associated impairment of bank function and channel dynamics (likely applicable to the Central reach as well).
- Continue to recognize localized effects of large wood on riverbank structure, sediment retention, etc. Recognize that riparian vegetation further from the river is more likely to contribute large wood when trees are located on steep slopes.
- Differentiate between the quality of functions provided by natural or semi-natural vegetation and highly manicured landscapes. Downgrade the value assigned to cultivated vegetation for bank function, sediment, pollution and nutrient control, and organic inputs/food web.
- Modify criteria related to microclimate and shade functions to require that forest vegetation be contiguous to the river itself. Recognize that shrubland and cultivated woodland vegetation do not contribute significantly to microclimate and shade functions in the North Reach.

Details regarding the criteria refinements can be found in Appendix B - City of Portland Inventory GIS Model Criteria and Appendix E -*City of Portland Natural Resource Inventory Update: Project Report - Discussion Draft July 2008*.





# Chapter 4. THE WILLAMETTE RIVER NATURAL RESOURCES INVENTORY

The Willamette River Natural Resources Inventory chapter provides information, data and maps regarding the presence, extent and condition of natural resources along the Willamette River in Portland. This chapter is organized into the following sections:

**Section 4.a: THE WILLAMETTE RIVER BASIN** – Provides a general description of the Willamette River Basin and a context for the inventory

**Section 4.b: THE WILLAMETTE RIVER IN PORTLAND** – Contains summary information, including water quality, hydrology, fish and wildlife, regarding the Lower Willamette River in Portland

## **Section 4.c: THE NORTH REACH**

**Section 4.c1: OVERVIEW**– Includes information, data and maps about natural resources in the Willamette River North Reach.

**Section 4.c2: NORTH REACH INVENTORY SITES** – Detailed information, data and maps are provided for the following inventory sites:

WR1: Kelley Point Park

WR2: Terminal 5 Riparian Forest

WR3: Harborton Wetlands

WR4: South Rivergate Corridor

WR5: Time Oil/Terminal 4

WR6: Linnton

WR7: North Oak Palisades/Cathedral Park

WR8: Doane Lake

WR9: Willamette Cove

WR10: McCormick/Baxter and Triangle Park

WR11: Northwest Industrial Area

WR12: Swan Island

WR13: Willamette Bluff

**Section 4.d: THE CENTRAL REACH** – To be completed at a later date

**Section 4.e: THE SOUTH REACH** – To be completed at a later date

## Section 4a.

# THE WILLAMETTE RIVER BASIN

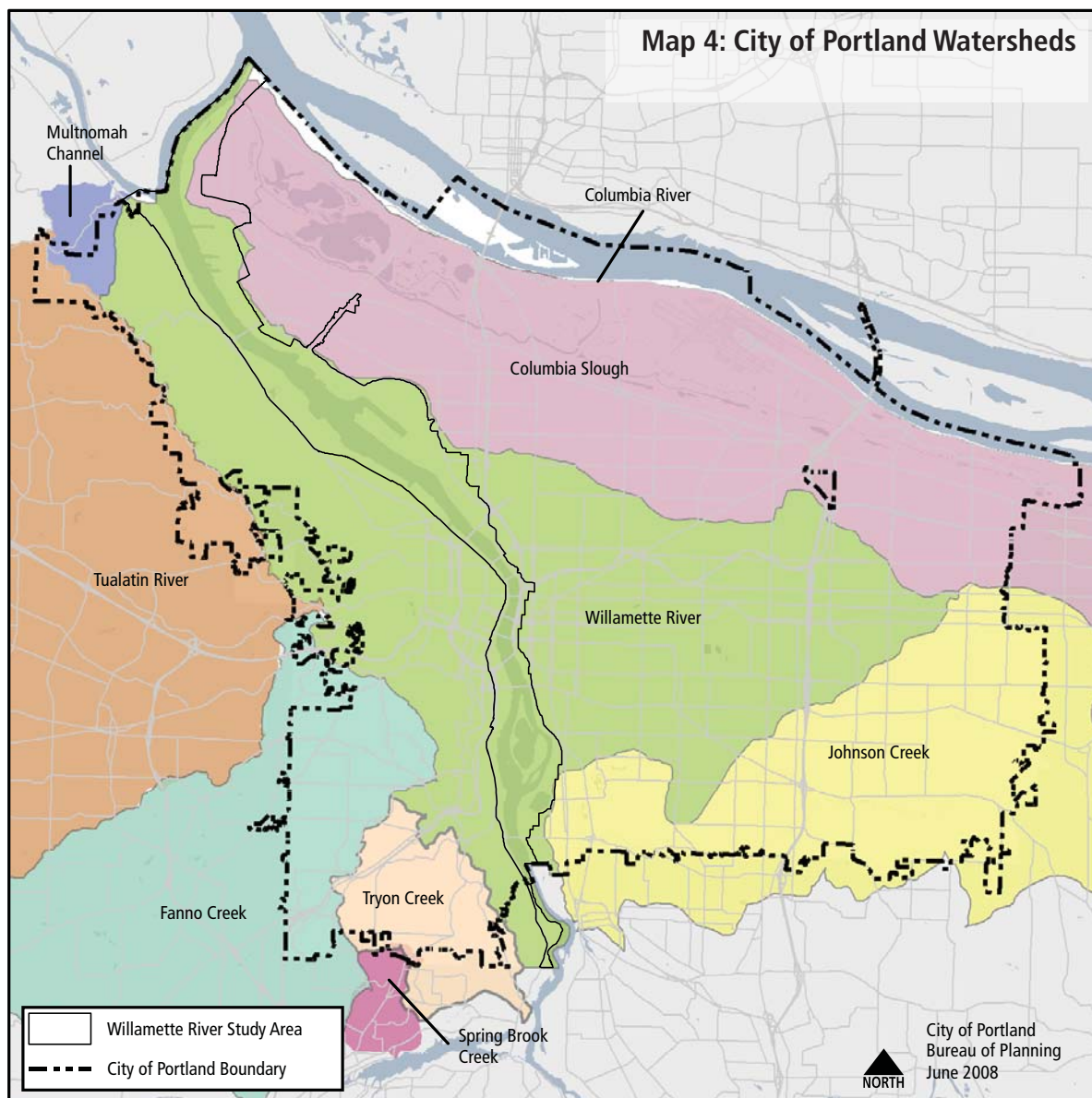
Regionally situated in the Lower Columbia River Basin, the Willamette River Basin is an 11,500 square mile watershed located between the Cascade Mountains to the east, and the Coast Range to the west. The 187-mile long Willamette River flows north through 128 jurisdictions including Eugene, Corvallis, Salem and Portland as well as eight counties: Lane, Linn, Benton, Marion, Polk, Yamhill, Clackamas and Multnomah. Nearly 70% of Oregon's population lives in the Willamette River Basin. The mix of land use ranges greatly from forestry and agriculture to urban residential, commercial and industrial.

The basin occupies roughly 12% of Oregon's land and plays an important role in the ecology of the region. The basin extends from mountains approximately 10,000 feet in elevation to the Columbia River just 10 feet above sea level. The Willamette Basin is also made up of 12 tributary sub-basins that are diverse in terms of elevation, hydrology, and landscape character. The Willamette basin helps to disperse aquatic and avian species among rivers and streams, upland forests, valleys, floodplains, and to and from the Columbia River and the Pacific Ocean. It is part of the Pacific Flyway for migratory birds, and is a key component of the extensive network of spawning streams for anadromous salmon and steelhead.

The hydrology of the Willamette River Basin has been altered substantially by the development and operation of 13 dams in tributary sub-basins. The dams provide flood control and hydroelectric power. However, the dams and associated changes in the river flow regime have affected water temperature, reduced the ecological values provided by seasonal flooding, and pose challenges to fish passage and migration. Dam construction, river and stream channelization, bank hardening, non-native species introductions, supplementation of fisheries through aquaculture, timber harvesting, agricultural activities, and urbanization have contributed to changes in historic aquatic habitats and biota.



**Map 3: Willamette River Basin**



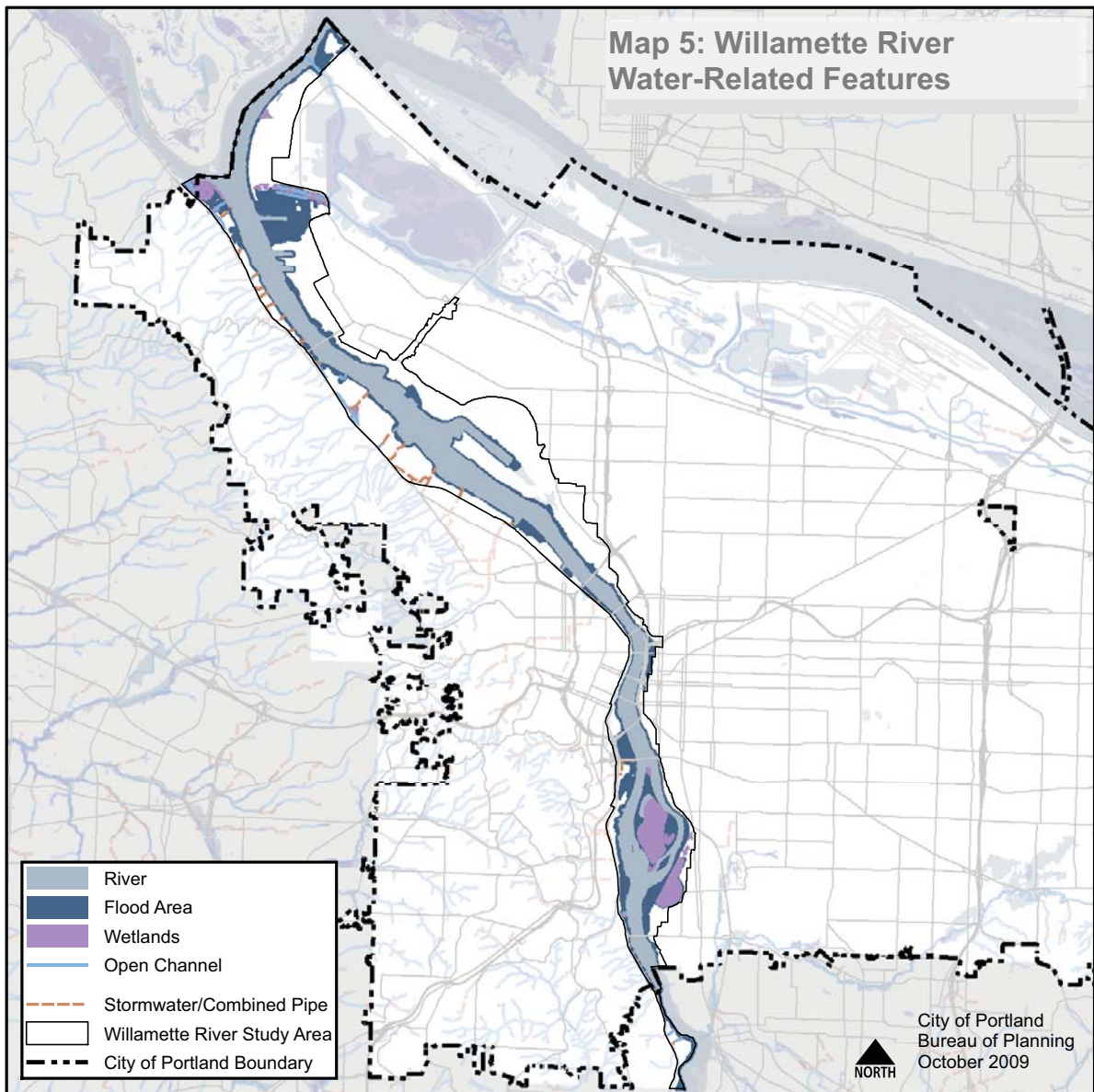
## Section 4b.

