working for clean rivers

ACTIONS for WATERSHED HEALTH

2005 Portland Watershed Management Plan


COLUMBIA SLOUGH


FANNO CREEK


JOHNSON CREEK


TRYON CREEK


WILLAMETTE RIVER

"In Portland, land and water are elemental, the very icons of the city. The rain, our region's rivers, and our land - the watersheds that gather, feed, and protect them - are our identity, the essence of who we are and where we've come from. Portland's Watershed Management Plan reflects these icons, establishing a plan for sustaining Portland's 160-year vision of itself as a land of waters. In a world and a time of concerns and challenges, the City's goals for managing our watersheds give us reason for hope and confidence in a sustainable future."

Chet Orloff, Chair
Portland Parks Board

CITY OF PORTLAND
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204-1912 ▪ Sam Adams, Commissioner ▪ Dean Marriott, Director

March 8, 2006

Dear Friends of Portland's Watersheds:

It gives me great pleasure to present Actions for Watershed Health: the 2005 Portland Watershed Management Plan. This document builds on years of City work in our urban watersheds fostering community stewardship of valuable waterways, and protecting natural stream functions. It also describes how these individual actions contribute to the citywide goal of healthy watersheds.

Our title begins with the word "Actions" because it is my intent that unlike so many other efforts, this plan will not be shelved but will be the catalyst to achieve much more for Portland's watershed health. Considering the backlog of existing work, I've directed BES to propose an additional 5 priority projects for each watershed that represents work above and beyond what has already been proposed for the coming fiscal year. It's my intent to enhance funding of this work, to the extent that existing revenue allows.

Watershed Plan goals include improving bureau collaboration, reducing inefficiencies and managing for results. The Plan emphasizes that City bureaus must work together to protect and restore wildlife habitat and watershed health.

While some actions are already underway, I cannot overemphasize the need to do more and to move quickly. The Oregon Water Quality Index describes water quality as fair in the Willamette River and as very poor in Johnson Creek and the Columbia Slogh. However, each watershed still sustains remnant natural resources such as urban forest, woodlands, grasslands, streams, wetlands and floodplains that provide important watershed functions.

Therefore, this plan is a "Call to Action" for all City Bureaus to find the best opportunities to work to support our watersheds. Whether it's through simply performing their work in a more watershed friendly manner, or through the implementation of new projects that require intense collaboration and creative thinking.

This plan presents opportunities to honor the commitment Portland residents have made to an urban environment where nature and city coexist and support each other. It reflects the City's commitment to regulatory compliance. It emphasizes protecting public health and spending public money responsibly. The Plan is based on thorough analysis of watershed conditions and desirable improvements. It is guided by the Framework for Integrated Management of Watershed Health, and by assistance from many external and internal technical and policy advisors.

The Portland Watershed Management Plan acknowledges that watersheds, transportation systems, neighborhoods and the economy are interconnected. The activities of the City, citizens, businesses and developers can all have positive impacts on watershed health. I look forward to working with all of you for healthy watersheds.

Sincerely,

Sam Adams, Commissioner of Public Works

Activities of the City, citizens, businesses and developers all impact watershed health

ACKNOWLEDGEMENTS

The Willamette River Basin contains a multitude of people and organizations dedicated to revealing the nature of the Willamette River system and how we, its inhabitants, interact with it. We have drawn from their collective knowledge to craft this plan and hope to set a good example for other jurisdictions seeking to responsibly manage their portion of the watershed.

In particular, we would like to express our gratitude to the following individuals for giving selflessly of their time and experience:

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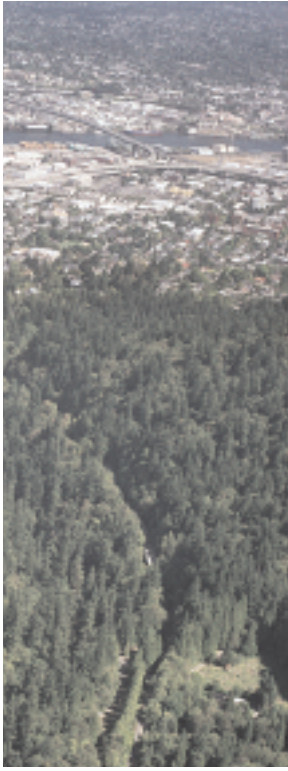

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Glossary and Acronyms

Portland is clearly committed to natural resource protection and sustainable development

EXECUTIVE SUMMARY

The City of Portland is responsible for managing its urban watersheds. This responsibility requires coordination between City bureaus, community businesses and neighborhood partners. As City budgets tighten and regulations become more demanding, it is important to maximize collaboration with all potential partners.

The Portland Watershed Management Plan (PWMP) will guide City decisions and projects by providing a comprehensive approach to restoring watershed health. This Plan is a first step toward creating a citywide effort. Urban watershed management is complex and includes a wide range of activities. Implementing this plan is challenging, but at the same time it provides exciting opportunities to make meaningful improvements in watershed health.

There is a role for everyone in the Portland Watershed Management Plan. Changing 'business as usual' requires the input and participation of elected officials, City staff, private citizens, businesses, non-profit organizations and school and volunteer groups. With Goals and Objectives in Chapter 3, Strategies and Actions in Chapter 4 and a Management System in Chapter 5, the intent and direction of improving watershed health is laid out to incorporate into work plans and practices.

The watershed management system described in Chapter 5 will guide future versions of the Plan to include more socio-economic analysis with involvement from City Bureaus and community partners. Collaboration among Bureaus on projects like green streets, land acquisition, floodplain restoration and fish and wildlife habitat protection will continue and current efforts will be better coordinated. Community involvement will continue in the form of local watershed councils and will be strengthened by neighborhood and other volunteer interests and activities.

Portland is committed to natural resource protection and sustainable development. The city has made great progress on many fronts, with much work yet to do. Because natural resource management responsibilities are spread across the city, it is critical that a comprehensive, coordinated system provide the structure and context for identifying priority actions and areas where attention should be focused. While this is a first attempt to bring all of the information together in one place, the 2005 Portland Watershed Management Plan proposes to provide that structure with a long-term commitment to adapt and improve over time.

The City's River Renaissance Initiative set the course for this citywide focus, and the Portland Watershed Management Plan will be instrumental in implementing the River Renaissance "Clean and Healthy River" theme. This Plan focuses on developing partnerships and designing multi-objective projects that incorporate a wide range of City values. With the Plan's initial structure in place, all City

bureaus can consider watershed health as they design and implement their projects. Over time and with greater inter-bureau involvement, this plan will guide city efforts to improve watershed health.

Portland's Watershed Approach

This plan lays out Portland's comprehensive, strategic and integrated approach to improving watershed health. By identifying goals, objectives, strategies and actions this approach aims to protect the best remaining resources and improve watershed functions and conditions citywide. It includes the development of management tools to track progress and measure results, with a focus on seeking net environmental improvement over time.

Built on a scientifically sound foundation, the watershed approach addresses the sources and causes of environmental problems rather than focusing on symptoms or meeting specific regulatory requirements. This approach seeks efficiencies and greater flexibility to find creative, multi-objective solutions that meet multiple requirements and save money.

The watershed approach relies on integrating the activities of multiple City bureaus, and maximizing limited resources by looking for solutions that meet multiple interests. The approach incorporates City values of improving public safety, economic vitality and community stewardship into decision-making. This approach will guide the activities of each City bureau and program that affects watershed health to improve watershed conditions while addressing a wider range of community priorities.

Purpose

This plan describes Portland's comprehensive approach to improving Portland's watershed conditions. This is the first time that all five Portland watersheds (Columbia Slough, Fanno Creek, Johnson Creek, Tryon Creek, and Willamette River) are discussed collectively in one plan. This effort takes into account whole watersheds, addressing upland conditions, and stream and river channels.

This comprehensive perspective presents watershed management issues on a citywide scale as a system plan, comparable to the Office of Transportation's Transportation System Plan or the Environmental Services Public Facilities Plan. From the analytical perspective of system function, this plan documents the extensive technical foundation Portland has established, including existing and desired future conditions. Based on that foundation, endorsement of this Watershed Plan by the City Council confirms the City's policy and commitment to improved watershed health.

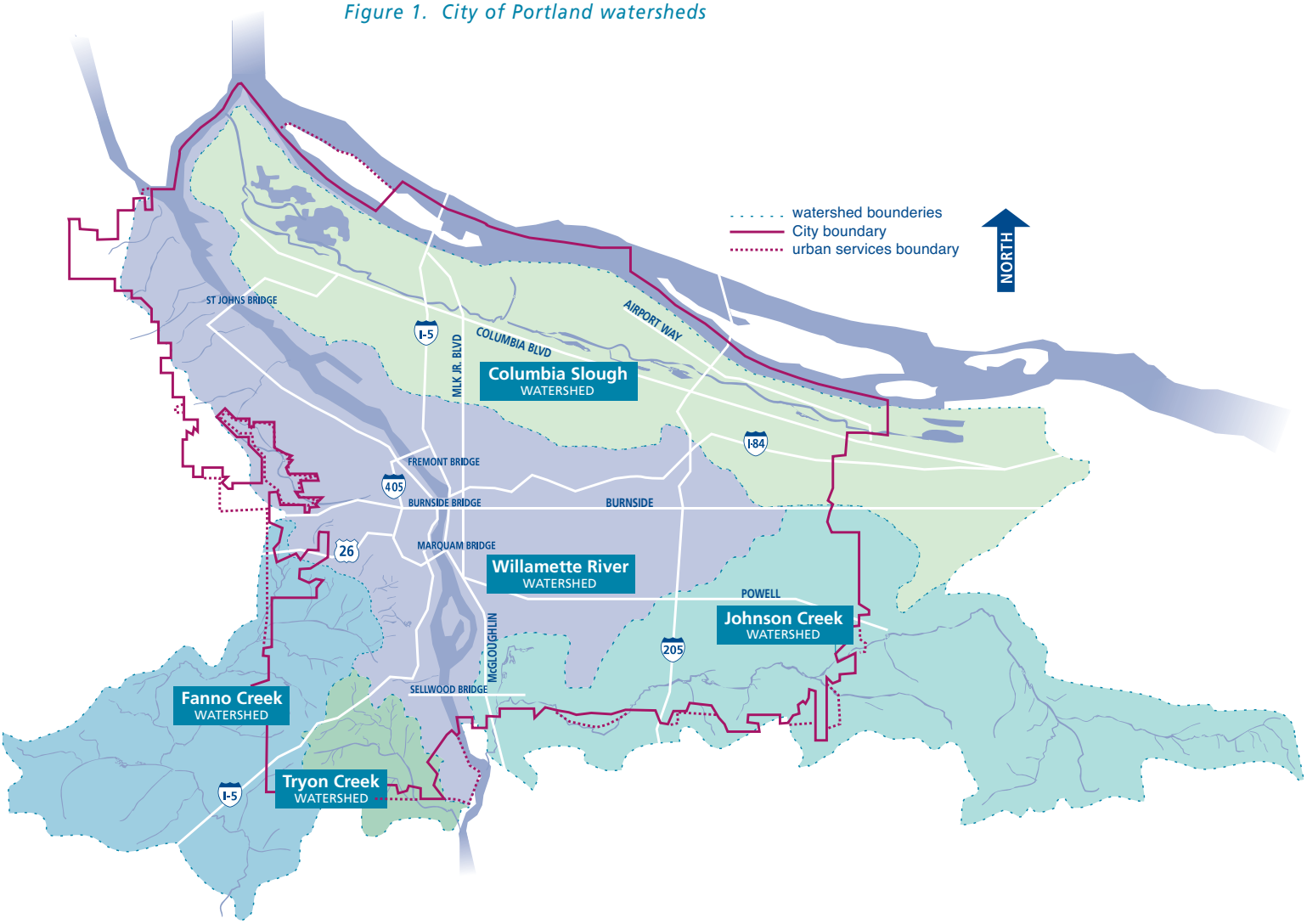
Organizational Scope

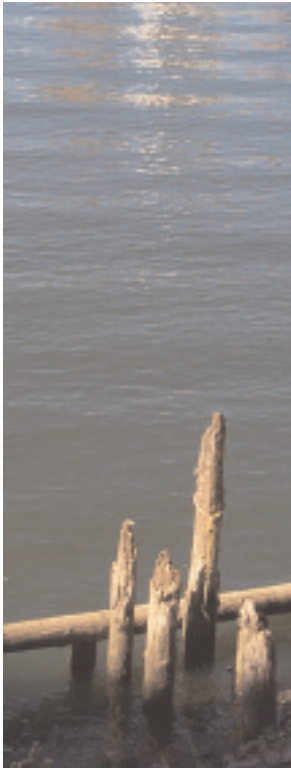
Environmental Services has the lead responsibility for developing this plan and management system, but changing how the City impacts watershed conditions relies on integration of these actions into all City activities. This plan is consistent with and complements other city system planning work, including the City's Comprehensive Plan (city wide land use plan), the River Plan (a District Plan for land along the Willamette River), the Public Facilities Plan (sanitary and storm infrastructure), the Transportation System Plan (transportation infrastructure) and Parks 2040 Plan (park and recreation needs). This watershed plan provides the overarching system management that connects watershed improvement projects, plans, and documents throughout the City.

Geographic scope

The study area for this plan includes the jurisdictional and urban services boundary of the City of Portland (future Plan updates will integrate urban services land currently not included). Encompassing over 130 square miles, Portland is a small but important part of the larger Willamette River Basin. And while the study area is technically limited to Portland, the City recognizes the importance of coordinating with up and down

Figure 1. City of Portland watersheds





stream jurisdictions and will continue to work regularly with a wide range of partners to foster broad regional collaboration.

The city is delineated into five watersheds representing its largest urban streams. The ***Columbia Slough*** watershed stretches 18 miles from Fairview Lake in Gresham into the Willamette River near Kelley Point Park. ***Johnson Creek*** flows west for 25 miles crossing several jurisdictions before entering the Willamette River in Milwaukie. Only a portion of ***Fanno Creek*** is in Portland, flowing 15 miles west and south before it enters the Tualatin River (the Tualatin flows into the Willamette just south of West Linn). ***Tryon Creek*** flows seven miles through parts of southwest Portland and unincorporated Multnomah County before entering the Willamette in Lake Oswego. For the purposes of this document, Portland's ***Willamette River*** watershed represents only the area of land that drains directly to the last 17 miles of Willamette River through small drainage ways, pipes, and streams before it enters the Columbia River.

Technical Scope

The technical scope of the Portland Watershed Management Plan is driven by goals and objectives identified to create healthy watersheds (see Chapter 3). The goals and objectives are based on the following definition of watershed health established in Portland's Framework for Integrated Management of Watershed Health (July 2005):

> *"A healthy urban watershed has hydrologic, habitat, and water quality conditions suitable to protect human health and maintain viable ecological functions and processes, including self-sustaining populations of native fish and wildlife species whose natural ranges include the Portland area."*

The Portland Watershed Management Plan:

- Uses a comprehensive approach to respond to state and federal regulatory requirements for water quality and endangered species;
- Uses the best available science;
- Integrates the work of several City work groups;
- Seeks cost-effective solutions;
- Identifies priority areas for protection and improvement of watershed functions; and
- Establishes a watershed management system that allows the City to adapt its approach as it learns more.

Recommendations

This plan identifies 20 actions (see Chapter 4), grouped into the following six strategies:

❶ Stormwater Management

Reduces impervious area, increases infiltration, and removes pollutants

❷ Revegetation

Slows runoff, increases infiltration, traps sediments, and absorbs pollutants

❸ Aquatic and Terrestrial Enhancement

Improves stream flow, recharges groundwater, provides flood storage, reduces heat island effects, provides connectivity, protects biodiversity and provides habitat for native fish and wildlife species.