### THE WILLAMETTE RIVER IN PORTLAND

The 27 mile stretch of river between Willamette Falls in Oregon City and the Columbia River is often referred to as the Lower Willamette River. This portion of the basin connects directly with the regional ecosystem that includes Sauvie Island, Ridgefield and Shilapoo Wildlife Areas, Vancouver Lake, Tualatin Mountains (Forest Park), Burlington and Oak Bottom, the Smith and Bybee Lakes preserve, Sandy River, and floodplain islands in the Columbia River.

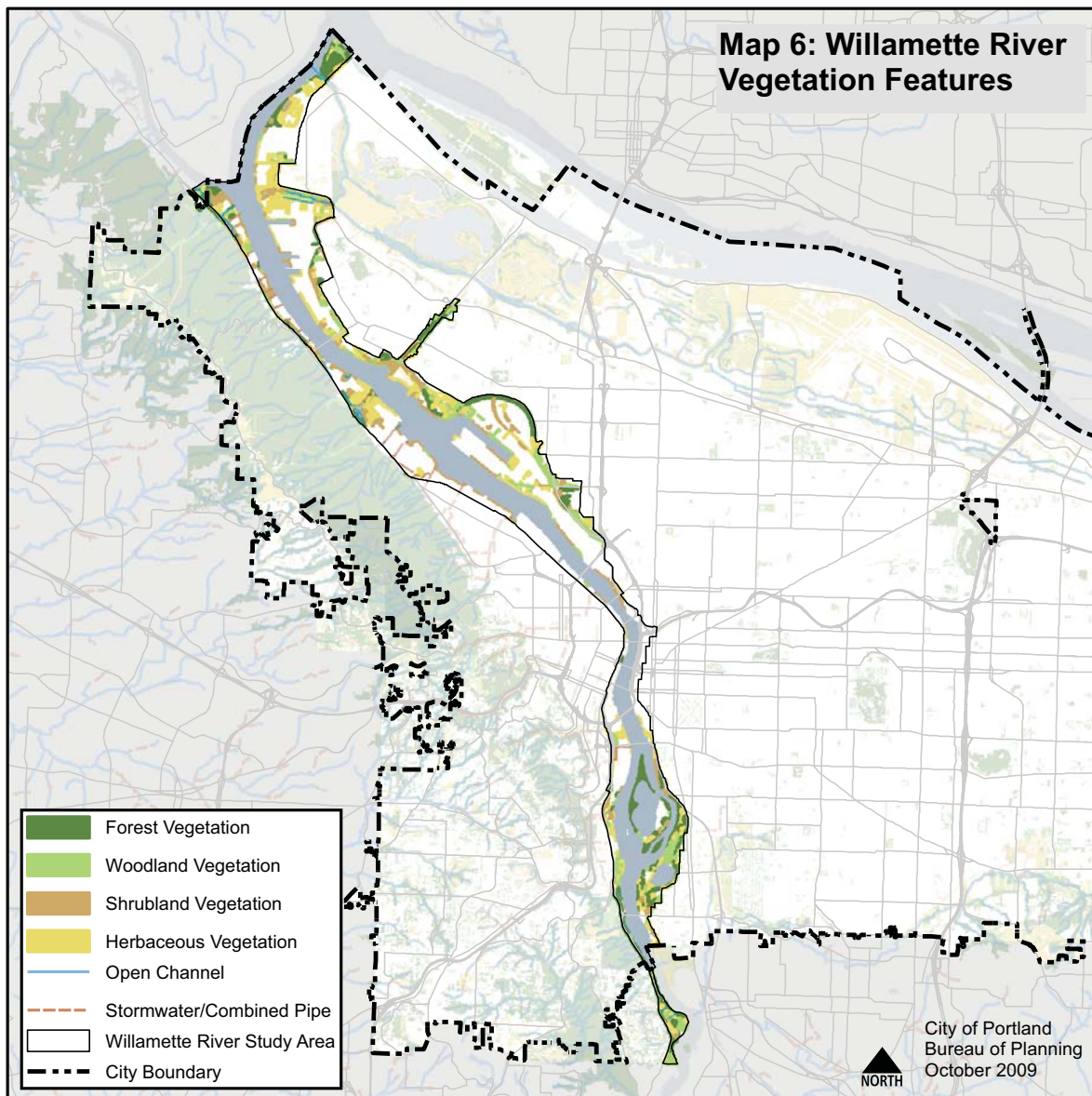
This inventory study area includes 17 miles of the Lower Willamette River as it flows northward through Portland to its confluence with the Columbia River. The confluence of the Willamette and the Columbia Rivers, the 9th and 2nd largest rivers in US respectively, occurs partially within the city limits. The inventory also includes lands adjacent to this portion of the river. The boundary of the inventory study area is shown on Map 4.

The study area is 8,900 acres in size. The Willamette River channel comprises approximately 3,290 acres (37%) of the study area. The study area contains 5 miles of tributary stream channels including segments of the Columbia Slough, Johnson Creek, Tryon Creek, Saltzman Creek, Doane Creek, Balch Creek and Stephens Creek. Many of the smaller tributary streams originate in Forest Park and the West Hills, and are piped through the study area. Wetlands comprise approximately 340 acres of the study area. The largest are Harborton Wetlands and Oaks Bottom. The study area contains roughly 4,570 acres of flood area, including 3,265 acres of open water flood area, 615 acres of vegetated flood area and 690 acres that are not vegetated, much of which is developed with industrial or other land uses. (See Map 5)



Also within the study area are approximately 1,570 acres of vegetated patches greater than one-half acre in size. These include 530 acres of forest or tree canopy, 295 acres of woodland, 235 acres of shrubland and 510 acres of herbaceous cover. This vegetation covers roughly 17% of the Willamette River inventory study area. The vegetated areas include sporadic patches of native oak trees, primarily located along approximately 7 miles of the east-side escarpment referred to in the inventory as the Willamette Bluff. (See Map 6)

Table 5 provides a summary of natural resource features within the inventory study area for the Willamette River.



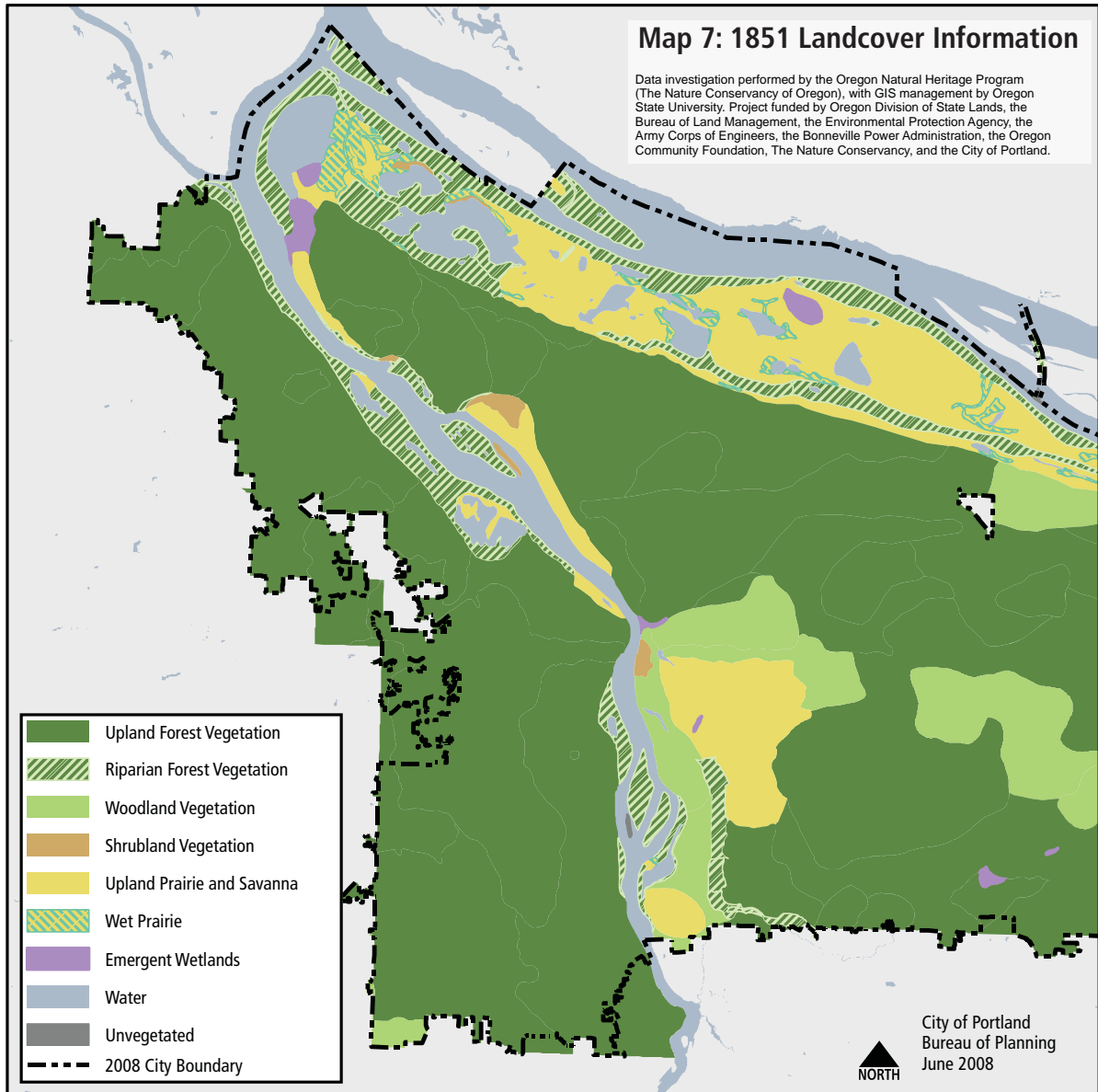
**Table 5: Summary of Natural Resource Features in the Willamette River Study Area**

	Study Area (acres)
<b>Stream (miles)</b>	
Willamette River (miles/acres)	17 / 3,220
Open Stream Channel (miles)	5
Piped Stream Segments (miles)	11
<b>Wetlands (acres)</b>	<b>340</b>
<b>Flood Area (acres)*</b>	<b>4,645</b>
Vegetated (acres)	625
Non-vegetated (acres)	750
Open Water (acres)	3,270
<b>Vegetated Areas &gt;= 1/2 acre (acres)+^</b>	<b>1,570</b>
Forest (acres)	530
Woodland (acres)	295
Shrubland (acres)	235
Herbaceous (acres)	510
<b>Impervious Surfaces (acres)</b>	<b>3,070</b>

\* The flood area includes the 100-year floodplain, determined by FEMA, combined with 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 has been updated based on 2006 aerial photography.

The Willamette River channel within Portland is a generally wide, although in the southern portions of the city the river is constrained by historic basalt flows. As noted above, flow levels are managed through the operation of 13 dams in the upper basin. River levels are also subject to tidal influences. Historically the Willamette River in the Portland area was comprised of an extensive interconnected system of active channels, open slack waters, emergent wetlands, riparian forests, and adjacent upland forests. Vegetation in bottomland and wetland forests consisted of black cottonwood, Oregon ash and willow with associated understory assemblages. Denser mixed conifer forests of Douglas fir, Bigleaf maple, western red cedar, western hemlock, grand fir and red alder dominated the west hills and some parts of the east terrace. Foothills savannas of Oregon white oak, Pacific madrone, red alder and Bigleaf maple were found on the east side of the river.



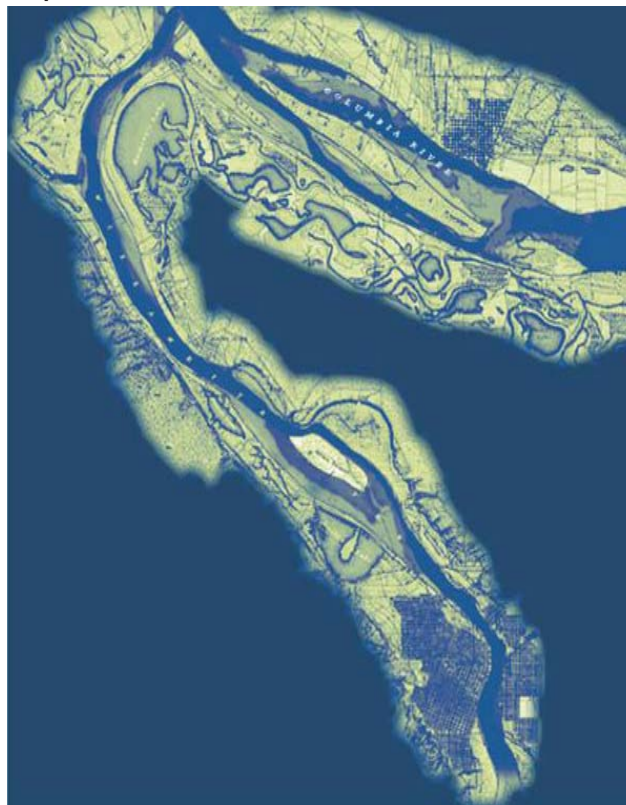
Today, the Willamette River has many uses, including shipping, industry and commercial enterprises, floating homes, recreation, and fish and wildlife migratory corridor. The river itself has been substantially altered in Portland. The river bottom is dredged to improve navigation and allow large barges and ships to access Portland terminals. The Willamette River federal navigation channel extends from the mouth of the Willamette River upstream 11.6 miles to the Broadway Bridge in Portland. The width of the channel varies between 600 and 1,900 feet and the maintained depth is 40 feet. The Portland District U.S. Army Corps of Engineers maintains this federal navigation channel. The channel was last dredged in 1997. Maintenance dredging has been suspended until legal and technical issues are resolved regarding dredging within the boundaries of the Portland Harbor Superfund site. Portions of the channel are now less than 40 feet deep, which can pose a hazard to large cargo ships.

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. Where the river flows through downtown Portland the banks are largely hardened, including nearly 97,390 linear feet of riprap and 32,570 linear feet of pilings and seawalls, roughly 25% and 8% respectively of the total length of river bank in Portland. The remainder of the Willamette riverbank in Portland is comprised of beaches (32%), rocks/rock outcrops (20%) and unclassified fill (13%).

Marine cargo activities are common in this reach, with large vessels docking at berths. Maintenance dredging of the channel allows for continued access to this reach by large ocean-going ships, but reduces channel complexity.

The historic floodplain and lowlands of the Willamette River in Portland was located between Forest Park and the Southwest Hills on the west and the remnant oak bluffs on the east. Over the years, many floodplain areas, bottomland forests and wetlands have been filled and developed, leaving

**Map 8: 1888 Portland Wetlands and Water Bodies**



**Map 9: 2007 Portland Wetlands and Water Bodies**



some larger natural resource areas, but primarily small strips and isolated pockets or narrow corridors of riparian forest, wetlands, and upland vegetation. The remaining floodplain is generally narrow and contains both undeveloped and developed areas.

Even with the physical changes and development, the Willamette River and nearby resources continue to provide important watershed functions. The floodplain provides flood storage during large storm events. Remnant wetlands, trees and vegetation provide water storage, filter pollutants from stormwater, cycle nutrients, and create localized microclimate and shading of riverbanks and tributary streams. These areas also provide wildlife habitat and connectivity corridors along the river and tributary streams. The river, nearshore mudflats and islands, and adjacent lands also provide habitat for numerous aquatic species and birds and terrestrial wildlife, including species that have been listed as 'at-risk' by one or more agencies or wildlife organizations, including bald eagle, American Peregrine falcon, little willow flycatcher and olive-sided flycatcher, pileated woodpecker, painted turtle, northern red-legged frog and several other bird and bat species.



**Picture 2: Tributary stream in North Reach industrial area – Forest Park in background**

The main channel of the river is used by anadromous salmonids as a migration corridor. The confluences of the Willamette River and its tributaries provide important fish and wildlife habitat. Beach, near-shore shallow water areas, sandy substrates, and large woody debris provide refugia habitat for salmonids that are listed as threatened species under the Endangered Species Act and feeding areas for shorebirds and other wildlife (ODFW, 2005). These areas also provide connectivity corridors between the river and tributaries.

Ward et al. (1994) investigated the effect of shoreline development within the Portland Harbor on migrating juvenile salmonids and concluded that shoreline development associated with offshore wharves, piers, floating platforms, and pilings had no adverse effect on the migration patterns of juvenile salmonids that were actively moving through the area. The study did not assess the effect of development on resident, rearing, or over wintering juvenile salmonids. The study did look at predation related to pikeminnow and determined that predation rates at developed sites were the same as at undeveloped sites within the study area. Warm-water fish may benefit from the type of habitats associated with developed banks.

The Lower Willamette River does not meet water quality standards for bacteria, mercury, dioxin, and temperature (see Table 6). Oregon Water Quality Index values from 1986 to 1995 for the Lower Willamette Basin in Portland range from fair to very poor. The Lower Willamette River in Portland is also deemed unsafe for swimming.

Cool water is one of the necessities of anadromous salmonids and aquatic macroinvertebrates. Tributary streams can influence water temperature in portions of the Willamette by providing cool water. However, many tributaries to the river, including the Columbia Slough, do not meet standards for temperature and other pollutants, such as sediment and heavy metals.



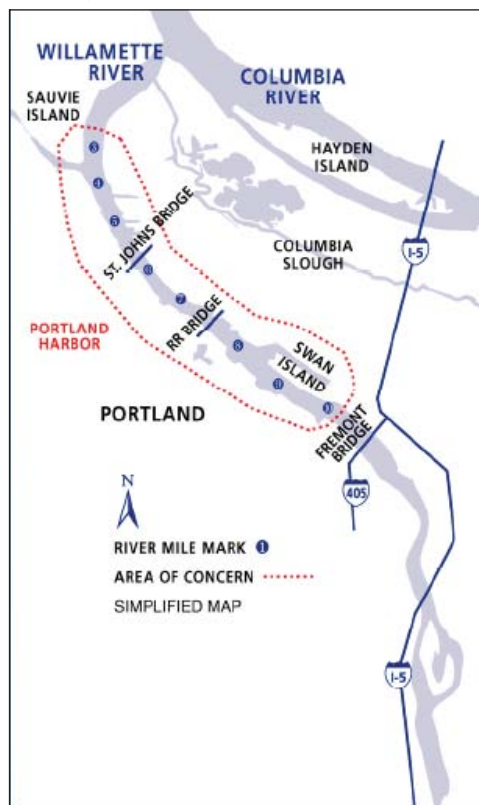
**Table 6: Water Quality (303(d) Listings) in the Lower Willamette River and Tributaries**

POLLUTANT	SEASON	YEAR RIVER WAS LISTED FOR THIS POLLUTANT	RISK FACTORS
<b>Pesticides and Toxics</b> (DDT/DDE, Dieldrin, Aldrin, Pentachlorophenol, PCB, PAH)	Year Around	1998, 2002	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
<b>Heavy Metals</b> (iron, manganese, mercury)	Year Around	1998, 2002	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
<b>Bacteria</b> (Fecal Coliform)	Fall/Winter/Spring	1998	Water contact recreation
<b>Temperature</b>	Summer	1998	Salmonid fish rearing, anadromous fish passage
<b>Biological Criteria</b>	N/A	1998	Resident fish and aquatic life

The Portland Harbor, which includes the Willamette River from roughly the Fremont Bridge downstream to river mile 2 near the tip of Sauvie Island, has been listed on the National Priorities List of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or “Superfund” (Figure 2). Sediments in the river are contaminated with various toxic compounds, including metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides and dioxin. Levels of these pollutants in the river appear to be highest near contaminated upland sites adjacent to the river. One of the main ways in which people come in contact with these toxic compounds is by consuming fish caught in the Willamette. In June 2004, the Oregon Department of Human Services issued a fish advisory related to high PCB levels found in fish caught from the Willamette River in Portland Harbor. The advisory recommends that children and pregnant or nursing women should not consume fish from the Willamette. For more information about the Portland Harbor Superfund, see the Department of Environmental Quality’s website <http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/index.htm>.