❸ Protection and Policy

Preserves remaining natural areas and ensures sustainable development

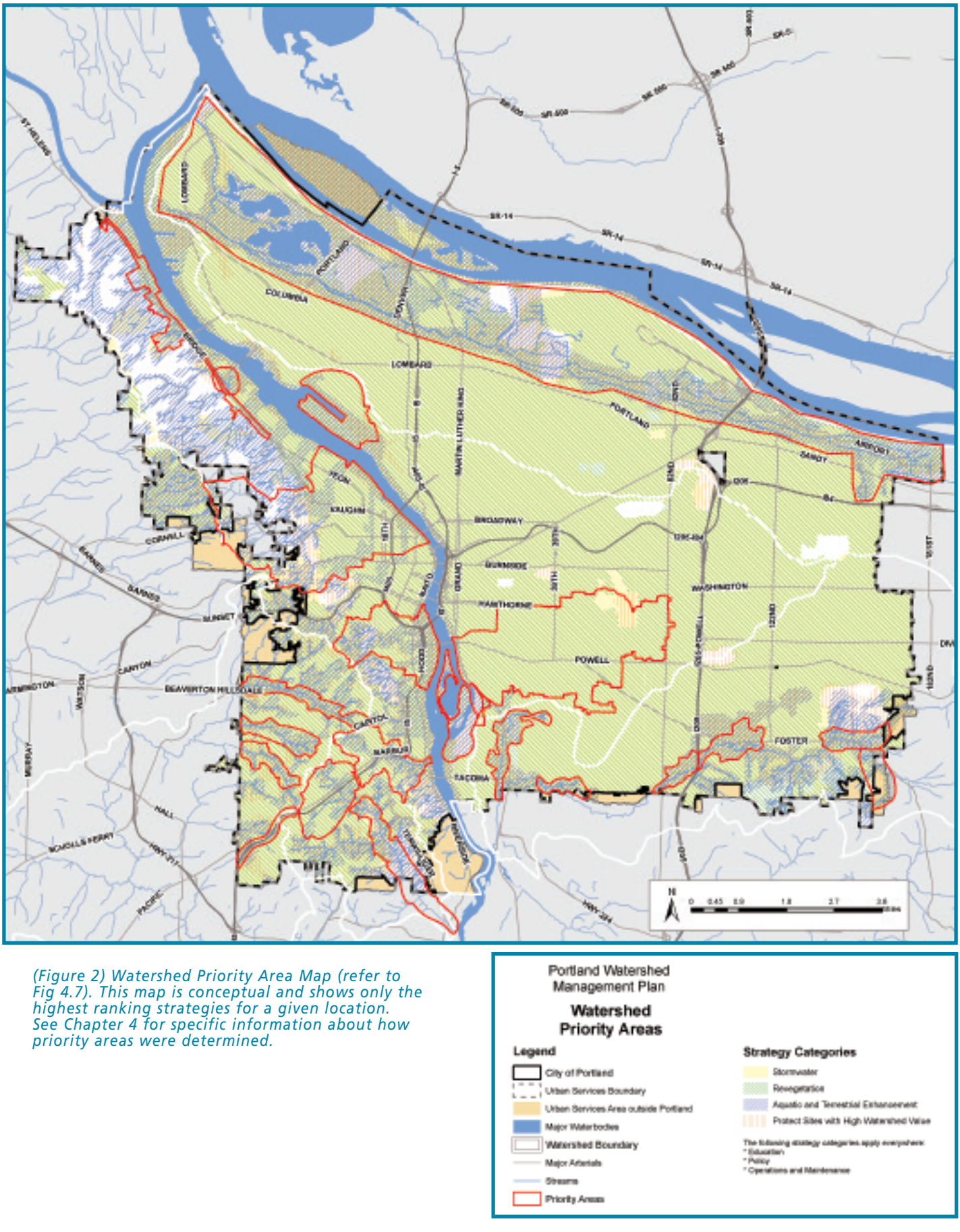
❹ Operations and Maintenance

Increases efficiency, reduces waste, and prevents pollution

❺ Education, Involvement, and Stewardship

Enhances public understanding, generates support, and ensures success

Central to the 2005 Plan's recommendations, maps were developed to show priority implementation areas for each of the strategies. In many cases the maps show more than one strategy for a given area. This indicates that strategies can be complimentary and are not meant to be mutually exclusive. Existing projects, programs and areas of opportunity are also identified in order to incorporate watershed improvement strategies into existing city priorities. From this analysis the Watershed Priority Areas map (Figure 2) highlights key areas of interest for improving watershed conditions over the next 2 to 5 years



(Figure 2) Watershed Priority Area Map (refer to Fig 4.7). This map is conceptual and shows only the highest ranking strategies for a given location. See Chapter 4 for specific information about how priority areas were determined.

What's in the 2005 Portland Watershed Management Plan?

The Plan summarizes years of extensive technical work of many City work groups and community partners, and provides guidance in implementing citywide watershed improvements (see Figure 3).

The Watershed Management Plan contains:

- Background information (Chapter 1);
- Summaries of current watershed conditions (Chapter 2);
- Watershed improvement goals and objectives (Chapter 3);
- Strategies, actions and priority areas to improve conditions in Portland's watersheds (Chapter 4); and
- A watershed management system that provides the organizational structure to implement actions and measure progress (Chapter 5).

Improving watershed conditions depends on citywide collaboration. No single effort can restore watershed health. With a firm commitment to work together and to systematically track progress, the Portland Watershed Management Plan will bring clarity, security and connections to the process of improving watershed health in Portland.

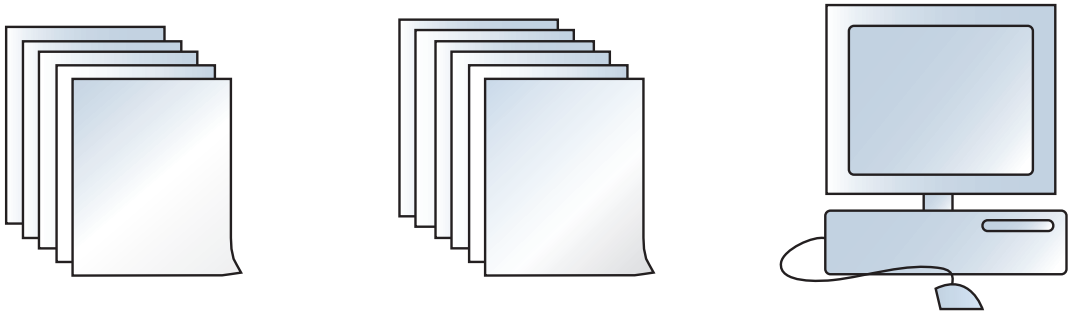
Figure 3

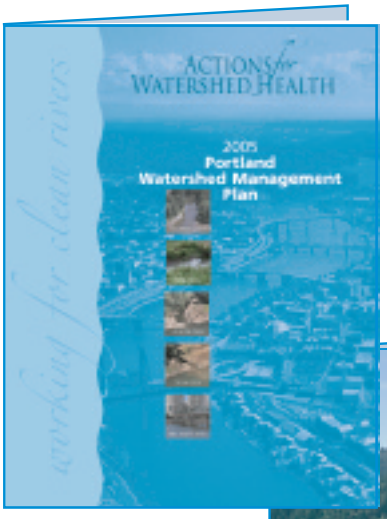
2005 Portland Watershed Management Plan

TECHNICAL REFERENCES

All documents are available on a CD and www.portlandonline.com/bes

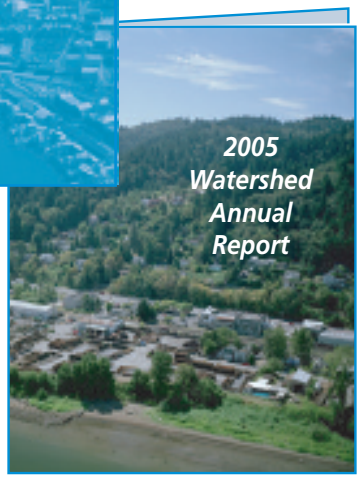
- Framework for Integrated Watershed Health
- Watershed Characterizations
- Existing Watershed Plans
- Technical Memorandums
- www.portlandonline.com/bes
- Actions Database





ACTION PLAN - *Update every 5 years*

- Background Information
- Conditions of Portland's Watersheds
- Watershed Goals and Objectives
- Watershed Improvement Strategies and Actions
- Watershed Management System



ANNUAL REPORT - *Update every year*

- Watershed Health Performance Measures
- 2004-05 Achievements
- Upcoming Implementation Priorities
- Short term correction or actions as needed

With this watershed plan Portland moves toward a more sustainable urban environment

CHAPTER 1: BACKGROUND

The City's distinctive urban and natural appeal continues to attract more residents each year, creating numerous economic benefits, but also increasing pressures on our engineered and natural systems. The approach in this Plan moves Portland toward a more sustainable urban environment, providing opportunities for City bureaus to address watershed goals in the context of regular City business like road construction and maintenance, land use planning and economic development.

This Watershed Plan supports the River Renaissance Clean and Healthy River vision, which acknowledges that the Willamette River is part of a connected ecosystem that includes a system of natural functions integral to maintaining the health of the river. Maintaining a prosperous, working harbor, embracing the river as Portland's front yard, creating vibrant waterfront districts and promoting partnerships, leadership and education are the other River Renaissance visions.

The Watershed Plan is also compatible with the City's Managing for Results initiative to improve management and make the City more accountable to the public. Managing for Results is designed to keep the public and management focused on missions, goals and objectives by tying program performance directly to resource allocation. It provides a common format for all city work groups to describe accomplishments. Similarly, the Watershed Plan sets the stage to develop a common format to improve watershed health.

Multiple City bureaus have important natural resource management roles. The Bureaus of Maintenance, Transportation, Planning, Water, and Environmental Services all have important natural resource management roles. Other city agencies like the Bureau of Housing and community development and Portland Development Commission also have a role in improving natural resource management.

The Portland Watershed Management Plan is administered by Environmental Services, Watershed Services Group. This group is responsible for evaluating conditions in the City's urban watersheds and implementing projects to improve watershed health. Watershed Services works with River Renaissance, other City bureaus, agencies, and citizens' groups that share a common goal to protect Portland's natural resources, restore critical ecosystems, and implement stormwater solutions that integrate the urban area with the natural environment.

The Watershed Plan focuses on improving watershed conditions in Portland, while recognizing the importance of regional efforts that include upstream and downstream communities and resources. Portland works with Metro, the Oregon Watershed Enhancement Board (OWEB), the Willamette Partnership, the Northwest Power and Conservation Council, Clean Water Services of Washington County, Portland State University, the University of Oregon and Oregon State University to collaboratively improve watershed health in the Willamette and Lower Columbia River basins.

Regulations and Watershed Management

Environmental Services is the City's lead agency for complying with several state and federal regulatory requirements relating to water and stormwater resources. The City, the Port of Portland and Multnomah County implement stormwater management programs through a permit issued by the Oregon Department of Environmental Quality (DEQ) under the federal Clean Water Act (CWA). The Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit requires the three co-permittees to control stormwater pollutants to the maximum extent practicable.

The City must also comply with many other water quality, floodplain management, land use, and natural resource protection requirements (Table 1.1). The work of many of the City's bureaus (BES, Water, Planning, Parks) go into compliance of these State and Federal regulations. The breadth of these regulations demonstrates stormwater management is a significant watershed health issue. The quantity and quality of stormwater runoff generated by development is one of Portland's greatest environmental challenges. One of the most effective ways to address this challenge is to incorporate stormwater into urban development as a resource that adds water quality benefits and improves livability, rather than considering it a waste that is costly to manage and dispose of. The City has attempted to do this by regulating management of the 25-year storm event. Impacts of this regulation in terms of achieving normative flow are currently unknown.

Table 1.1 Overview of Portland's Regional, State and Federal Regulatory Responsibilities

REGULATORY RESPONSIBILITIES	
Amended Stipulation and Final Order	CSO surface water protection
Clean Water Act	NPDES MS-4 stormwater permit
Clean Water Act	TMDL surface water protection: EPA approved TMDLs for Fanno Creek (Tualatin TMDL) and Columbia Slough; TMDLs in development for Willamette, Johnson Creek, & Tryon Creek
Endangered Species Act	Biological communities protection
CERCLA	Portland Harbor Sediment Investigation
State Land Use Planning Goals and Requirements	Includes goals 5-Protection of Significant Resources; 6-Air and Water Quality; 7-Natural Hazards; 11-Public Facilities and Services; and 15-Willamette Greenway. The City must demonstrate compliance with these goals to the Oregon Land Conservation Commission and/or Metro.
Safe Drinking Water Act	Water Pollution Control Facility Permit for UIC groundwater protection

Building on Experience

Over the years, the City has devoted extensive resources to natural resource protection. For several decades Portland has worked to inventory its natural resources, create protection plans, and manage and restore parks and greenspaces. In past decades watershed management efforts responded to urgent issues, such as flooding along Johnson Creek or contaminated sediments in the Columbia Slough. This plan provides the context for the City's watershed management approach to encompass broader landscape activities and changes.

The most recently published City watershed plans are the Johnson Creek Watershed Action Plan (2003), Fanno Creek Resources Management Plan (1998), and the Upper Tryon Creek Corridor Assessment (1997). The Columbia Slough Watershed Council also published an Action Plan (2003). Each plan includes a profile of watershed characteristics, history and current conditions, and identifies important natural resource sites and potential projects that could improve watershed conditions.

In 1998, BES prepared the Integrated Watershed Plan and in 2000, published the Clean River Plan, which proposed implementing ten actions for healthy rivers and comprehensive stormwater management. Designed to supplement Portland's combined sewer overflow (CSO) abatement effort, the Clean River Plan contains many innovative techniques to reduce stormwater runoff,

reduce pollutant levels, restore floodplains and foster environmental education and stewardship bringing about noticeable improvements in watershed health. As a result of the Clean River Plan, the City initiated the Johnson Creek Willing Seller Program, completed the Johnson Creek Restoration Plan, developed the Watershed Revegetation Program, the Sustainable Stormwater Program and numerous watershed and stormwater education programs.

While this Watershed Plan builds on previous efforts, it is unique because it is the first plan to present the shared goals, objectives, strategies and actions of the city's five watersheds in one comprehensive document. It is a first step toward documenting all of the City's watershed work, as well as the functional and organizational relationships between the work elements. The individual watershed plans still play an important role in watershed management. They document detailed information about each watershed, and will continue to serve as the basis for selecting and implementing specific projects to improve watershed health.

Portland's Watershed Approach

The Watershed Approach moves away from watershed management that responds individually to different environmental regulations. The requirements of each regulation are typically complex and address a specific public health or environmental concern. The resulting programs are independent, single focus efforts that don't consider overlapping issues. Trying to satisfy these requirements one at a time often means lost opportunities to serve multiple objectives at once (Figure 1.1).