Significant riparian and wildlife habitat resources still exist at Kelley Point Park, Harborton Wetlands, South Rivergate Corridor, Ross Island, the Oaks Bottom Wildlife Refuge, and in numerous smaller tributaries, wetlands, and vegetated habitat areas along the Willamette corridor in Portland. These areas provide flood storage, water cooling and sediment filtering, and fish and wildlife habitat. These areas also provide important wildlife connectivity corridors along the river and to other significant resources within Portland and the region.

Eleven bridges cross the Willamette River in Portland. The Sellwood, Marquam, Ross Island, Hawthorne, Morrison, Steel, Broadway, Fremont, Railroad, and St. Johns bridges are designed to accommodate automobile and truck traffic. Just south of the St. Johns Bridge a railroad bridge cross the Willamette. Several of the bridges provide habitat. For example, the St. Johns, Railroad, Fremont, and Marquam bridges provide nesting opportunities for Peregrine falcons.



**Figure 2: Portland Harbor Superfund (Department of Environmental Quality)**

The Lower Willamette River also contains and connects to important upland resource areas. The Willamette River corridor provides connectivity for north/south and east/west wildlife movement. For example, the river connects to Forest Park and further west to the Tualatin Mountains and Coast Range. These large forested areas provide a major wildlife migration corridor for deer and elk and are a source of species recruitment. The Lower Willamette River corridor provides important wintering habitat for waterfowl and raptors, and breeding habitat for Neotropical migratory songbirds. To the east, the Willamette River corridor connects to the East Buttes in the Johnson Creek watershed and the Sandy River delta via the Columbia Slough and the Columbia Gorge. A seven-mile escarpment runs along the east side of the river within the city, providing important native oak habitat and wildlife habitat connectivity. Local neighborhoods contain tree canopy and vegetation that help manage stormwater by intercepting rain and filtering pollutants from overland flow. Neighborhood vegetation can also provide important wildlife habitat areas and corridors.

**Picture 3: Oaks Bottom Wildlife Refuge/Ross Island**



**Picture 4: Waud Bluff/Mocks Crest**



## Section 4c. THE NORTH REACH

### Section 4c1. OVERVIEW

The North Reach of the Willamette River Natural Resources Inventory study area is 6,470 acres in size and extends approximately 12 miles from the Broadway Bridge to the confluence of the Willamette and Columbia rivers. The North Reach is the longest reach of the Willamette River within the City of Portland. The landscape of the North Reach is comprised of industrial lands, river-dependent uses, a few residential areas, and several parks and natural areas.

The North Reach is located within a dynamic junction of ecosystems linking the northernmost portions of the Willamette River Basin with the Columbia River Gorge and Sandy River Basin, the forests and emergent wetlands of the Ridgefield Wildlife Refuge and Vancouver Lake Lowlands, Sauvie Island, Tualatin Mountains, and the Columbia River Estuary and Pacific Ocean. Because of these connections, the North Reach serves as a migration corridor for salmonids moving between the ocean and spawning areas upstream, as well as a connectivity corridor for mammals and birds.

Given its location along two major river systems, the North Reach also plays a critical role in the region's economy. Portland originated as a seaport for timber and grain exports. Railroads and major highways were constructed connecting Portland to Seattle, San Francisco, Los Angeles and eastward.

To facilitate industrial development and use of the river for shipping, the landscape has been altered significantly. Large portions of flood plain wetlands, such as Doane and Guilds lakes, have been filled. Swan Island and portions of the river channel were altered. Numerous small streams originating in Forest Park have been piped. The banks of the Willamette have also been filled, steepened and armored; wharves and piers are built out into the river and the channel is dredged to improve navigation for large ships and barges. Today, the Portland Harbor is a major distribution point for many goods. Three industrial districts are located in the North Reach: Rivergate, Swan Island

**Picture 5: Railyard**



**Picture 6: Port of Portland Terminal 5**



and Northwest Industrial. Of the jobs provided by Portland's industrial districts, 36% are located within these three districts. Between one-half and three-quarters of the developed, occupied land in the North Reach is in heavy industrial use, primarily freight distribution – rail yards, marine terminals and truck terminals (Industrial Lands Atlas, Bureau of Planning 2004).

Within the industrial districts are large areas of vacant, non-vegetated or sparsely vegetated land. Much of this non-vegetated, vacant land contains fill, and has been cleared, graded, and compacted. With the exception of the floodplain, these areas are not currently providing significant riparian corridor or wildlife habitat functions as assessed in the inventory. However, some of these vacant areas in the North Reach represent restoration opportunities, particularly if located adjacent to or between areas with existing functions.

Portions of two residential communities, Linnton and St. Johns, are located partially within the North Reach study area. Both neighborhoods represent a transition between river-dependent industrial uses and residential/commercial uses. Also located in the North Reach are four parks, including Kelley Point Park and Cathedral Park, four Port of Portland Terminals, and numerous industrial developments.

The Willamette River and considerable portions of the land in the North Reach is contaminated with toxic compounds. The Portland Harbor is a listed Superfund site, and more than 100 Environmental Cleanup Sites have been identified by the Department of Environmental Quality (Map 10). The types of contamination include polychlorinated biphenyls (PCBs), DDT, polycyclic aromatic hydrocarbons (PAHs), and heavy metals such as mercury. Some contaminants are bound to soil particles, while others can dissolve in water. The level of risk to humans and wildlife varies depending on the type of contaminant as well as exposure. The inventory site descriptions provide an overview of contaminated areas, types of contaminants, risk, and status of clean up activities. For more information, see the Department of Environmental Quality's website (<http://www.deq.state.or.us/lq/ECS/ecsi.htm>).

Although contamination is prevalent in the North Reach, the area also contains important natural resources including remnant bottomland hardwood forests, upland forests and oak escarpments, wetlands, streams, riparian corridors, and the river itself.

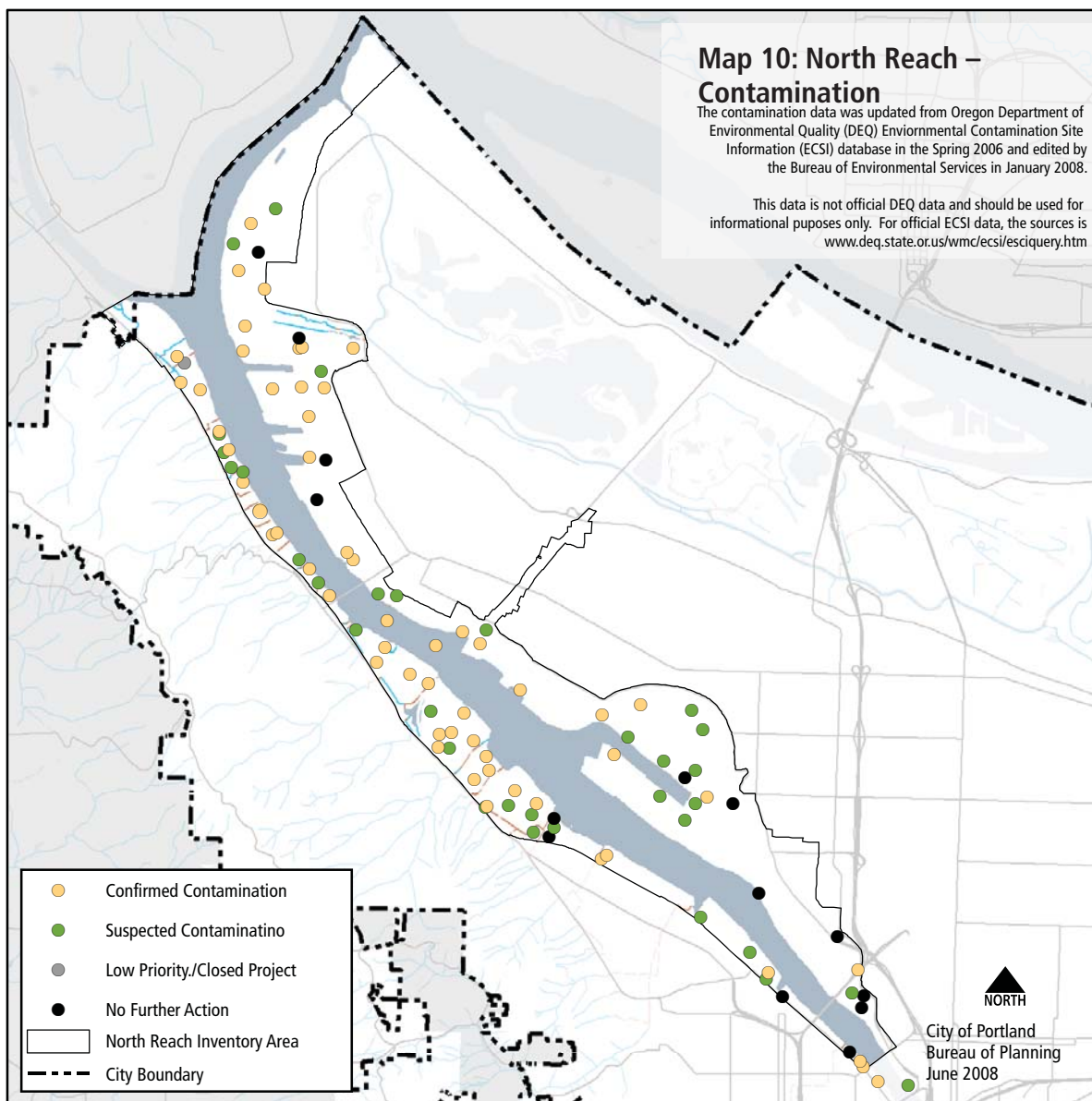
Larger natural resource areas remain at Kelley Point Park, the Harborton Wetlands, South Rivergate corridor, Willamette Cove, Doane Lake and the Willamette Bluff. These areas provide



**Picture 7: Cathedral Park**



**Picture 8: Turtle**



important connections with natural resources to the east including Smith and Bybee Wetlands and the Columbia Slough as well as to the north and west including the Multnomah Channel, Sauvie Island and Tualatin Mountains (Forest Park).

Remnant bottomland hardwood forests, associated wetlands, and intermittent river bank vegetation occur along the river. These resources provide bank functions, sediment and pollution control, localized microclimate and shading, organic inputs, wintering and breeding habitat for waterfowl, shorebirds and neotropical migrating birds. The river, river banks and vegetated riparian areas contribute to channel dynamics and provide important opportunities for wildlife to move and access water, food, and shelter. Travel corridors along the Columbia Slough are important for dispersion of mammals such as deer, coyote, fox and beaver, as well as reptilian (turtles and snakes) species. Upland tree canopy and vegetated cliffs offer additional hydrologic, water quality and habitat benefits, including stopover areas for neotropical migratory birds.

The forests provide year-round seeds, berries, nuts and insects for a variety of resident songbirds. Bald eagle, blue heron, osprey and other raptors depend on the bottomland forests, emergent wetlands and upland forests for food and nesting sites. These habitats are also important for terrestrial species such as deer, river otter, coyote, and fox, which make use of the proximity of shelter in the uplands and forage along the river. Reptiles, such as native Western Painted and Pond Turtles and garter snakes, and amphibians, such as northern red-legged frogs, also move between the upland and riparian habitats. Moving from the upland areas to the lowland forests and river is relatively easy for avian species and bats, but is difficult for mammals, reptiles and amphibians that must cross roads, such as Highway 30, railroads, parking lots, and maintained landscaped areas.

Historically, the North Reach was one of the most unconstrained of the river reaches below Willamette Falls. The low-lying delta islands and dynamic floodplains likely resulted in significant channel movement and change. The river was historically a half mile wide with a large shoal along the east river bank. Surveys from the 1800s indicate that banks in this reach were dominated by beaches and wetlands. Islands and floodplains provided extensive off-channel refuges for large historic salmon runs. Fish passage between the river channel and tributaries included access to the Columbia Slough, Miller Creek, Rock Creek, and Multnomah Channel.

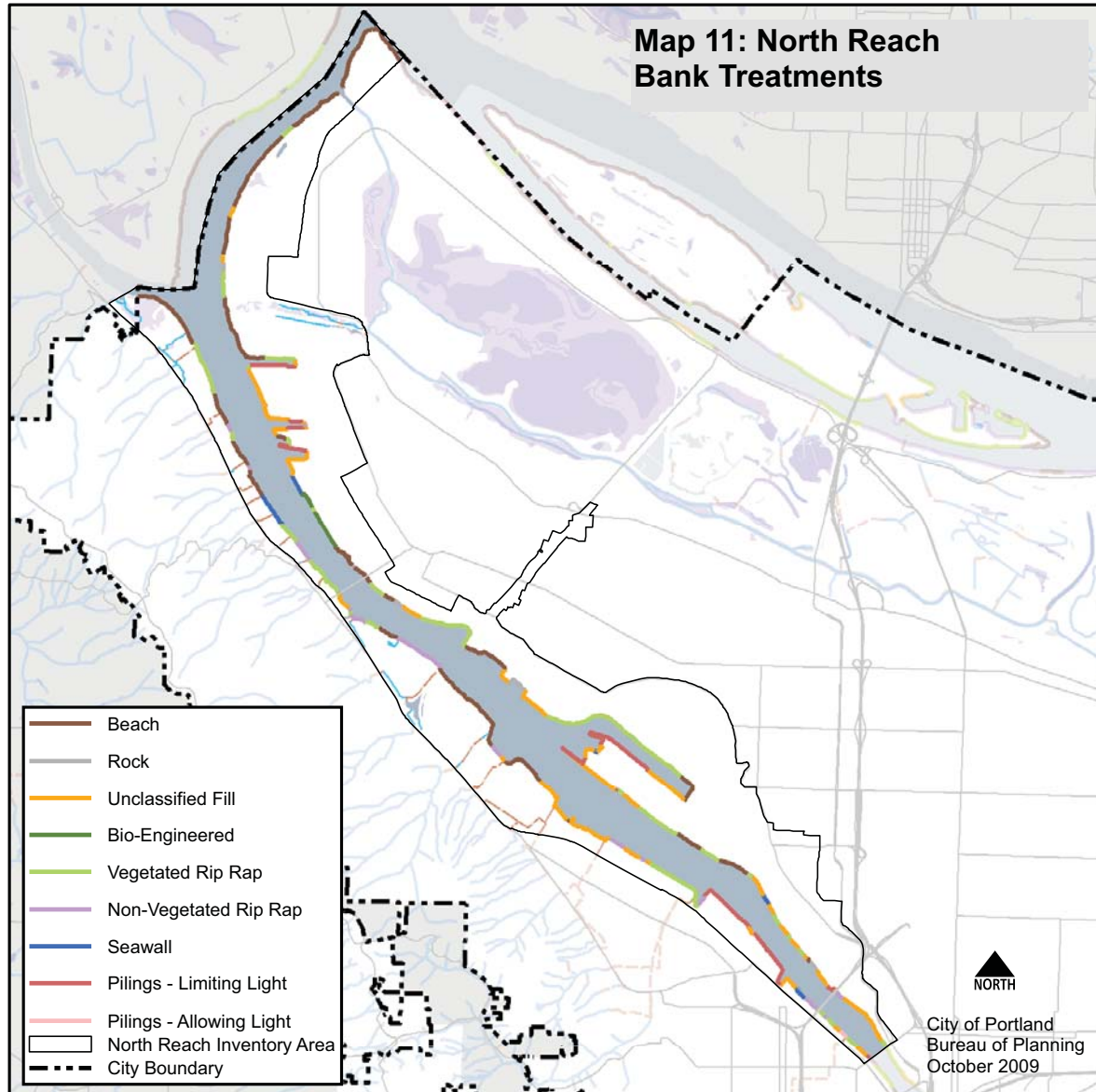
Today, the Willamette River channel in the North Reach is a deep, simplified channel that is dredged to support navigation. Water less than 20 feet deep used to comprise more than two thirds of the channel area. Now shallow water areas comprise about 10 percent of the channel area. The channel generally has steep banks which have been largely filled and armored with pilings and riprap. Numerous docks are used by river-dependent industries. In some places, vegetation has been mixed with riprap to stabilize the bank. This vegetation provides many functions, including sediment control and wildlife habitat.



**Picture 9: Beach along Willamette at Harborton Wetlands**

**Table 7: River Bank Treatments in the Willamette River North Reach**

Bank Type	Length (ft)	% of Total
Beach	37,633	23%
Bio-Engineered	4,927	3%
Vegetated Rip Rap	39,311	25%
Non-Vegetated Rip Rap	21,911	12%
Unclassified Fill	33,765	21%
Pilings - Limiting Light	21,427	13%
Pilings - Allowing Light	433	0%
Rock	2,339	1%
Seawall	2,803	2%
<b>Total</b>	<b>164,549</b>	<b>100%</b>



Anadromous salmonids use the Willamette River North Reach primarily for passage (upstream and downstream). Rearing does occur at the confluence with the Columbia Slough and Multnomah Channel as well as at other embayments. Shallow-water areas such as Willamette Cove, and remnant beaches that accumulate large wood, are also used by anadromous salmonids, shad and sturgeon for migration and rearing (ODFW, 2005). Other fish that use the Lower Willamette include yellow perch, largemouth bass, smallmouth bass, northern pikeminnow and sunfish. Warm water fish find refuge among the wharves and docks, as evidenced by the large numbers of piscivorous birds. Pacific lamprey are also found in the Willamette River. Few studies have been done on lamprey, which are an anadromous eel-like fish. Recent research conducted by Portland General Electric suggests that the Willamette River is one of the most important production areas for Pacific lamprey in the Columbia River Basin (PGE 2008).

Macroinvertebrates (aquatic insects), zooplankton and phytoplankton are a significant food sources for fish and other aquatic species. The invertebrate community in the Lower Willamette is relatively homogenous, consisting primarily of oligochaetes, cladocerans, amphipods and chironomids (Friesen et. al., 2005). The highest species diversity and taxa richness tends to be found at beaches. High densities of invertebrates usually exist at riprapped banks, but the species diversity and richness varies from high to relatively low. Seawalls tend to have the lowest species densities, diversity and richness likely caused by the lack of interstitial spaces or other complex microhabitats. Figure 3 is representative of taxa found in the Lower Willamette River: (A) copepods (Calanoida), (B) chironomids (Diptera), (C) *Daphnia* spp. (Cladocera), (D) *Eogammarus* spp. (Amphipoda), (E) *Corophium* spp. (Amphipoda), (F) *Bosmina* spp. (Cladocera), (G) caddisfly (Trichoptera), (H) mayfly (Ephemoptera), and (I) stonefly (Plecoptera).