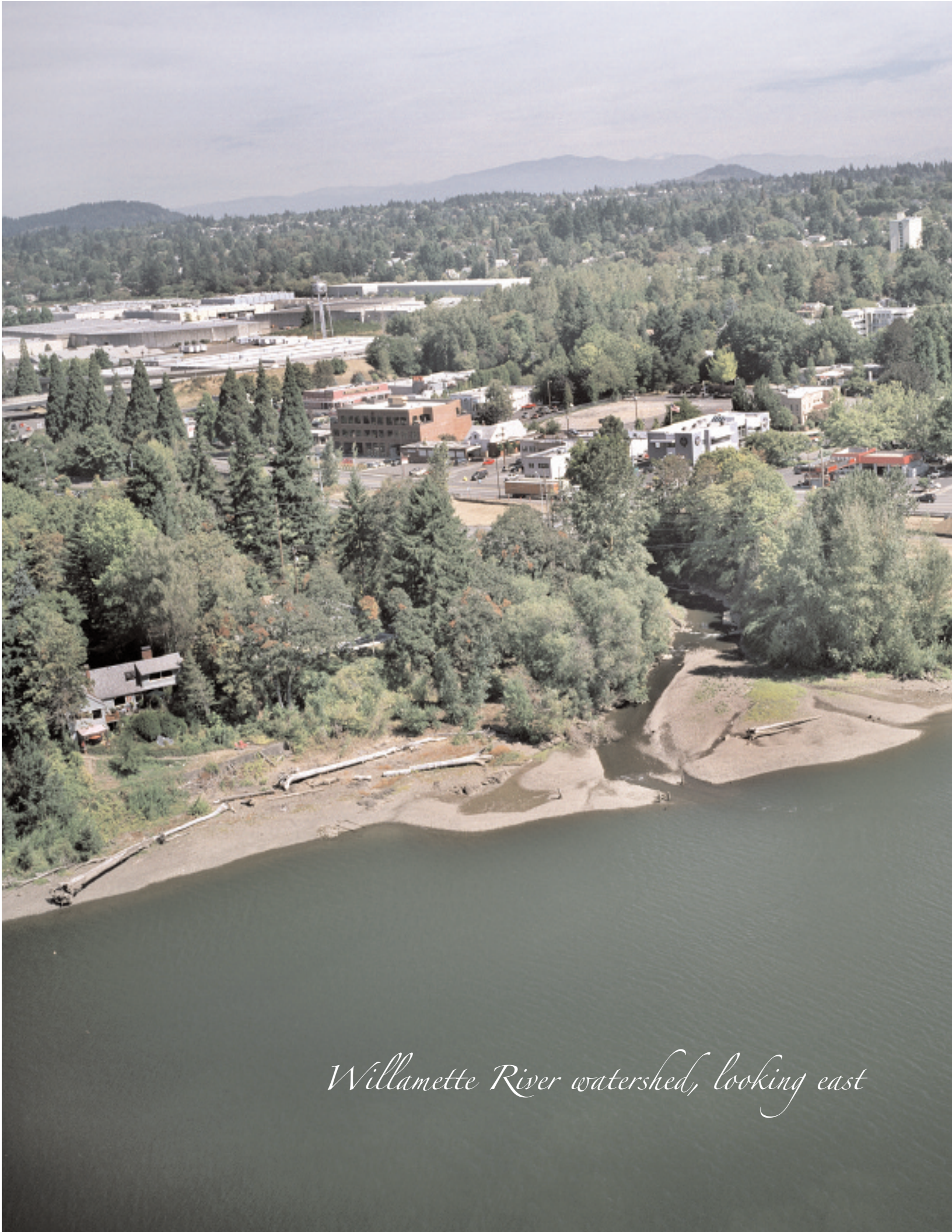
Each component of a watershed affects every other component, and the whole watershed system is connected through the hydrologic cycle. Evaporation from the land and ocean forms clouds, rain falls to earth to fill streams, and rivers flow back to the sea. Watersheds store, treat and distribute rainfall. In undeveloped areas, rain soaks into the ground, filters through wetlands, and eventually enters a stream or river. Everything that happens on the land within the watershed affects the rivers and streams in some way. Rather than focusing separately on single issues such as flooding, combined sewer overflows, or contaminated sediments, the Portland Watershed Management Plan considers all activities that affect watershed conditions including issues like transportation, redevelopment and open space needs (Figure 1.2). Features like trees, ecoroofs and swales integrated into the urban environment can capture and filter precipitation that would otherwise drain through outfall pipes directly into rivers and streams.

Figure 1.1 Traditional response to regulatory mandates

Figure 1.2 Integrated approach to meeting regulatory mandates

The Watershed Plan promotes techniques that incorporate the benefits of natural systems into urban areas. Stormwater runoff can soak into the ground instead of flowing into sewer pipes. Native plants can help remove pollutants and provide habitat, and other innovative technologies can help prevent the rapid flow of stormwater off roofs and parking lots. Retrofitting existing development with landscape facilities that infiltrate stormwater into the ground helps protect Portland streams and terrestrial habitats.

This holistic approach integrates the work of various city bureaus, private citizens, business and local non-profit organizations to improve watershed health. This approach will restore more natural watershed and stream functions. It has the most potential to protect and improve water quality while meeting state and federal regulatory requirements in the process. Rather than regulatory requirements defining City actions, ecological principles and watershed conditions will set the course. The result will be net environmental improvements over time.



Willamette River watershed, looking east

The Willamette River Basin is the largest river basin in Oregon

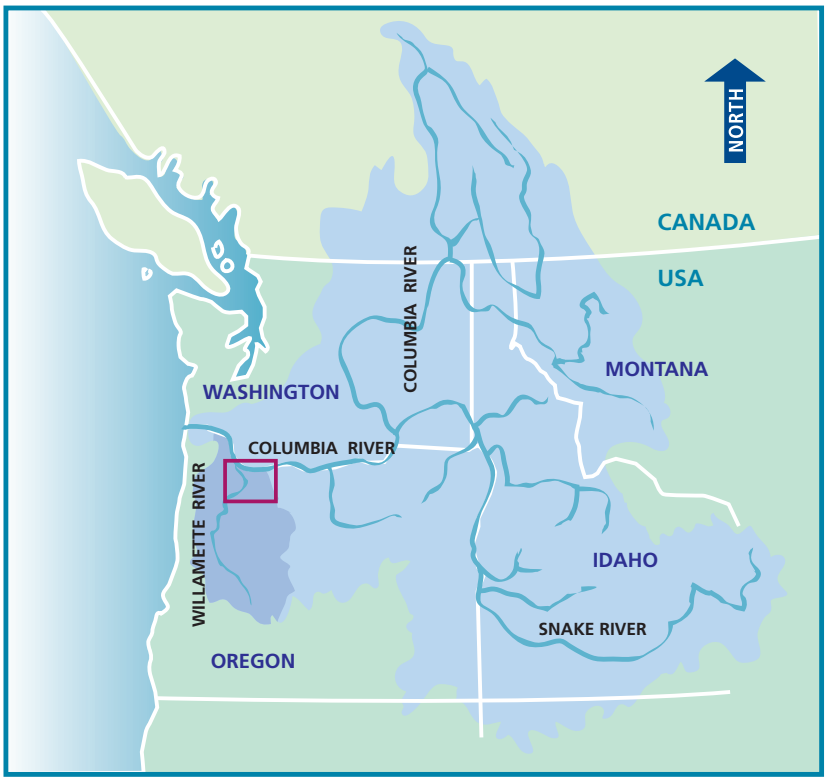
CHAPTER 2: WATERSHED CHARACTERIZATION

Watershed characterization is the process of collecting and analyzing data on historic and current watershed conditions and using the information to determine the actions needed to improve watershed health.

The characterizations of Portland's watersheds contain information the City of Portland collects to comply with laws and regulations, and data collected over the years by public agencies, universities, watershed councils and independent researchers.

The characterizations help develop watershed goals and objectives and are available as reference tools for City bureaus and Portland residents. Information about developing watershed objectives is in Chapter 3 of this report.

Figure 2.1 Columbia Basin/Willamette Basin map



Regional Context

The City of Portland encompasses 130 square miles, but its streams and tributaries are part of an 11,478 square mile Willamette River Basin, which is shared with many other upstream cities and counties. The Willamette River Basin is the

largest river basin in Oregon. Thirteen major tributaries join the Willamette as it stretches 187 miles from its headwaters to its confluence with the Columbia River at Kelley Point. The river passes through forests, small towns, large cities, and farmland.

The lands that drain the Columbia River Basin cross seven states and contain 219,000 square miles. Portland occupies only about 1/16 of 1 percent of the Columbia Basin, but the city occupies an important ecological site at the confluence of the Willamette and Columbia Rivers (Figure 2.1). Portland's small part of a large system is important to the region's fish and wildlife habitat and its economy.

Citywide Perspective

Portland grew from a small settlement to a large metropolitan area over the past 150 years. Trees, vegetation, duff and soil layers were removed to make way for development. Urbanization and legacy pollution have significantly degraded Portland's watersheds. Rain falling on streets, parking lots, roofs and other hard surfaces carries pollutants to rivers and streams.

Like hundreds of communities across the country, Portland's growth is exceeding the capacity of its sanitary sewer infrastructure. Portland has made significant progress in this area by controlling combined sewer overflows (CSOs). Improved management practices for the City's sewer system have reduced pollutant discharges. The City has restored and protected important natural areas. But there are still many opportunities to improve the health of Portland's urban watersheds (Figure 2.2).

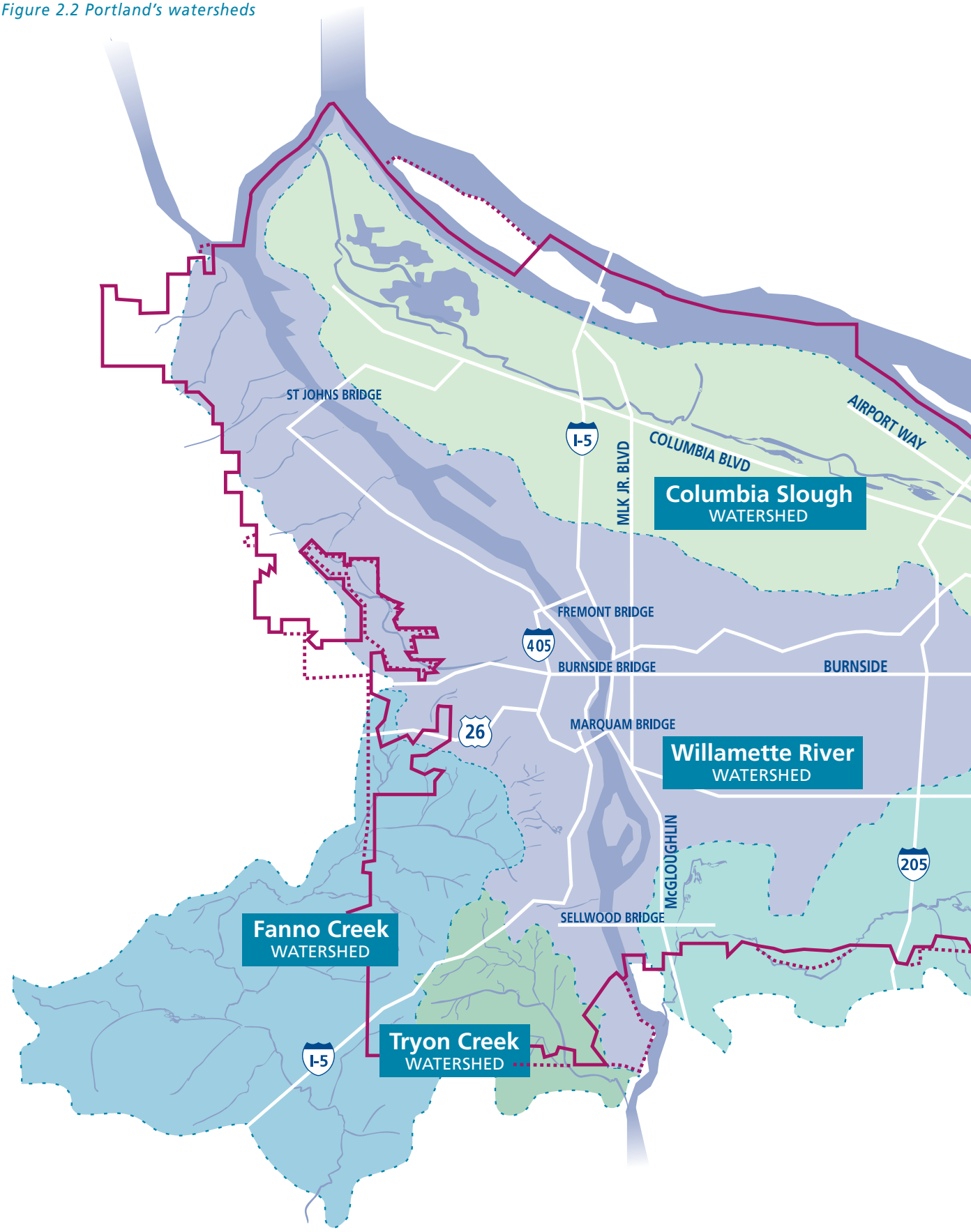
Stormwater Infrastructure

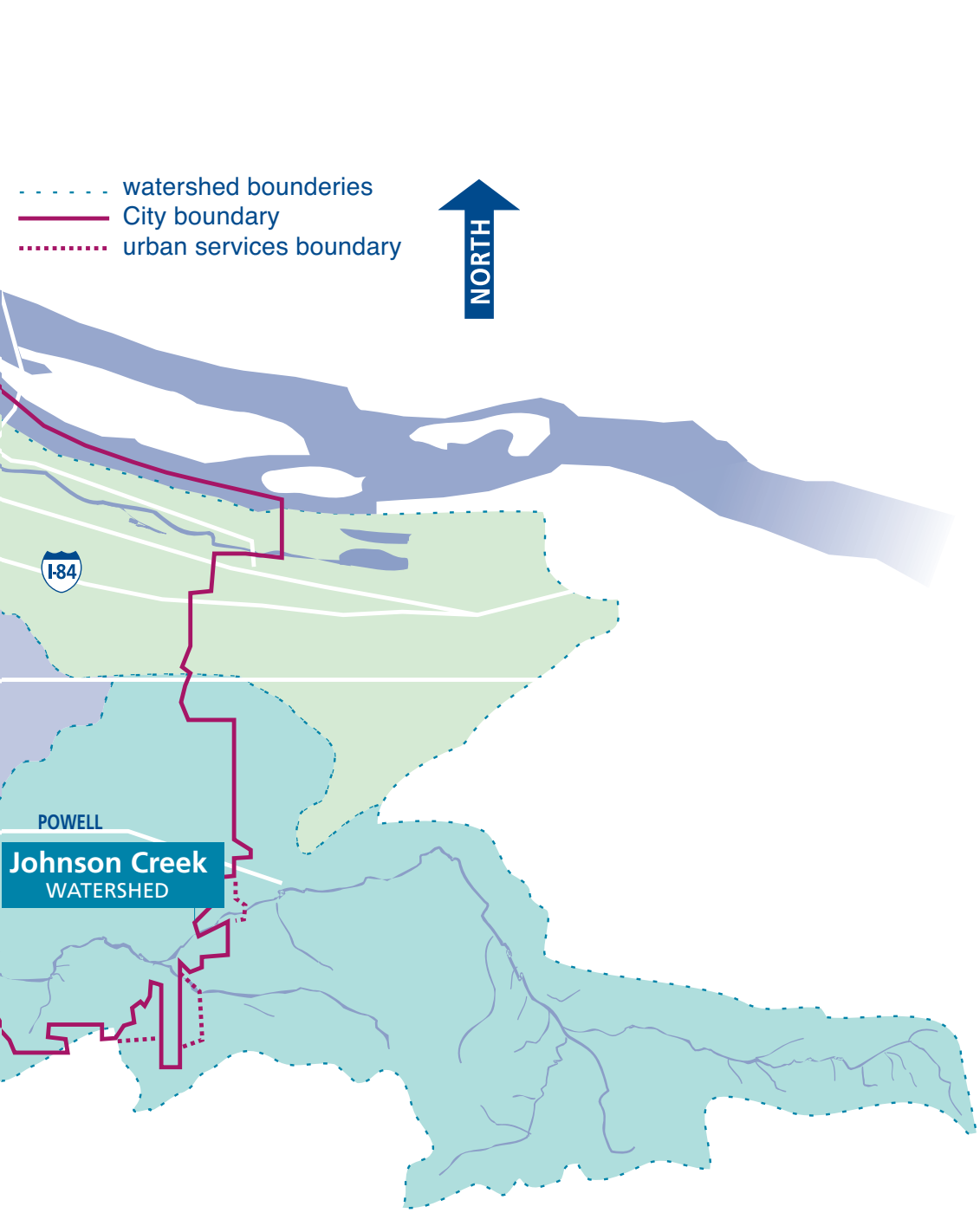
Portland's first sewers were made of wood and drained the City's muddy streets directly into the Willamette River. As indoor plumbing became more common, sanitary waste was directed into existing sewers. For nearly a century, these combined sewers carried stormwater runoff and sanitary sewage directly into the Willamette and Columbia Slough. By the 1920s, the river and slough were badly polluted.