Picture 10: Coho found in Millers Creek

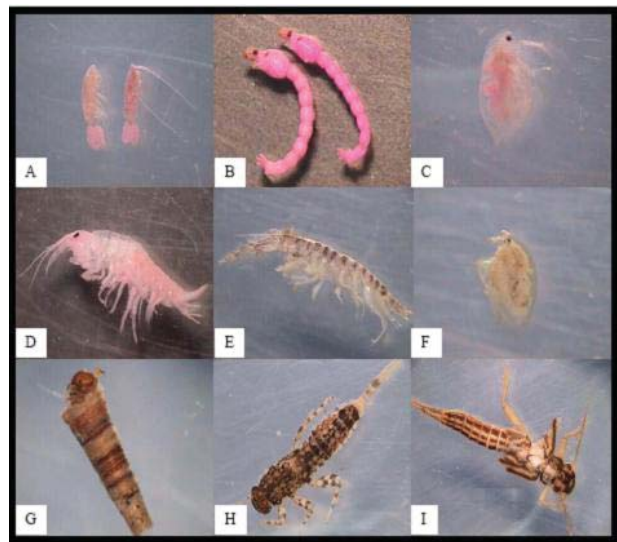
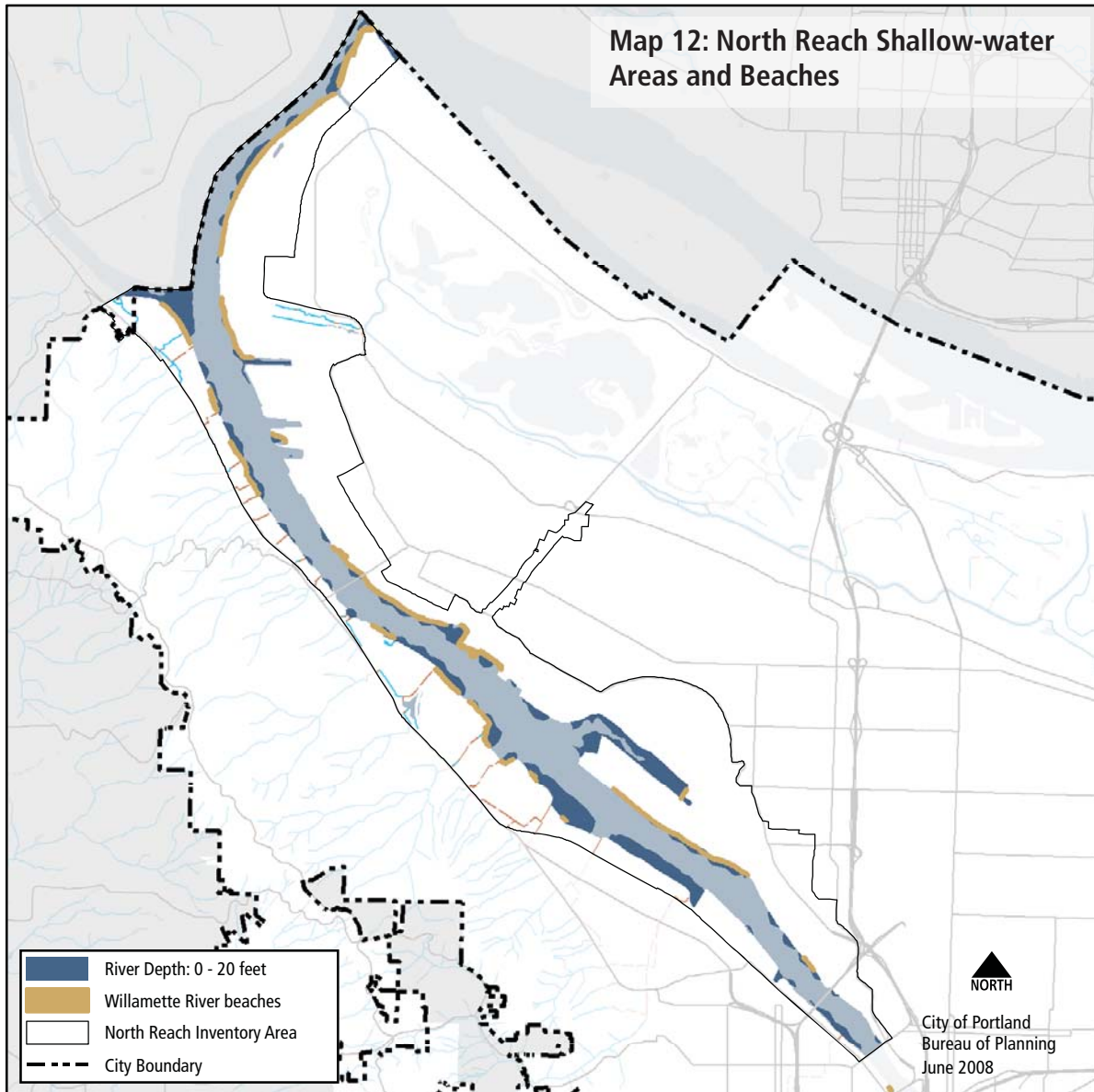
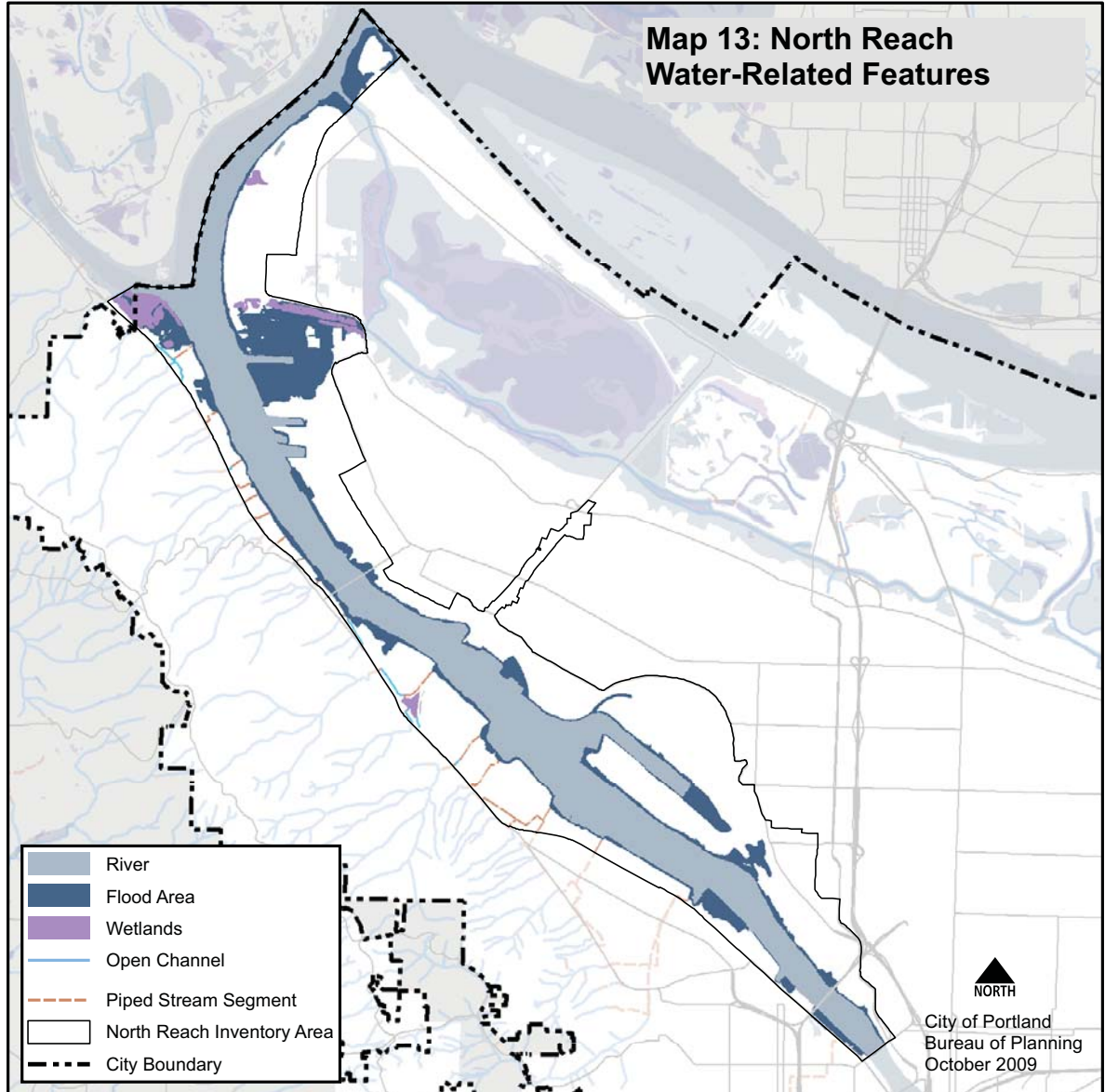


Figure 3: Macroinvertebrates

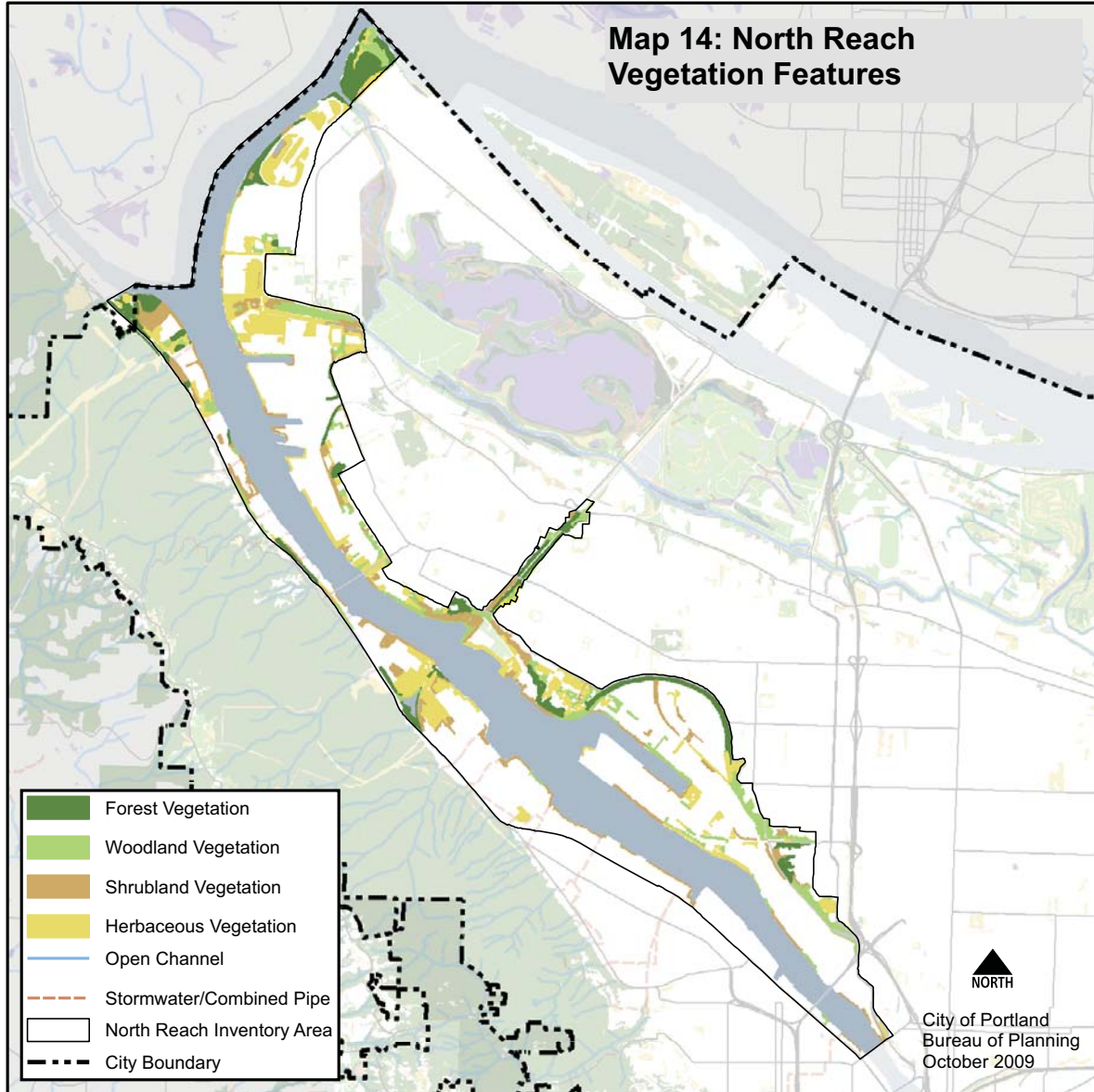




The Willamette River North Reach is roughly 6,470 acres in size. The North Reach contains 12 miles of the river, which is about 2,171 acres or 34% of the North Reach study area. There are also 4 miles stream channels in the North Reach, including the confluences of the Columbia Slough and Multnomah Channel. There are 3,005 acres of flood area within the North Reach, 2,155 acres of which are the open water area of the river. Roughly 320 acres of the land portion of the flood area are vegetated while the remaining 530 acres are developed with industrial or other land uses. Wetlands, such as Harborton Wetlands and North Doane Lake, comprise an additional 88 acres in the North Reach.