In the late 1940s, the City began building large diameter interceptor sewers paralleling the river and slough to carry dry weather flows to a new sewage treatment plant in north Portland. The Columbia Boulevard Wastewater Treatment Plant opened in 1952. But during wet weather, stormwater filled combined sewers to capacity and some of the sewage and stormwater mixture overflowed to the Willamette River and Columbia Slough. Combined sewer overflow (CSO) abatement projects controlled CSOs to the slough in 2000. The City will complete projects to control CSOs to the river in 2011.

The current state of Portland's wastewater infrastructure is illustrated in Figure 2.3. (page

Figure 2.2 Portland's watersheds




watershed bounderies
City boundary
urban services boundary
NORTH
I-84
POWELL
Johnson Creek
WATERSHED


COLUMBIA SLOUGH


FANNO CREEK


JOHNSON CREEK


TRYON CREEK


WILLAMETTE RIVER

Table 2.1: Oregon Water Quality Index

Water Quality Index Range	*Water Quality*
90-100	Excellent
85-89	Good
80-84	Fair
60-79	Poor
<60	Very Poor

The Oregon Water Quality Index (OWQI) uses an aggregate of parameters to evaluate water quality conditions equally across the state. It is based on temperature, dissolved oxygen, biochemical oxygen demand (BOD), pH, ammonia, nitrate nitrogen, total phosphorus, total solids and total fecal coliform. The state has taken samples throughout the state for 20 years at 165 sites. The OWQI is a useful indicator of whether the water resource meets the requirements of environmental laws and is suitable for human use (drinking, swimming and fishing).

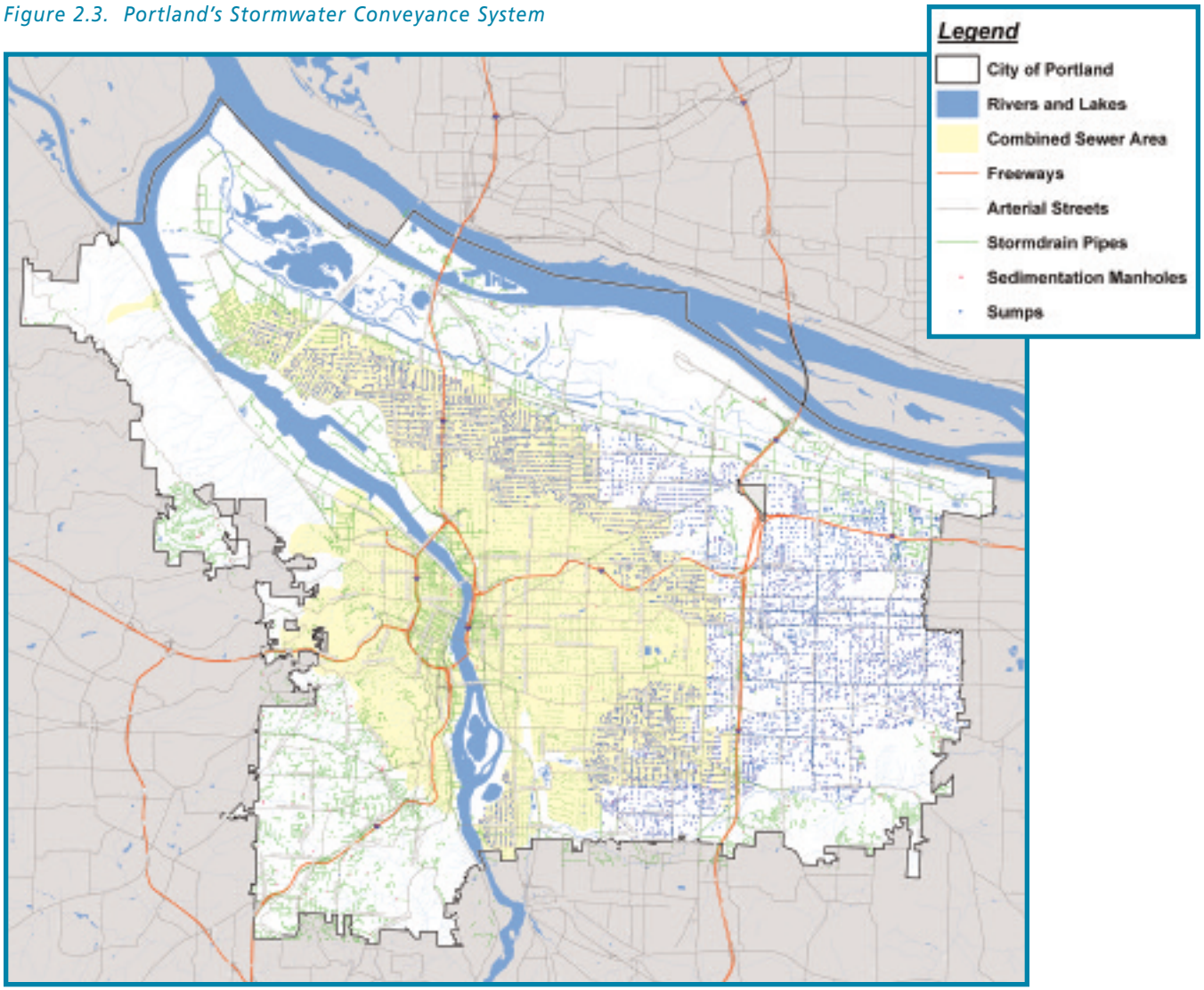
General Watershed Conditions:

- The Oregon Water Quality Index describes water quality as fair in the Willamette River and as very poor in Johnson Creek and the Columbia Slogh. All of Portland's major water bodies except Balch Creek are on the state's water quality limited list because they do not meet water quality standards for bacteria, temperature, toxics, and dissolved oxygen.
- Bacteria levels in the Willamette River often do not meet state in stream water quality standards during storms and dry periods.
- Low water flow, lack of vegetation along streambanks to shade and cool water, and changes in channel structure increase river and stream temperature in the summer. Higher water temperature reduces dissolved oxygen, which aquatic organisms need to survive.
- Despite these conditions, each watershed still sustains remnant natural resources such as urban forests, woodlands, grasslands, streams, wetlands and floodplains that provide important watershed functions.
- Long-term monitoring data on the Willamette River and the Columbia Slough show improvements in water quality.
- Urban parks, environmentally sensitive golf courses (several Portland area golf courses are certified Audubon Cooperative Sanctuaries), remaining protected natural areas, street trees, and neighborhood habitats continue to provide high-quality habitat.

The Environmental Services website www.portlandonline.com/bes has more detailed information about the City's watersheds.

Under a 1991 agreement with the Oregon Department of Environmental Quality (DEQ), the City is working to control CSOs. Portland eliminated CSOs to the Columbia Slough in 2000 and will reduced CSO volume to the Willamette River by 94% when all construction is finished in 2011. The program will cost Portland sewer ratepayers an estimated $1.4-billion.

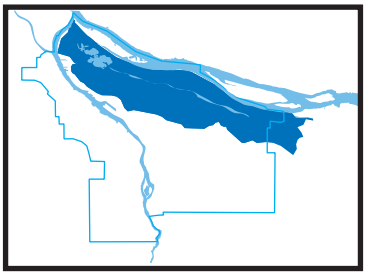
Figure 2.3. Portland's Stormwater Conveyance System



COMBINED SEWER areas carry both sanitary sewage and stormwater in the same pipes. When it rains, stormwater overwhelms the capacity of the pipe and overflows to the Willamette River in a combined sewer overflow (CSO). CSOs are regulated by the Clean Water Act, and Portland has additional directives through legal action and DEQ called the Amended Stipulated Final Order to nearly eliminate CSOs by 2011.

THE MUNICIPAL SEPARATE STORM SEWER PERMIT (MS4 or stormwater permit), with the Port of Portland and Multnomah County as co-permittees. The MS4 permit requires the City to reduce pollutants from the City's storm system to the maximum extent practicable. The permit applies to all existing and future stormwater discharges from the municiple storm system within Portland's Urban Services Boundary. The MS4 permit is also regulated by the Clean Water Act.

SUMPS or UNDERGROUND INJECTION CONTROLS (UICs) are also used in Portland. There are approximately 8,500 active sumps which manage stormwater through underground infiltration. The City has recently been issued a UIC permit to guide the management of the UICs and the area draining to them to protect groundwater resources. The UIC permit is regulated by the Safe Drinking Water Act.



Columbia Slough:

The Columbia Slough Watershed drains 51 square miles of land. The Slough extends from Kelley Point Park on the west to Fairview Lake and Fairview Creek on the east. The watershed boundary includes portions of Portland, Troutdale, Fairview, Gresham, Maywood Park, Wood Village and unincorporated Multnomah County.

The watershed once contained a system of side channels, lakes, and wetlands that covered the floodplain of the Columbia River between the mouths of the Willamette and Sandy Rivers. Native Americans fished, hunted and gathered food in these areas.

Over the years, the watershed and waterway were altered substantially to accommodate industry and agriculture. Beginning in 1918, levees were built to block Columbia River and Willamette River flows and provide flood protection. Wetlands and side channels were drained and filled to allow for development. Waterways were channelized, and dozens of streams were filled or diverted to underground pipes. This resulted in a significant loss of habitat, flood storage capacity, and reduced ability to filter sediments and pollutants.

Today, the Columbia Slough comprises an 18-mile main channel and 30 miles of secondary waterways, many ponds and lakes, including Smith and Bybee Lakes complex near the Slough's confluence with the Willamette. The Upper and Middle Slough waterways are managed by the Multnomah County Drainage District, which is responsible for an extensive system of pipes, levees, and pumps for flood control. The Drainage District is required to keep the water levels artificially high in order to fulfill existing water rights along the Slough in the summer months. Impervious surfaces cover 54% of the watershed. Lower Slough flows are affected by tidal variations, and its floodplain is partially protected by a system of levees. The watershed is a key transportation hub, and its designation as an industrial sanctuary helps provide nearly 60,000 jobs. It is also the home to almost 160,000 people. Portland's Columbia South Shore Well Field, which supplies supplemental drinking water to a large portion of the region, is also in the Columbia Slough Watershed.

Increased stormwater runoff and peak flows during rainstorms have changed the character and functions of the Slough. Urban development has led to extensive vegetation removal in riparian areas. Habitat areas were greatly reduced, and those that remain are significantly disturbed. Lack of vegetation in the stream corridor has increased water temperature and decreased capacity to filter pollutants and sediments from runoff. Oregon Water Quality Index scores for the Columbia Slough are very poor. Upland areas contain little native forest

and include primarily fragmented habitat areas such as city parks and street tree canopy that offer limited habitat value for native wildlife. Salmon use is confined to the Lower Slough's 9 miles because levees prevent further upstream passage. The Lower Slough is a salmon refuge, utilized by migrating juveniles from both the Willamette and Columbia Rivers who are attracted by the slow velocities and low gradient of the waterways.

In addition to elevated water temperature and the associated high levels of algae and aquatic plant growth at certain times of the year, the Slough experiences seasonal low oxygen levels, which limits the ability of fish and bottom dwelling organisms to survive. Contaminants such as PCBs and the pesticides DDT and chlordane are present in Slough sediment and fish tissue. Some Slough areas also contain elevated levels of metals, such as lead and chromium, which can adversely affect benthic organisms and wildlife. Groundwater flows into some portions of the Slough are high in phosphorus, which could occur naturally or because of the septic systems once common in the watershed.

The Slough is an important wildlife corridor to the Columbia River, Vancouver Lowlands and Ridgefield Wildlife Refuge. Biological communities in the Columbia Slough have been negatively impacted by habitat loss and water and sediment quality issues. The loss of habitat is detrimental to a large number of bird, mammal, fish, reptile, and amphibian species that use the watershed at various points in their life cycle, including Willamette and Columbia River ESA-listed fish species. Many invasive plant and animal species, such as Himalayan blackberry, reed canary grass and nutria flourish in the watershed.

Watershed conditions are improving, however, as regulatory measures and best management practices reduce pollution and improve natural resources. Industrial discharges have been regulated, combined sewer overflows are controlled, and 40 miles of streambank have been re-vegetated. Developers and landowners are beginning to view the Slough as an amenity. Hundreds of private landowners have partnered with the City's revegetation program to restore riparian vegetation. Recently constructed buildings facing the Slough and its trees and wildlife command increased rents that reflect these added values. And a new award-winning industrial building in the watershed meets the country's most stringent environmental and energy efficiency standards.

Lower Slough

The off-channel habitat from the mouth of the Lower Slough to Simpson Cove, including Smith and Bybee Lakes, is very valuable for migrating salmon. It represents some of the last remaining resting and rearing habitat near the confluence of the Columbia and Willamette Rivers. Smith and Bybee Lakes and the Peninsula Drainage Canal in the Lower Slough provide habitat for painted turtles, western pond turtles, red-legged frogs, and great blue herons.

Middle Slough

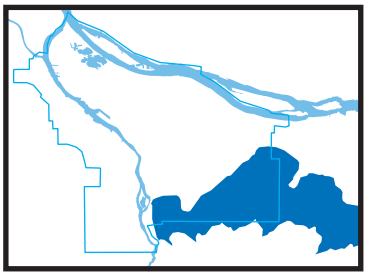
The Subaru Wetlands provide valuable habitat for wetland species. Prison Pond meets water temperature standards year-round. Macroinvertebrates sensitive to watershed degradation have been found here, documenting the site's relative health. Macroinvertebrates are aquatic insects such as stone flies, mayflies, and dragonfly nymphs that are food sources for many aquatic species.

Upper Slough

Wilkes Creek and Alice Springs in the Upper Slough are suspected to meet water temperature standards year-round. Macroinvertebrates that are sensitive to watershed degradation have been found at these sites, documenting their relative good health. Although it is not possible for ocean-going salmon to use these streams, resident salmon species could likely benefit from the streams' habitat, if they were re-introduced. Big Four Corners and Fairview Creek wetland complexes provide valuable habitat for many species such as neotropical migratory songbirds, willow flycatcher, pileated woodpecker, deer, coyote, river otter and several species of bats.

Environmental education and stewardship opportunities are offered to schools and citizens in the watershed. People are rediscovering the Slough through its hiking and biking trails, wildlife watching, regional environmental education center, and canoe and kayak access points.

Increasing riparian canopy, managing wildlife such as beaver and recreating more natural flows in the main channel offer the potential for watershed restoration. Stormwater management, increased street tree canopy, and protecting restoring and connecting wetlands and upland vegetation would significantly improve how upland areas contribute to the hydrology, water quality and habitat functions in the watershed. In the Lower Slough, opportunities include increasing salmon refuges and instream improvements up to the 18th street levee, and enhancing wildlife corridors that connect the Willamette River and Columbia Slough systems.



Johnson Creek:

Johnson Creek originates in Clackamas County east of Boring, and flows west for 25 miles to its confluence with the Willamette River. The watershed covers 3454 square miles and includes portions of the cities of Milwaukie, Portland, Gresham, Happy Valley and Multnomah and Clackamas Counties.

Crystal Springs Creek and Kelley Creek are Johnson Creek's main tributaries and contribute the largest amount of flow to the mainstem. Crystal Springs Creek is fed mostly by cold, clean groundwater originating from springs on the north side of Johnson Creek. Many smaller tributary streams like Mitchell, Errol, Deardorf, and Wahoo creeks still flow, but about 38% of the watershed's historical tributaries are now piped, sumped, or diverted to the combined sewer system.

The northern watershed is characterized by large, flat floodplains, particularly in Lents neighborhood. These floodplains are remnants of large glacial floods that took place about 15,000 years ago. The topography south of the mainstem, where most of Johnson Creek's tributaries are located, is steep and varied.

One of the most significant changes in the watershed occurred in the 1930s when the Works Progress Administration (WPA) attempted to control flooding by straightening, deepening and rock-lining the creek, creating a trapezoidal channel in 15 of the 25 stream miles. These actions disconnected the channel from its floodplain, degraded streambank conditions, and substantially altered the creek's ability to dissipate energy and absorb high winter flows. The work also degraded the watershed's historic, rain-absorbing wetlands. Impervious surfaces now cover 38% of the watershed in the Portland City limits. Because of these alterations, steady rainfall and surging stormwater runoff from hard surfaces overwhelms the confined stream channel.

As a result, Johnson Creek has flooded 37 times since 1942, and at least seven floods caused major property damage in the last 35 years. These erosive stormwater surges have further altered natural pools and riffles that once helped to balance the creek's energy, provide habitat and filter pollutants.

The loss of shady riparian vegetation has increased water temperature and reduced the system's capacity to filter pollutants and sediment from runoff. The source of woody debris that once contributed nutrients, structural diversity and added water-dwelling bugs to the food web was also displaced. As a result, invasive species, such as Himalayan blackberry, reed canary grass and Scotch broom have spread. In the stream channel, excessive growth of aquatic plants and algae are evidence of altered flow.

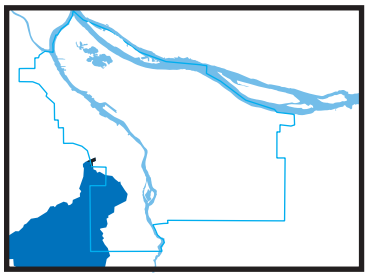
In the summer, the mainstem and some tributaries often do not meet minimum flow targets. This further increases temperatures, degrades water quality and reduces available habitat for aquatic species. Many tributaries also contain artificial obstructions that impair salmon migration.

Water quality in Johnson Creek is rated as poor. Bacteria levels are high in some areas due to failed septic systems and agricultural runoff. Water temperatures are elevated due to lack of base flow and riparian vegetation. Some creek sediments are contaminated with pesticides, upland activities and high stream flows have eroded stream banks, and sedimentation has damaged instream habitat.

These changes in hydrology, physical habitat, and water quality have negatively affected the native biological communities throughout the watershed. Many bird, mammal, fish, reptile, and amphibian species that were once prevalent are now locally extinct or are struggling. In 1997, steelhead trout were listed as threatened under the Endangered Species Act and a year later Chinook salmon received the same federal protection. Today, Johnson Creek is designated as critical habitat for these species.

Despite these challenges, there are indications that watershed conditions are improving. Fish surveys and sampling indicate that native fish use creek habitat at multiple life-stages. Barriers to habitat are being removed in key tributary streams. Acres of native vegetation are being replanted annually and some of the first reclaimed floodplains are storing floodwaters and expanding habitats for multiple biological communities.

Restoration in Eastmoreland, Westmoreland, Tideman Johnson Park, Errol Creek, lower Mitchell Creek, the Gresham reaches and centrally located floodplains offer some of the best locations to restore watershed health. Protecting functional areas - like lower Kelley Creek's meandering channel and riparian corridor of native vegetation - will preserve the watershed's best assets as a foundation for continued recovery.



Fanno Creek:

Fanno Creek flows southwest for about 15 miles from its headwaters in Hillsdale to the Tualatin River near Durham. The Fanno Creek Watershed covers 20,259 acres, or 32 square miles. About 4,529 acres are within the City of Portland. The remaining watershed area is mainly within Washington County's jurisdiction.

More than 80% of the Fanno Creek Watershed in Portland is zoned for single-family residential use. Impervious surfaces cover 33% of Portland's portion of the watershed. The Fanno Creek Watershed has steep slopes, steep stream gradients, and soils that are slow to infiltrate rain. These characteristics cause relatively high stormwater volumes and velocities, streambank instability and undercutting, erosion, instream sedimentation, and loss of streambank vegetation. The mainstream Fanno Creek floodplain area has been cleared of vegetation and filled, reducing historical floodplain interactions and reducing habitat.

Watershed development and streamside disturbance reduced riparian vegetation and habitat along many sections of Fanno Creek and its tributaries. The result is increased stream temperatures and decreased filtering of pollutants and sediments from stormwater. Loss of vegetation results in decreased large wood in the creek, reducing in-water habitat. Instream habitat quality is extremely impaired or threatened, primarily because of the impact of fine sediment eroding from streambanks. A lack of connecting riffle-type habitat (shallow water flowing over gravel) limits the number of fish that can survive in the creek. Culverts are common throughout the watershed, and many are impassible to fish, which limits salmon access and affects stream processes.

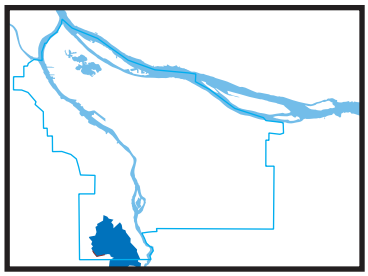
Overall water quality in Fanno Creek is rated from very poor to poor. Water temperatures are above the state standard in the summer. The creek also has high bacteria levels, low dissolved oxygen due to increased water temperature and the decay of organic matter in the stream, and high phosphorus levels from natural sources in soil and fertilizers and many other sources carried by stormwater runoff.

Columbia Creek and another small Fanno Creek tributary near Shattuck Road provide critical off-channel habitat during high storm flows and cool-water areas in the summer. This reach also contains the best spawning and rearing habitats. Deep complex pools, a beaver pond, and undercut banks immediately upstream of this area provide critical habitat for fish

during the winter. North Ash Creek and about half of the upper part of Woods Creek provide riffle habitat with gravels, cobbles and low amounts of fine sediment. South Ash provides important pool habitat.

Biological community health in Fanno Creek is greatly reduced from historical conditions. Most wildlife species that remain are those that can tolerate the compromised habitat and disturbed conditions. Many native species of fish and aquatic insects are at risk, and many non-native species compete with native species for habitat.

Protection and restoration of intermittent streams, seeps and springs throughout the watershed, particularly in the upland areas, is important to improve overall stream hydrologic and flow functions and to reduce or prevent flooding.



Tryon Creek:

The Tryon Creek Watershed in southwest Portland covers about six square miles. About 21%, or 857 acres, is outside the Portland city limits and within the jurisdictions of Multnomah County, Clackamas County, and the City of Lake Oswego.

The watershed is divided into three subwatersheds: Tryon Creek, Arnold Creek, and Falling Creek. Arnold Creek and Falling Creek are Tryon Creek's main tributaries. Other smaller tributaries flow into Tryon Creek both within and outside Portland's city limits. The mainstem of Tryon Creek is about seven miles long from its headwaters near Multnomah Village (just north of Interstate 5 and Highway 99) to its confluence with the Willamette River in Lake Oswego at the Highway 43 crossing. The watershed includes the Tryon Creek State Natural Area.

Significant residential development in the upper watershed above SW Boones Ferry Road has had negative effects. Impervious surfaces cover about 26% of the watershed. Steep slopes and soils are slow to infiltrate water and increase surface runoff. These characteristics cause relatively high stormwater volumes and velocities, streambank instability and undercutting, erosion, instream sedimentation and loss of streambank vegetation. Residential development, impervious surfaces, and road crossings have severed the creek from its floodplain, decreased habitat and increased stream flow.

Instream habitat conditions range from optimal in a few areas to marginal in most. Wood and other structural habitat diversity are almost nonexistent. Impassable or partly passable culverts limit salmon access and affect watershed processes. Tryon Creek State Natural Area is in the lower watershed, and the riparian area along Tryon Creek is largely intact providing habitat diversity. However,

development has significantly fragmented and altered riparian areas in the upper watershed. Lack of riparian vegetation increases water temperature, reduces filtration of pollutants and sediments from runoff, and reduces wildlife habitat.

Tryon Creek water quality is rated as poor, with elevated temperatures in summer, periodic elevated levels of bacteria, elevated suspended sediments and nutrients, and ongoing contribution of pollutants from stormwater runoff.

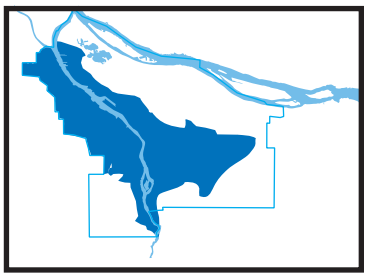
Lower Tryon Creek, which includes the Tryon Creek State Natural Area, retains more intact streamside vegetation and complex, winding stream channel than other parts of the creek and provides important habitat for salmon as well as fish and other wildlife. Trees and shrubs in this area provide good sources of wood in the creek, the tree and shrub canopy helps maintain appropriate stream temperatures and dissolved oxygen levels.

Upper Tryon Creek contains areas important to watershed health, particularly Marshall Park. Tryon Creek just above Boones Ferry Road has intact vegetation and relatively good stream bank conditions. Arnold Creek's water quality provides benefits for both that creek and Tryon Creek main stem.

Biological communities in the watershed have been greatly reduced from historical conditions. The watershed is critical habitat for ESA-listed species and still supports small salmon and trout populations. Many native wildlife species have disappeared or have been greatly reduced in number. Non-native species compete with native species for food and habitat.

Protection and restoration of intermittent streams, seeps, and springs throughout the watershed, particularly in the upland areas, is important to improve overall stream hydrologic and flow functions and to reduce or prevent flooding.

Urban sections of the upper Tryon Creek Watershed and the Interstate 5, Barbur Boulevard, and Terwilliger Boulevard transportation corridors are the largest sources of ongoing stormwater-related watershed health problems.



Willamette River:

Portland's Willamette Watershed covers about 44,000 acres or 69 square miles and occupies about 0.5% of the Willamette River's total drainage basin. It is the most highly urbanized portion of the watershed and is a gateway for migrating salmon to the upper basin. It includes Forest Park, downtown's commercial core, industrial districts on both sides of the river and Portland's most densely populated residential neighborhoods.

The west side of the watershed is dominated by the West Hills, rising from a narrow terrace along the Willamette River. The east side is flat with little elevation change except for a few volcanic buttes such as Mt. Tabor and Rocky Butte.

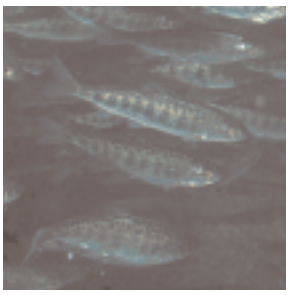
Consequently the east side is almost completely developed, and the small streams that once crossed the area have been diverted into the sewer system. The steeper slopes in the West Hills developed more slowly, and most of the watershed's remaining open stream channels are on the west side.

The watershed is highly urbanized. About 40% of the area is covered with impervious surfaces. Development, urban activities and structural changes throughout the watershed have diminished watershed functions and affected hydrology, physical habitat, water quality, and biological communities.

Alterations to stream and riverbanks and channels has reduced floodplain functions and increased stream velocities. Dams and reservoirs in the Willamette River Basin have altered the volume, timing and velocity of Willamette River flows. The volume of water upstream of Portland and the presence of dams and reservoirs severely constrain the City of Portland's ability to affect the hydrology of the Willamette River.

Significant dredging, diking, and channeling of the mainstem Willamette and its tributaries has affected habitat. The mainstem has been narrowed and deepened for flood control and navigation, off-channel habitat has been virtually eliminated, and the floodplain has been degraded. The river bank has been hardened with retaining walls and riprap, which prevents natural channel changes and minimizes the interaction between the river and riparian and floodplain vegetation.

The water quality of the mainstem Willamette River and its tributaries is degraded by elevated water temperatures, bacteria, and contaminants in stormwater runoff. The Environmental Protection Agency has listed an area of the lower Willamette between Swan Island and Sauvie Island as a Superfund site because of contaminated sediments.



Despite highly urbanized conditions and Endangered Species Act listings, salmon, steelhead and lamprey migrate through Portland to upstream spawning grounds, their offspring migrate back through the City to the Pacific Ocean. Some salmon use the river year 'round, inhabiting off channel and shallow water habitat. Birds and other wildlife use the Willamette River corridor, including adjacent uplands, to reach the Columbia River, Vancouver Lowlands and the Ridgefield Wildlife Refuge.

The Willamette River segment between the St. Johns Bridge and the Willamette's confluence with the Columbia River includes both remnant off-channel areas and relatively intact conditions on the west bank. The Swan Island lagoon and other terminal facilities also provide off-channel habitat. Ross Island and adjacent wetlands at Oaks Bottom provide off-channel habitat, relatively intact streamside vegetation, and natural bank conditions as well as watershed functions such as groundwater recharge and stormwater retention. Although Stephens Creek has been affected by urbanization, its confluence with the Willamette just north of the Sellwood Bridge provides important off-channel habitat.

Forest Park provides important habitat and serves as a corridor to the Columbia River, the Coast Range, and other adjacent habitat areas. The water quality, hydrology and habitat in the upper reaches of several streams in Forest Park contribute to watershed health. Several of these streams also support populations of cutthroat trout, sculpin and other native fish. A wide range of small mammals, amphibians and birds inhabit Forest Park and several large mammals including bear, cougar and moose have been known to migrate through the area.

There have been significant efforts to restore riparian habitat sites such as Port of Portland's automobile terminal north of the St. Johns Bridge, and some habitat value and connectivity exist at sites such as Powers Marine Park, Willamette Park, and Willamette Cove. Oaks Bottom Wildlife Refuge and Ross Island provide opportunities to link riparian and aquatic habitats in the southern half of the watershed, and there are other remnant, fragmented habitat areas that could be connected to improve upland wildlife corridors. Redevelopment in the South Waterfront District will reflect the ability of new development to improve riverbank conditions and provide sustainable stormwater management. In the northern half, Forest Park is one of the largest contiguous open spaces in the metropolitan region and has the greatest concentration of open streams remaining in the Willamette watershed. Kelley Point and Cathedral Parks both provide important riverside habitat as well as upland and terrestrial wildlife value. Off channel habitat could be increased in park areas that aren't in active use.