The North Reach contains approximately 1,015 acres of vegetated patches greater than one-half acre in size, including 245 acres of forest or dense tree canopy, 210 acres of woodland, 170 acres of shrubland and 390 acres of herbaceous cover. These vegetated areas cover approximately 17% of the North Reach study area. There are also 20 designated Special Habitat Areas, totaling 2,695 acres, within the North Reach. These include native oak assemblages, bottomland hardwood forests and wetlands. Impervious surfaces, such as buildings, parking lots and 96 miles of roads, cover 2,620 acres (40%) of the North Reach study area.



**Table 8: Summary of Natural Resource Features in the Willamette River North Reach**

	North Reach (6492 Acres)
<b>Stream (miles)</b>	
Willamette River (miles/acres)	12 / 2,170
Open Stream Channel (linear feet)	4
Piped Stream Segments (miles)	7
<b>Wetlands (acres)</b>	<b>88</b>
<b>Flood Area (acres)*</b>	<b>3,007</b>
Vegetated (acres)	323
Non-vegetated (acres)	528
Open Water (acres)	2,156
<b>Vegetated Areas &gt;= ½ acre (acres)+</b>	<b>1,015</b>
Forest (acres)	247
Woodland (acres)	208
Shrubland (acres)	170
Herbaceous (acres)	390
<b>Impervious Surfaces (acres)</b>	<b>2,623</b>

\* The flood area includes the 100-year floodplain, determined by FEMA, combined with 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 on 2006 aerial photography.

## Resource Evaluation

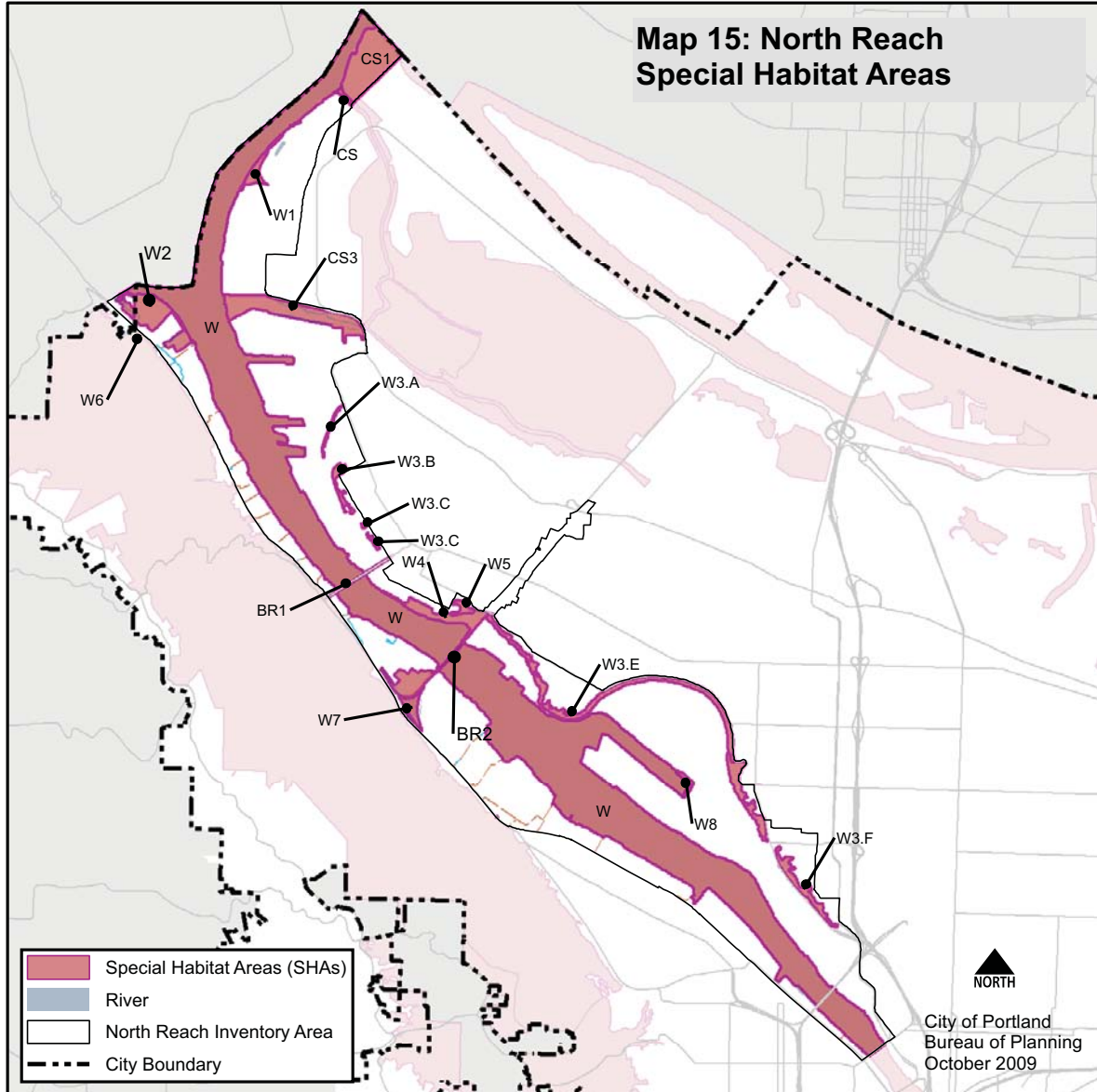
The methodology for evaluating relative resource function is outlined in the previous chapter and details are available in Appendix E – City of Portland Natural Resource Inventory Update: Project Report – Discussion Draft June 2008.

Designated Special Habitat areas in the North Reach are shown in Table 7 and Map 15. Special Habitat Areas rank high for wildlife habitat and combined riparian corridor and wildlife habitat.

**Table 9: Special Habitat Areas in the Willamette River North Reach**

Watershed/ Site ID	Site Name	P	W	O	B	I	D	M	C	S	E	G	U
<b>Columbia Slough</b>													
CS	Lower Columbia Slough	--	X	--	X	--	--	X	X	X	--	--	X
CS1	Kelley Point Park	--	--	--	X	--	--	X	X	--	--	--	--
CS3	West Wye/ I-5 Powerline Mitigation Site	--	X	--	X	--	--	X	X	X	--	--	--
<b>Willamette River</b>													
BR1	St. Johns Bridge	--	--	--	--	--	--	--	--	X	--	--	X
BR2	Railroad Bridge	--	--	--	--	--	--	--	--	X	--	--	X
BR3	Fremont Bridge	--	--	--	--	--	--	--	--	X	--	--	X
W	Willamette Mainstem ESA Critical Habitat	--	--	--	--	--	--	--	X	X	--	--	--
W1	NW Willamette River Forested Wetland	--	X	--	X	--	--	--	X	--	--	--	--
W2	Harborton Forest & Wetlands Complex	--	X	--	X	--	--	X	X	X	--	--	--
W3.A	Willamette Bluff Complex - Roberts/ Railroad Bluff	--	--	X	--	--	--	--	X	--	--	--	--
W3.B	Willamette Bluff Complex - Weyerhauser Ave Woodlands	--	--	X	--	--	--	--	X	--	--	--	--
W3.C	Willamette Bluff Complex - Edison Street Woodlands	--	--	X	--	--	--	--	X	--	--	--	--
W3.D	Willamette Bluff Complex - Decatur Bluff	--	--	X	--	--	--	--	X	--	--	--	--
W3.E	Willamette Bluff Complex - Willamette Bluff	--	--	X	--	--	--	--	X	--	--	--	--
W3.F	Willamette Bluff Complex - Riverwood Woodland	--	--	X	--	--	--	--	X	--	--	--	--
W4	Willamette Cove Bottomland	--	--	X	X	--	--	--	X	--	--	X	--
W5	Edgewater Street Forest and Ravine	--	--	X	--	--	--	--	X	--	--	--	--
W6	Forest Park	--	--	X	X	--	--	X	X	X	X	--	--
W7	Doane Lake and Wetlands	--	X	--	X	--	--	X	X	X	--	X	--
W8	Swan Island Lagoon Beach and Wapato Wetland	--	X	--	--	--	--	X	--	X	--	--	X

- P - Area contains sensitive or rare plant populations
- W - Wetlands and associated seeps, springs and streams that are part of the wetland complex
- O - Native oak
- B - Bottomland hardwood forest
- I - Riverine island
- D - River delta
- M - Migratory stopover habitat
- C - Corridor between patches or habitats
- S - Area critical to sensitive species life history, on more than an incidental basis; critical habitats as designated by NOAA
- E - Elk migratory corridor
- G - Upland meadow, prairie or grassy area important to migrants and grassland-associated species
- U - Resource or structure that provides critical or unique habitat function in natural or built environments



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.