Metro's recently completed inventory of regionally significant riparian and wildlife habitat resources estimates that more than 10,000 acres of land exists within Portland's Willamette watershed. Currently almost 7,600 acres within the watershed are protected by environmental overlay zones.

Summary

Management issues in each watershed vary depending on land use, development history and the state of remaining natural resources. Urban activities have degraded conditions in each watershed. But there is also progress in restoring and protecting natural areas, and there are many opportunities to further restore watershed function.

Compiling watershed characterizations that document current conditions and setting watershed goals and objectives are the basis for planning actions to restore watershed health. It will also help the City decide where and how to allocate staff and money. The characterizations will be continually updated as issues emerge and ongoing monitoring reveals more about watershed conditions. For example, significant data has been collected on the behavior and needs of fish species, but additional research is needed to adequately describe the needs of terrestrial species and aquatic invertebrates.

For more detailed information please see the City of Portland Watershed Characterization Summary (March 2004) or the full watershed characterizations found on the Environmental Services website at http://www.portlandonline.com/bes/index.cfm?c=32197.

As the area grows, the City will address the causes of environmental problems instead of their symptoms.

CHAPTER 3: GOALS AND OBJECTIVES

This section defines watershed health in urban areas and identifies the City's goals and objectives for Portland watersheds. The scientific foundation of Portland's watershed approach is described in the City's *Framework for Integrated Management of Watershed Health* (July 2005). The Framework describes watershed health goals, why the goals are desirable, and relevant ecological principles and restoration guidelines that support the watershed health goals. The watershed health objectives in this chapter bring greater specificity to the watershed health goals. Based on the direction set forth in the Framework, the objectives were developed in response to improving current watershed conditions (summarized in Chapter 2).

The watershed approach emphasizes that it's not necessary to recreate pre-development watershed conditions to have clean water, livable neighborhoods, and high quality fish and wildlife habitat. The goals and objectives describe the functions and conditions of healthy urban watersheds. The strategies and actions detailed in Chapter 4 describe how the City is working toward these goals and objectives.

Defining Watershed Health

The Framework is built on the principle that urban areas do not have to cause damage to watershed health, that citizens, businesses, government, and other groups can be responsible stewards of their environment and that we can reverse the damage of past years. Portland has already undertaken many projects to do that. As the area grows, the City will address the causes of environmental problems instead of their symptoms, as called for by the watershed approach.
The Framework defines urban watershed health as:

> "A healthy urban watershed has hydrologic, habitat, and water quality conditions suitable to protect human health, maintain viable ecological functions and processes, and support self-sustaining populations of native fish and wildlife species whose natural ranges include the Portland area."

Watershed Health Goals

The following watershed health goals were established in the Integrated Framework for Watershed Health (July 2005):

Hydrology: Move toward normative* stream flow conditions to protect and improve watershed and stream health, channel functions, and public health and safety.

Physical Habitat: Protect, enhance, and restore aquatic and terrestrial habitat conditions and support key ecological functions and improved productivity, diversity, capacity, and distribution of native fish and wildlife populations and biological communities.

Water Quality: Protect and improve surface water and groundwater quality to protect public health and support native fish and wildlife populations and biological communities.

Biological Communities: Protect, enhance, manage and restore native aquatic and terrestrial species and biological communities to improve and maintain biodiversity in Portland's watersheds.

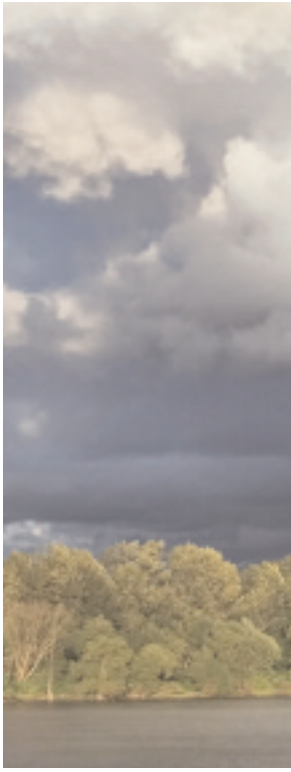
* Normative flow has the magnitude, frequency, duration and timing essential to support salmonids and/or other native species and resources and the formation and maintenance of aquatic habitat. In response to the programmatic mandates in Chapter 1, Table 1.1, the City has adopted standards to manage the quantity and quality of surface water runoff generated by new development (Chapter 17.38.025 of the Portland Municipal Code). These standards manage runoff generated from storm events up to the 25year storm, depending on the location and watershed of the development. The impact of the regulatory approach on the watershed health goal of moving towards normative stream flow conditions is not known and requires further analysis. Until the science and technology become available to make this determination, the city will continue to manage the runoff generated by new development under existing programs.

Watershed Health Objectives

Watershed objectives are desired changes in watershed conditions and functions and set the stage for identifying strategies and actions to bring about those changes. The changes identified by the objectives are based on what is known about watershed conditions from the characterizations.

Table 3 Goals and Objectives

Goals	Watershed Health Objectives
Hydrology	***Stream Flow and Hydrologic Complexity:*** Stream Flow and Hydrologic Complexity: Protect and increase rainfall interception areas, create infiltration and detention areas to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.
	Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainageways, wetlands, riparian areas and floodplains to improve bank stability and natural hydrologic functions and reduce risk to development and human safety.
	Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity.
Physical Habitat	***Aquatic Habitat:*** Protect and improve aquatic, riparian, and floodplain habitat extent, quality, and connectivity that supports the persistence of native fish and wildlife communities.
	Terrestrial Habitat: Protect and improve upland habitat extent, quality, and connectivity that support the persistence of native terrestrial communities and connectivity to aquatic and riparian habitat.
Water and Sediment Quality	***Stream Temperature:*** Protect and improve stream temperatures, dissolved oxygen, and pH levels that protect ecological health and achieve applicable water quality standards.
	Human Pathogens: Maintain and manage sewer infrastructure and stormwater inputs and runoff to limit sewage overflow and the delivery of pathogens to waterways and achieve applicable water quality and sewer design manual standards.
	Urban Pollutants: Manage the sources and transport of urban stormwater and industrial pollutants and nutrients to limit surface water, groundwater, soil, and sediment contamination to levels that protect ecological and human health and achieve applicable water quality standards.
Biological Communities	***Fish and Other Aquatic Organisms:*** Implement watershed actions to maximize the persistence of native Willamette and Columbia River fish and other aquatic organisms and assist with species recovery and potential population productivity by protecting and improving hydrology, habitat, and water quality.
	Terrestrial Wildlife and Vegetation: Implement watershed actions to restore populations of terrestrial organisms to healthy, self-sustaining levels, protect and restore the composition and structure of native vegetation communities, and reduce populations of non-native plants and organisms to levels that do not compete with native species.



In addition to the watershed plan goals and objectives and the Framework's scientific principles and restoration guidelines, other City goals will help prioritize and implement strategies and actions. These include:

- **Human Heath and Safety:** Protect human health and safety by implementing watershed actions, education, and outreach.
- **Sustainability:** Implement and support watershed actions in a manner that is self-sustaining in the long term.
- **Livability:** Implement and support watershed actions in a manner that enhances appropriate human access to the natural environment, livability, and aesthetics.
- **Economic Considerations:** Implement and support watershed actions in ways that are cost-effective and equitable, taking into consideration local and regional economic goals, indirect costs, externalities, and ecosystem services.
- **Partnerships and Education:** Implement and support watershed actions in a manner that utilizes community partnerships and provides education to the public about important watershed issues.

The watershed health objectives set forth a direction. They will be refined in the future to include qualitative and quantitative desired future conditions, and to the extent possible quantitative targets and timelines for achieving them (see Chapter 5 for information regarding watershed management system and adaptive management). Objectives ensure that City resources are focused clearly on common desired outcomes. They will ultimately be used to evaluate effectiveness of the chosen strategies and actions.

The process used to develop the watershed objectives and desired future conditions is described in more detail in Technical Memorandum 3.1.

Summary

The watershed goals and objectives provide direction for a watershed management system (detailed in Chapter 5) and help identify and prioritize strategies and actions to improve watershed health. They establish the link between watershed health and the work of the City, and create more consistency in the prioritization and allocation of limited City resources. Clear objectives with direct links to watershed conditions ensure that resources are focused on the most effective strategies and actions.

Strategies are the guiding principles... the actions are the specific projects to be implemented

CHAPTER 4: STRATEGIES AND ACTIONS

The watershed goals and objectives provide direction for a watershed management system (detailed in Chapter 5) and help identify and prioritize strategies and actions to improve watershed health. They establish the link between watershed health and the work of the City, and create more consistency in the prioritization and allocation of limited City resources. Clear objectives with direct links to watershed conditions ensure that resources are focused on the most effective strategies and actions.

Watershed Improvement Strategies

1. **Stormwater Management**
2. **Revegetation**
3. **Aquatic and Terrestrial Enhancement**
4. **Protection and Policy**
5. **Operations and Maintenance**
6. **Education, Involvement, and Stewardship**

1 Stormwater Management Strategy

Stormwater management is fundamental to improving hydrologic function and watershed health. Development creates streets, rooftops and other impervious surfaces that can increase the volume and velocity of stormwater runoff. Proper stormwater management controls runoff flow and protects property, infrastructure, and natural resources. Site design or retrofits of existing development that reduce impervious area also reduce the amount of stormwater runoff. Ponds, oversized pipes, ecoroofs and swales can all reduce runoff.

Properly designed swales, planters, ecoroofs, and other vegetated facilities also filter stormwater pollutants, protect water quality and provide habitat.

2 Revegetation Strategy

Planting native vegetation and removing non-native, invasive species is a key strategy to meet watershed goals. Vegetation plays a significant role in the hydrologic process by intercepting, storing, and absorbing rainfall and through evapotranspiration. These functions influence the rate, timing, and volume of stormwater runoff. Wetland, riparian area and understory vegetation filter pollutants and nutrients from stormwater runoff. Removing invasive species is critical to preserving biodiversity.

As Portland developed, buildings and streets replaced green spaces. Revegetation restores habitat and provides food and cover for native wildlife. It also restores the functions of once plentiful soils and organic layers.

One of the greatest impacts of urbanization on aquatic and terrestrial wildlife is habitat fragmentation. Urbanization leaves remnant patches of habitat, which are disconnected, isolated or fragmented segments of land or riparian area. Revegetation connects and expands habitat areas to increase their function and value and can be accomplished as land redevelops.

❸ Aquatic and Terrestrial Enhancement Strategy

In developing watershed protection and restoration strategies, it is essential to focus on both terrestrial and aquatic areas and processes that connect them within watersheds. River, stream, wetland riparian, and upland enhancement projects improve natural watershed processes and fish and wildlife habitat functions. Terrestrial enhancement is not fully addressed in the 2005 PWMP. This topic will be more fully integrated into future PWMP revisions and is included in chapter 5 as a priority work plan item.

Aquatic and terrestrial enhancement improves hydrologic functions. Restoring channel complexity, natural stream meanders, off-channel wetlands, riparian and upland vegetation helps normalize stream flows, recharges groundwater, provides flood storage and reduces high flows that can erode stream banks and degrade stream channels and aquatic habitat. Protecting upland vegetation, duff and soil conditions are critical for flow storage and erosion prevention.

Aquatic and terrestrial enhancements improve water quality. Restoring stream depth, increasing complexity with large wood, varying stream width and meandering the channel help manage aquatic plant growth. Over-production of aquatic plants leads to fluctuations in dissolved oxygen concentrations and pH, which damage aquatic species. Restored aquatic and terrestrial natural areas filter nutrients, sediment and toxics from stormwater that is not discharged via the MS4 system, before reaching the waterway. Through filtration, upland vegetation and wetlands capture and treat nutrients and pollutants, stabilizing pH and the dissolved oxygen concentration of the receiving waterway.

Aquatic and terrestrial enhancement improves habitat and protects and biodiversity. Restoring connectivity by removing or retrofitting impassible culverts, installing road undercrossings for wildlife, or planting vegetated wildlife corridors promotes the natural movement of aquatic and terrestrial species. These pathways restore critical areas for feeding, nesting, roosting and migrating. Restoring native vegetation, managing invasive plant and animal species and removing development from the riparian and floodplain area also increases connectivity between stream corridors and their associated uplands.

❹ Protection and Policy Strategy

Protecting important watershed functions and applying policies to improve development and redevelopment practices are important to watershed health. Preventing damage to watersheds is far more efficient and cost-effective than restoring damaged watershed functions. This strategy is particularly important for all City bureaus to refer to and incorporate into their plans and projects.

Protecting existing vegetation, stream channels and wetlands reduces stormwater runoff, stabilizes peak stream flows that cause flooding, maintains summer flow levels and

enhances wildlife habitat. Vegetated meadows, forests and stream corridors filter pollutants and improve water quality.

Stormwater management policies that reduce impervious areas will also reduce stormwater volume and velocity, which protects streams and aquatic habitat. Land use and development policies can reduce habitat fragmentation and landslide risk. Policies to avoid or minimize development in floodplains help protect public health and safety, reduce property damage, retain natural floodplain functions, and provide habitat.

❺ Operations and Maintenance Strategy

Effective operations and maintenance practices are critical to watershed health. The City operates and maintains a wide range of infrastructure that protects public health and safety, water quality, and property. This strategy applies to all publicly owned land. This version of the PWMP maps the Operations and Maintenance strategy citywide. Near term work efforts must identify areas in need of enhanced maintenance per the City's commitment in the MS4 permit. Priority maintenance activities include:

- Storm and sanitary infrastructure need to be maintained to operate properly.
- Both public and private facilities that remove sediment, oil, grease and debris from stormwater need routine cleaning to remove accumulated sediment and pollutants.
- Industrial permits need to be monitored (in coordination with DEQ).
- Regular street sweeping prevents debris and pollutants from washing into the storm system and streams.
- Greenspace enhancement projects that aren't properly designed and maintained lose effectiveness and could actually harm watershed health.
- Monitoring and maintenance of revegetation projects protects new plantings and prevents the return of non-native, invasive plants.

❻ Education, Involvement, and Stewardship Strategy

Promoting community education, public involvement and watershed stewardship benefits watersheds by:

- Helping City employees understand how their projects affect watershed conditions;
- Showing Portland residents and businesses how their individual behavior and actions can promote healthy watersheds;
- Increasing stewardship of City-owned natural areas;
- Increasing community interest in watershed stewardship grants and volunteer restoration projects that improve watershed health.

Education, involvement and stewardship raise awareness of watershed issues and the importance of healthy watersheds.

Public involvement encourages property owners to get involved and protect natural resources, prevent pollution and creatively integrate stormwater into the built environment. This strategy increases awareness of watershed health issues and acceptance of innovative stormwater management projects like green streets and ecoroofs on public property.

Actions

Actions are specific steps that implement strategies. They include protection and improvement programs and on the ground projects that can be done by City Bureaus, regional agencies and community partners. Most actions address many needs and could be included under more than one strategy, but to avoid duplication each action is listed under only one strategy. (see Table 4.1). More detailed information on the strategies and actions can be found in Technical Memorandum 4.2.

Table 4.1 Watershed Strategies and Actions

STRATEGIES	ACTIONS
Stormwater	Modify the storm drainage system to increase infiltration and maximize evapotranspiration
	Modify the storm drainage system to increase reuse or detain stormwater
	Modify the storm drainage system to treat stormwater pollutants
	Modify the storm drainage system to separate flow from combined storm/sanitary sewer
Revegetation	Increase the extent of canopy and other vegetative cover
	Improve the quality and composition of vegetative cover
Aquatic and Terrestrial Enhancement	Restore channel and floodplain function and stability
	Restore or create river, stream, wetland, and terrestrial habitat structure and function
	Restore habitat connectivity and access
	Manage for appropriate native species
Protection and Policy	Implement management of erosion, sediment, and pollutant discharge from construction sites
	Implement management of stormwater for all new and redevelopment projects
	Implement management of pollutant discharges for industrial and commercial sites
	Protect sites and features with high watershed values and functions
Operations and Maintenance	Operate and maintain the storm sewer system, public rights-of-way, greenspaces and other city facilities and infrastructure to remove and prevent pollutant discharges
	Reduce illicit and non-stormwater discharges
	Maintain and repair sewer systems to ensure conveyance for current demand and future growth
Education Involvement and Stewardship	Promote watershed awareness with city staff, schools, the business community, organizations, and general public
	Provide pollution prevention education to city staff, the business community, organizations, and general public
	Provide technical assistance and incentives to city staff, schools, the business community, organizations, and general public

The links in Table 4.2 (page 46) are based on the review of existing effectiveness reports, input from stakeholders, and other available effectiveness information. Source documents used to assess strategies effectiveness include the watershed characterizations, the Integrated Watershed Plan (1998), the Green Solutions and Inflow Controls Report (1997),

Storm Water Best Management Practices Effectiveness Workgroup Report (2005), TM 4.2, Stormwater Treatment Technologies, from the CSO Sizing and Flow Management Predesign Project (2004), Stormwater Managers Resource Center (2005), and the Draft Revegetation Guidelines (2004).

Table 4.2 Linking Strategies and Objectives

✔ Indicates action directly contributes toward achieving objective, per existing research and professional judgement. Actions without a direct link to an objective may still indirectly contribute to achieving that objective.

STRATEGIES		OBJECTIVES	Hydrology			PhysicaL Habitat		Water and Sediment Quality			Biological Communities	
			Stream Flow and Hydrologic Complexity	Channel and Floodplain Function	Stormwater Conveyance	Aquatic Habitat	Terrestrial Habitat	Stream Temperature	Pathogens	Urban Pollutants	Fish and Other Aquatic Organisms	Terrestrial Wildlife and Vegetation
STORMWATER MANAGEMENT	Modify storm drain system to increase infiltration		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Modify storm drain system to increase retention or detention of stormwater		✔	✔	✔	✔	✔		✔		✔	✔
	Modify storm drain system to separate flow from combined storm/sanitary sewer							✔	✔	✔	✔	✔
REVEGETATION	Increase canopy and other vegetative cover		✔	✔	✔				✔		✔	✔
	Improve quality and comosition of vegetative cover		✔	✔	✔	✔	✔	✔		✔	✔	✔
AQUATIC AND TERRESTRIAL ENHANCEMENT	Restore channel and floodplain function and stability		✔	✔	✔	✔		✔			✔	✔
	Restore or create riverine, wetland and upland habitat structure and function		✔	✔	✔	✔	✔	✔			✔	✔
	Restore habitat connectivity and access					✔	✔				✔	✔
	Manage for appropriate native species			✔		✔					✔	✔
PROTECTION AND POLICY	Implement management of erosion, sediment, and pollutant discharge from construction sites					✔			✔	✔	✔	✔
	Implement management of stormwater for all new and redevelopment projects		✔		✔			✔	✔	✔	✔	✔
	Implement management of pollutant discharge for industrial and commercial sites					✔		✔	✔	✔	✔	✔
	Protect sites and features with high watershed value		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
OPERATIONS AND MAINTENANCE	Operate and maintain storm sewer system, public rights-of-way, and other city facilities and infrastructure to remove and prevent pollutant discharges							✔	✔	✔	✔	✔
	Reduce illicit and non-stormwater discharges				✔			✔	✔	✔	✔	✔
	Maintain and repair sewer systems to ensure conveyance for current demand and future growth				✔				✔	✔		
EDUCATION, INVOLVEMENT AND STEWARDSHIP	Provide education and technical assistance to city staff and industrial and commercial facilities to prevent pollution							✔	✔	✔	✔	✔
	Provide education, involvement, and stewardship on pollution prevention to organizations and general public							✔	✔	✔	✔	✔
	Provide education, involvement, and stewardship on watershed function to city staff, businesses and public		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Mapping Strategies and Actions

The City developed a map of citywide strategies and priority implementation areas for the watershed plan. The map is based on the strategies and actions (described above) and goals and objectives (described in Chapter 3). The biological communities goal was not included in the Restore analysis because all actions identified benefit this goal by directly contributing to the hydrology, physical habitat and water quality goals (see Table 4.2)

The City developed the map using the decision-making tool Restore. Oregon State University developed Restore to aid watershed restoration in the Willamette basin, and several watershed councils and agencies in the basin have successfully used it. Restore requires three types of input: actions, objectives and geographic information (e.g., land use, impervious area, tree canopy cover, etc.). There were several limits to the data that will be addressed in future revisions to the PWMP. In particular, Restore needs to be updated to include land that falls between the Urban Services Boundary and the City of Portland jurisdictional boundary. There are many important natural resources in these areas that were not included in the current analysis.

Restore ties these inputs together with rules that allow the user to define which actions are most likely to advance watershed objectives under different geographic conditions. For example, planting native vegetation (which falls under the Revegetation strategy) would get a high score toward the objective of reducing stream temperature (which falls into the Water Quality goal category) when applied next to a small stream, because creating shade along small streams reduces water temperatures. Restore assigned scores between - 4 and + 4 to each action in 0.25 to 25-acre parcels across the City. The highest scoring action for each parcel was displayed on a map.

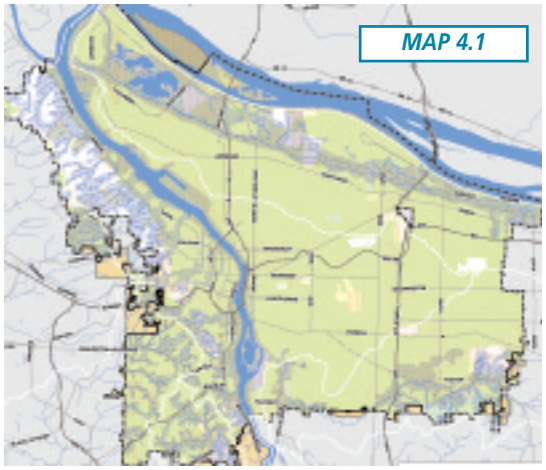
Restore was applied across the City of Portland and provided a first cut analysis of where the actions could apply given the City's watershed health objectives. Unfortunately, socio-economic objectives are not included in the 2005 Portland Watershed Management Plan because adequate data is not available. The City acknowledges that socio-economic factors are critical to successfully identifying watershed improvement efforts and compiling and analyzing this data is addressed in Chapter 5 as a work plan priority. Future updates to the Watershed Management Plan will include this analysis. In the meantime, socio-economic factors will be developed and considered as more detailed plans for specific areas of the City are created.

Output from Restore was quite detailed and showed the action recommended for each 0.25 to 25-acre parcel across the City. The Restore output was then generalized, showing only those actions that received scores of 2 or higher and grouping these actions into strategies to create the Watershed Improvement Strategies map (Figure 4.1). Each of the mapped strategies presents opportunities for implementation.

Watershed improvement strategies apply to a range of land uses and conditions, which in turn will affect how strategies and actions are applied to given areas or sites. For example, some kinds of revegetation in downtown Portland, such as green streets or ecoroofs, are beneficial to watershed health. Revegetation can be made more compatible with industrial and commercial areas because they include planting native grasses, groundcovers in addition to trees. Stormwater strategies focus on better managed stormwater from all devel-

oped land. Aquatic and terrestrial enhancement strategies could be incorporated in appropriate areas in conjunction with development and redevelopment.

Figure 4.1. Watershed Improvement Strategies Map



The Watershed Improvement Strategies map (Figure 4.1) is a broad illustration of the strategies as they potentially apply throughout the City to improve watershed health. The extent to which a given strategy can be applied should be considered on a site by site basis and requires further analysis. Likewise, if an opportunity to implement a watershed improvement strategy arises in an area not mapped, the opportunity should be explored. The map provides a general representation of where the strategies can be applied and the City expects this analysis to improve over time. Readers who are interested in the detail behind the Watershed Improvement Strategies map can find more information in Technical Memorandums 4.1 through 4.7.

Here is a brief description of where strategies apply across the City:

Stormwater Management

Implementing the stormwater actions (e.g., increasing infiltration and treating stormwater pollutants) will benefit watershed function in most parts of the City. The stormwater strategy was not applied to undeveloped areas like Forest Park. Rain in these areas is captured by vegetation or infiltrates the soil, making these areas less of a priority for stormwater strategies than more developed parts of the City.

Revegetation

Watershed function in almost every part of the City would benefit from added vegetation or an improvement in the quality of the existing vegetation. Revegetation can include native grasses, shrubs, ground covers, and trees. Many areas of the city that could benefit from an improvement in the quality of existing vegetation were not highlighted because it was assumed that, given limited resources, efforts would be focused on more vulnerable areas. This assumption needs to be revisited in future revisions to the PWMP.

Aquatic and Terrestrial Enhancement

The aquatic and terrestrial enhancement strategy applies in the parts of the City that contain streams or floodplain. This strategy was not applied to other parts of the City because, at the time the maps were developed, this strategy consisted largely of aquatic enhancement actions. The City recognizes that terrestrial enhancement is an important watershed improvement strategy and will include terrestrial enhancement actions in future revisions to the PWMP. Revised actions may be prioritized in proximity to stream corridors, as these locations will have the greatest multi-objective impact, but they will need to be applied citywide. Important terrestrial sites like Forest Park and Mt. Tabor will likely be identified as areas needing enhancement (or revegetation) when terrestrial actions are included in the analysis.

Protection and Policy

In general, the Protection and Policy strategy applies throughout the City. One action, "Protect Sites with High Watershed Value," was supported by data that allowed natural resource areas to be mapped that would benefit from additional protection and thereby benefit watershed health. Areas highlighted in this category do not represent all of the natural resources that warrant protection in order to prevent additional degradation of watershed conditions.

Operations and Maintenance

This strategy applies throughout the city and is not graphically represented on the Watershed Improvement Strategies map.

Education, Involvement, and Stewardship

This strategy applies throughout the city and is not graphically represented on the Watershed Improvement Strategies map.

Implementation Opportunity Maps

The Watershed Improvement Strategies Map (Figure 4.1) shows future project locations. In the short term, the City can improve watershed health with planned and existing projects. Meetings with City staff and watershed stakeholders, gathering data and creating maps identified current projects and opportunities. Implementation opportunities were mapped into four areas of interest:

Development and Redevelopment Opportunities (Figure 4.2),

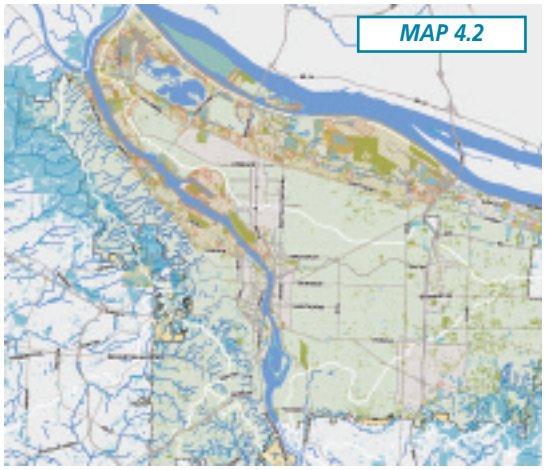
Community Stewardship Opportunities (Figure 4.3),

Bureau Collaboration Opportunities (Figure 4.4), and

Environmental Services Opportunities (Figure 4.5).

Development and Redevelopment Opportunities

The Development and Redevelopment Map (Figure 4.2) illustrates priority areas for planned development and redevelopment. Development and redevelopment provide opportunities to improve watershed function. New development can be designed to minimize impervious surface and to infiltrate as much stormwater as possible. Redevelopment can decrease impervious surfaces and increase the quantity and quality of onsite vegetation.

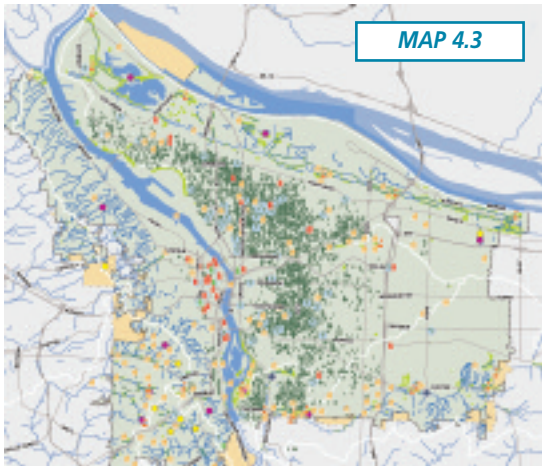


Information on the map is based on a 20-year time frame. The purpose is to show projects that foster economic development such as development of vacant lands and infill. These include projects in urban renewal areas and parts of the City that are likely to redevelop. Projects in this category focus on strategies that support economic activity, while improving watershed health. For example, ecoroofs in industrial areas don't reduce the amount of buildable land, and they meet stormwater manage-

ment requirements. The City is expanding efforts to help developers incorporate features that protect and improve watershed health into their projects.

Community Stewardship Opportunities

The Community Stewardship Map (Figure 4.3) shows the distribution of stewardship activities, such as Community Watershed Stewardship Grant and SOLV projects. The purpose of the map is to illustrate and track the trends in community involvement. There were many data gaps in this effort and future revisions to the PWMP will more completely address this issue.



The following Community Stewardship Programs are not mapped and are called out because they provide important opportunities to improve watershed health:

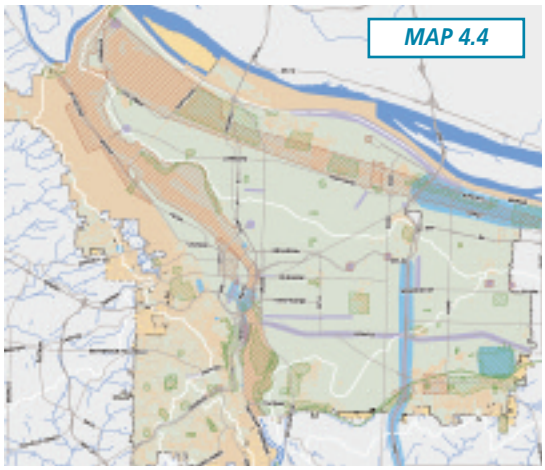
Portland Parks Natural Areas Volunteer Program
Over 50,000 hours have been donated by citizens removing invasive non-native plants, building and repairing trails, planting native plants and other valuable volunteer work in Portland's natural areas. Project sites range from Dickenson Woods Park in southwest, to Forest Park in the north, Columbia Slough and the entire length of Johnson Creek. Also, about 5,000 classroom students have participated in service learning when they come to a park and do hands-on science learning and restoration work.

Neighborhood Liaison Program
Bureau of Planning staff are assigned to six City districts act as the primary contact between communities, city agencies, and nonprofit groups on planning and development matters.

Community Visioning Project
The purpose of this initiative led by Mayor Potter is to engage the community to create a shared vision for Portland's future. This vision will be the basis of strategic plans for the city government and other individuals and organizations that share responsibility for shaping our community.

Bureau Collaboration Opportunities

The Bureau Collaboration Map (Figure 4.4) shows projects and planning efforts the City will implement in the next two to five years. These areas represent opportunities for city work to promote healthy watersheds and maximize limited resources to meet multiple objectives. Includes neighborhood planning, street improvement and natural area improvement projects.