**Table 10: Summary of Ranked Natural Resources in the Willamette River Inventory Study Area**

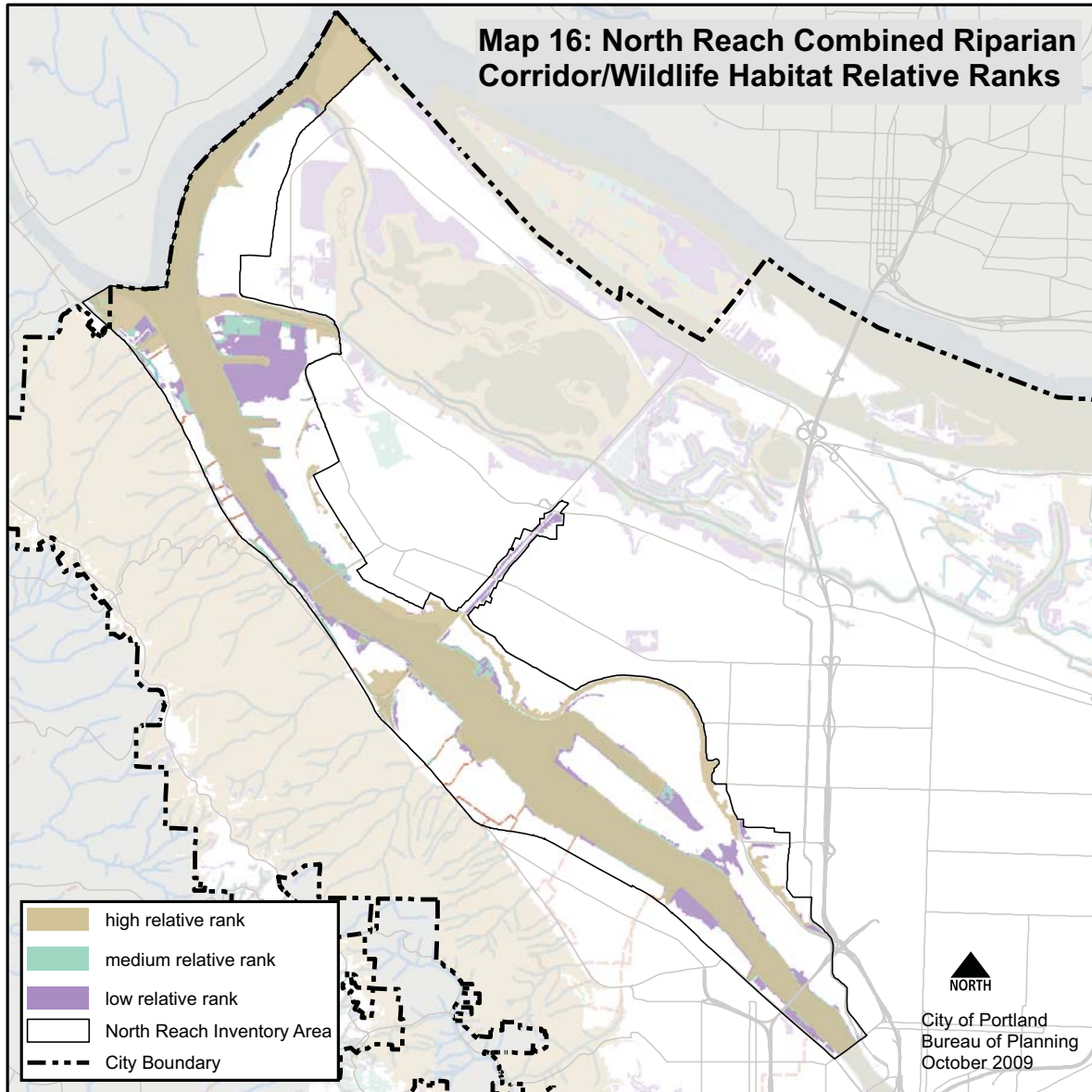
Total Inventory Study Area = 6,492 acres Terrestrial* = 4,320 acres Willamette River = 2,172 acres				
	High	Medium	Low	Total
<b>Riparian Corridor**</b>				
acres	2,437	240	572	3,249
percent total inventory study area	38	4	9	51
<b>Wildlife Habitat**</b>				
acres	0	191	149	340
percent total inventory study area	0	3	2	5
<b>Special Habitat Areas **</b>				
acres	2,697			
percent total inventory study area	42			
<b>Wildlife Habitat- adjusted for Special Habitat Areas ***</b>				
acres	2,697	21	51	2,769
percent total inventory study area	42	<1	1	43
<b>Combined Riparian Corridor/Wildlife Habitat*</b>				
acres	2,776	190	539	3,505
percent total inventory study area	43	3	8	54
<b>Combined Riparian Corridor/Wildlife Habitat (excludes Willamette River)</b>				
acres	621	190	539	1,350
percent total inventory study area	10	3	8	21

\* Terrestrial includes the land, tributary streams, drainageways and wetlands; excludes the Willamette River.

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

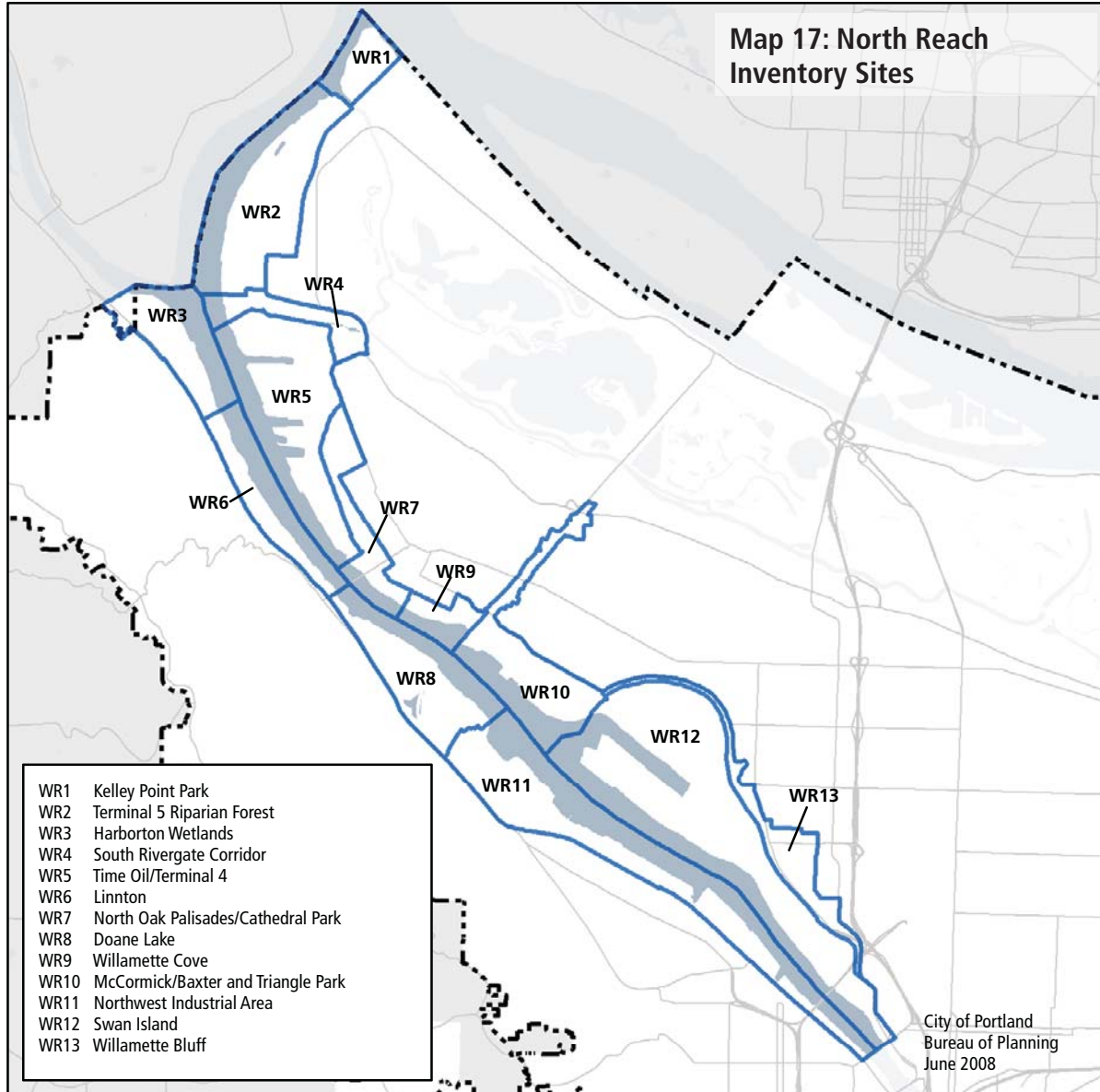
\*\*\* Special Habitat Areas rank high for wildlife habitat.

+ Because ranked riparian corridors, wildlife habitat, and Special Habitat Areas overlap, the areas cannot be added together to determine the combined area.



## Section 4c2. NORTH REACH INVENTORY SITES

There are thirteen inventory sites in the North Reach of the Willamette River Inventory study area. They range in size from approximately 119 acres to 1,450 acres, including land and portions of the Willamette River. The inventory sites support a variety of uses, primarily industrial, parks and natural area, and river recreation and commerce.





The following report sections provide information for each inventory site. Each site section starts with a summary of site characteristics (Table 11) and is followed by a description and evaluation of natural resources.

**Table 11: Explanation of Inventory Site Summary Information**

Characteristic	Explanation
Watershed	The name of the watershed(s) within which the inventory site is located.
Neighborhood:	The name of the neighborhood(s) within which the resource site is located.
Legal Description:	USGS quadrangle maps, and quarter section maps.
River Mile:	Beginning at the mouth of the Willamette River, mile 0 is where the centerline of the Willamette meets the centerline of the Columbia River. This is also coincident with the northwest corner of the City of Portland boundary.
Site Size:	Size estimates include land features, streams and drainageways, wetlands and portions of the Willamette River to the centerline of the channel (for sites on the river) .
Previous Inventory:	City-adopted natural resource inventories in which the site or portions of the site were addressed.
Zoning:	Zone designations within the site, including overlays (e.g. airport, design, open space, scenic, greenway and environmental).
Existing Land Use:	Primary land uses currently on the site.
General Resource Description:	Brief description of the site, its geographic location, natural resources and other key features.
Resource Features:	Specific natural resource features found on the site (e.g., stream, wetland, flood area, vegetation, beach, steep slopes, open water). Features may be in relatively good or poor/degraded condition.
Resource Functions :	Riparian and wildlife habitat resource functions are provided by the existing resource features located within an inventory.
Special Habitat Area:	Special Habitat Areas (SHAs) are designated where there are documented critical or rare or declining habitat types, or critical habitats for special status species.
Special Status Species:	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 identified by Oregon Department of Fish and Wildlife, Oregon Natural Heritage Information Center, the US Fish and Wildlife Service, or NOAA National Marine Fisheries Service. Special status species lists for Portland can be found in Appendix E.*
Hazards	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).
Contamination	Indicates whether any portion of the site is contaminated per the Department of Environmental Quality, Environmental Cleanup Site Information (ECSI) database.

\* Additional information regarding special status species is available in the draft Terrestrial Ecology Enhancement Strategy Summary and Update, Bureau of Environmental Services (August 2007).

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 description provides information on water bodies, wetland, 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 field assessments completed by City staff and Adolphson Associates

between 2000 and 2003. City staff conducted additional field visits to many of the sites in 2005 and 2006. Field observations and Wildlife Habitat Assessment forms are provided in Appendix D. Additional site visits were conducted after the Discussion Draft of this report was released in 2007. Other information sources used to develop these descriptions include: the Bureau of Environmental Services Willamette River Characterization; a four-year Oregon Department of Fish and Wildlife study on the life cycles and behaviors of listed salmonids in the lower Willamette River; 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 E - *City of Portland Natural Resource Inventory Update: Project Report - Discussion Draft July 2008*.

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 Willamette corridor 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.

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