The following Bureau Collaboration Programs are not mapped and are called out because they provide important opportunities to improve watershed health:

Parks Acquisition Strategy
Portland Parks & Recreation acquired over 750 acres of new natural area park land between 1990 and 2005. Parks is now responsible for 7,000 acres including 5,000 acres in Forest Park.

The Parks Acquisition Strategy directs the short and long-term growth of the natural area system. In the long term, the strategy envisions a large forested park on Portland's east side and connected protected corridors along major waterways. Parks has developed acquisition objectives and a priority list of parcels for acquisition for each watershed. Parks staff has worked with other bureaus to develop joint City natural resource acquisition priorities and make recommendations to Metro for a potential 2006 bond measure.

Portland streets contribute 66% of the City's total stormwater runoff discharge and 77% of the pollutants in the discharge.

Regulatory Improvement Program

Since 2002, the City's Bureau of Planning has worked to streamline and update its building and land development regulations and permitting processes through the Regulatory Improvement Work plan (RIW). Current RIW projects include:

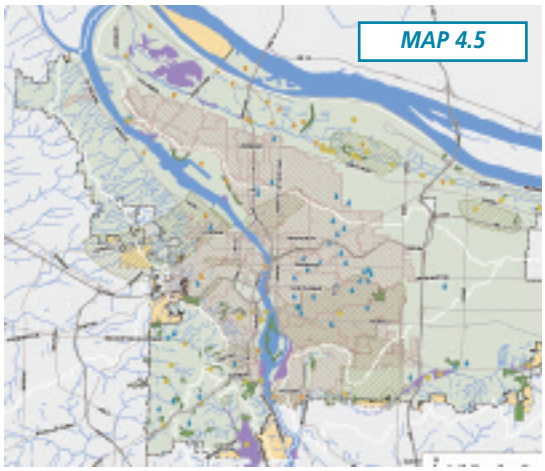
- Regulatory Improvement Code Amendment Package: Identifies improvements to City Code without making major city policy changes.
- Regulatory Rethink Project: This is a review of the City's existing regulatory framework and how it works to implement Comprehensive Plan goals.

Green Streets

Portland streets contribute 66% of the City's total stormwater runoff discharge and 77% of the pollutants in the discharge. Portland is building green street projects throughout the City to reduce the impacts of stormwater runoff. Green streets divert stormwater from the sewer system to reduce combined sewer overflows (CSOs) and increase stormwater infiltration, which reduces stormwater pollution in rivers and streams. Low-growing native and ornamental plants make green streets attractive neighborhood amenities.

Environmental Services Opportunities

The Environmental Services Map (Figure 4.5) illustrates priority work areas over the next two to five year and projects that may be proposed for funding through the Federal Water Resources Development Act (WRDA). Priorities range from sewer system improvements (predesigns) to revegetation.



Combined Sewer Overflow (CSO) Program

The CSO Program is a long-term effort to control CSOs to the Willamette River and Columbia Slough. The $1.4-billion program includes construction of pipelines, tunnels, a pump station, separated storm sewers, downspout disconnections, wetlands, wet weather sewage treatment facilities and stormwater sumps and sedimentation manholes. Projects eliminated CSOs to the Columbia Slough in 2000 and will reduce CSO volume to the Willamette River by 94% in 2011.

The following Environmental Services Programs are not mapped and are called out because they provide important opportunities to improve watershed health:

Public Facilities Plan/System Plan

Environmental Services began updating its 1999 Public Facilities Plan in May 2005. The new Environmental Services System Plan will use the latest technology to develop project alternatives

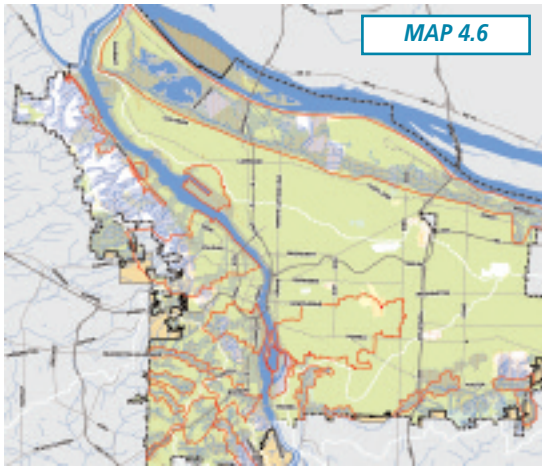
that protect public health and the environment. The System Plan is focused on the City's sewer pipe infrastructure (both sanitary and stormwater). In most cases, this work is closely tied to issues related to watershed health, and the work to implement this Plan will be closely tied to the System Plan.

The Portland Harbor Superfund Program

Portland Harbor is a heavily industrialized stretch of the Lower Willamette River from Swan Island to the southern tip of Sauvie Island. Contaminants in river sediments include metals, pesticides, PCBs and petroleum products. EPA is the lead for river cleanup, and DEQ is the lead for cleanup on land and controlling contamination sources. Identifying responsible parties and pollution sources, characterizing contaminant distribution and impacts, and evaluating cleanup options are underway. The City is a member of the Lower Willamette Group (LWG), a coalition of business and public agencies investigating harbor contamination. Environmental Services is working with DEQ to evaluate whether the City stormwater system conveys contaminants to the river, and Tribal governments and agencies to evaluate potential resource damages and restoration opportunities.

Watershed Priority Areas

The Watershed Priority Areas Map (Figure 4.6) highlights sites the City could focus on in the next two to five years to improve watershed health. In this version of the Plan, this map serves as reference to City bureaus in order to maximize City collaboration within these priority areas. In future updates to the Plan, Priority Areas will be established collaboratively between bureaus within the context of the Watershed Management System (see Chapter 5).



The Watershed Priority Areas are based on a number of factors, including:

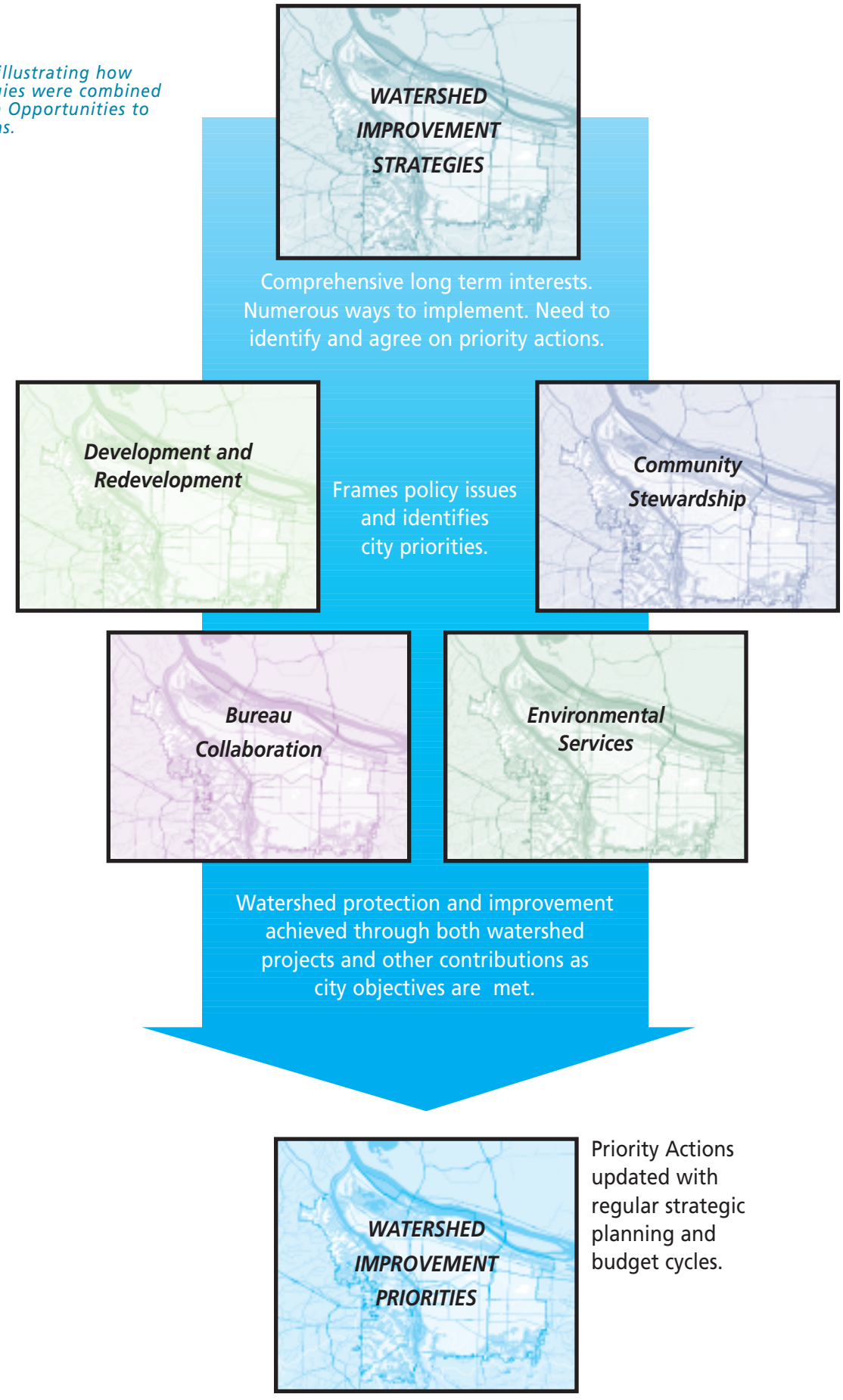
- Applicability of several strategies as shown in the Watershed Improvement Strategies Map. For example, stormwater management, revegetation, habitat enhancement and protection strategies all apply to the Crystal Springs area of Johnson Creek (Figure 4.1).
- An opportunity to coordinate with another project or program, as shown in the Implementation Opportunities maps. For example, the Environmental Services Engineering Services and Watershed Services groups are jointly conducting a predesign for the Taggart D combined sewer basin to explore both traditional pipe and sustainable stormwater solutions to sewer capacity and basement flooding problems.
- Restoration potential. For example, the mainstem of Tryon Creek is one of the best remaining stream habitats in the City, but still needs to be enhanced.
- Potential to improve stormwater management. For example, Oregon Health and Science University (OHSU) in the Marquam-Woods subwatershed is developing a Stormwater Master Plan.

The Priority Areas highlight current and planned watershed projects. To achieve watershed health goals, the City must incorporate these strategies into more projects over a longer period. Where implementation opportunities are not in a priority area, City staff can use the Watershed Improvement Strategies map as a guide to plant projects that will improve watershed health.

The Watershed Improvement Strategies map (Figure 4.1) shows locations where strategies are being applied or could be applied over the long term. The Implementation Opportunity maps (Figures 4.2 - 4.5) show existing programs with the potential to incorporate watershed improvement strategies. The Watershed Priority Areas Map highlights key areas of work to improve watershed function in the near-term (Figure 4.6).

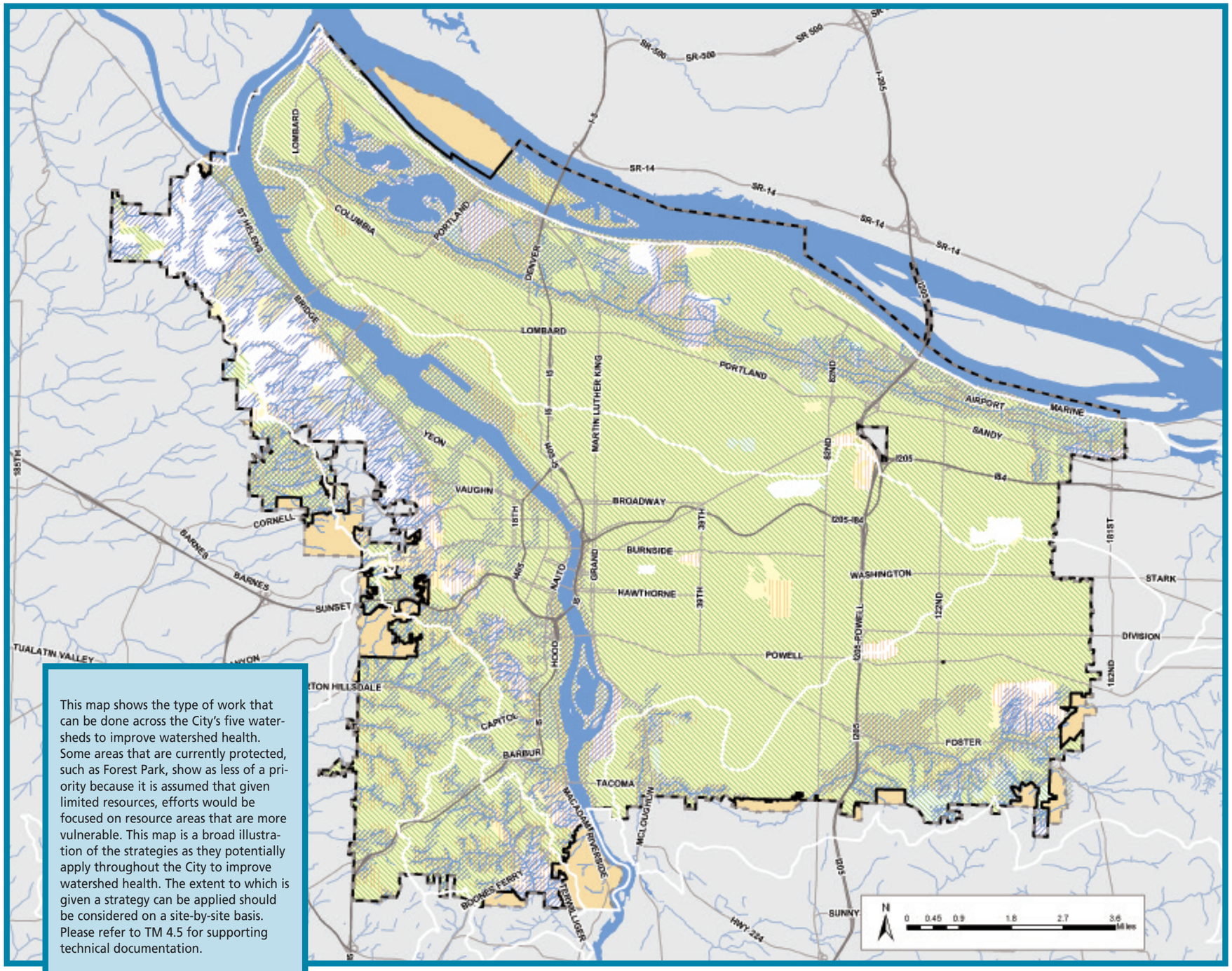
The Figure 4.7. Diagram (page 54) illustrates how Improvement Strategies were combined with Implementation Opportunities to identify Priority Areas.

Figure 4.7. Diagram illustrating how Improvement Strategies were combined with Implementation Opportunities to identify Priority Areas.



Actions for Watershed Health

Watershed Improvement Strategies



This map shows the type of work that can be done across the City's five watersheds to improve watershed health. Some areas that are currently protected, such as Forest Park, show as less of a priority because it is assumed that given limited resources, efforts would be focused on resource areas that are more vulnerable. This map is a broad illustration of the strategies as they potentially apply throughout the City to improve watershed health. The extent to which is given a strategy can be applied should be considered on a site-by-site basis. Please refer to TM 4.5 for supporting technical documentation.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

Strategy Categories

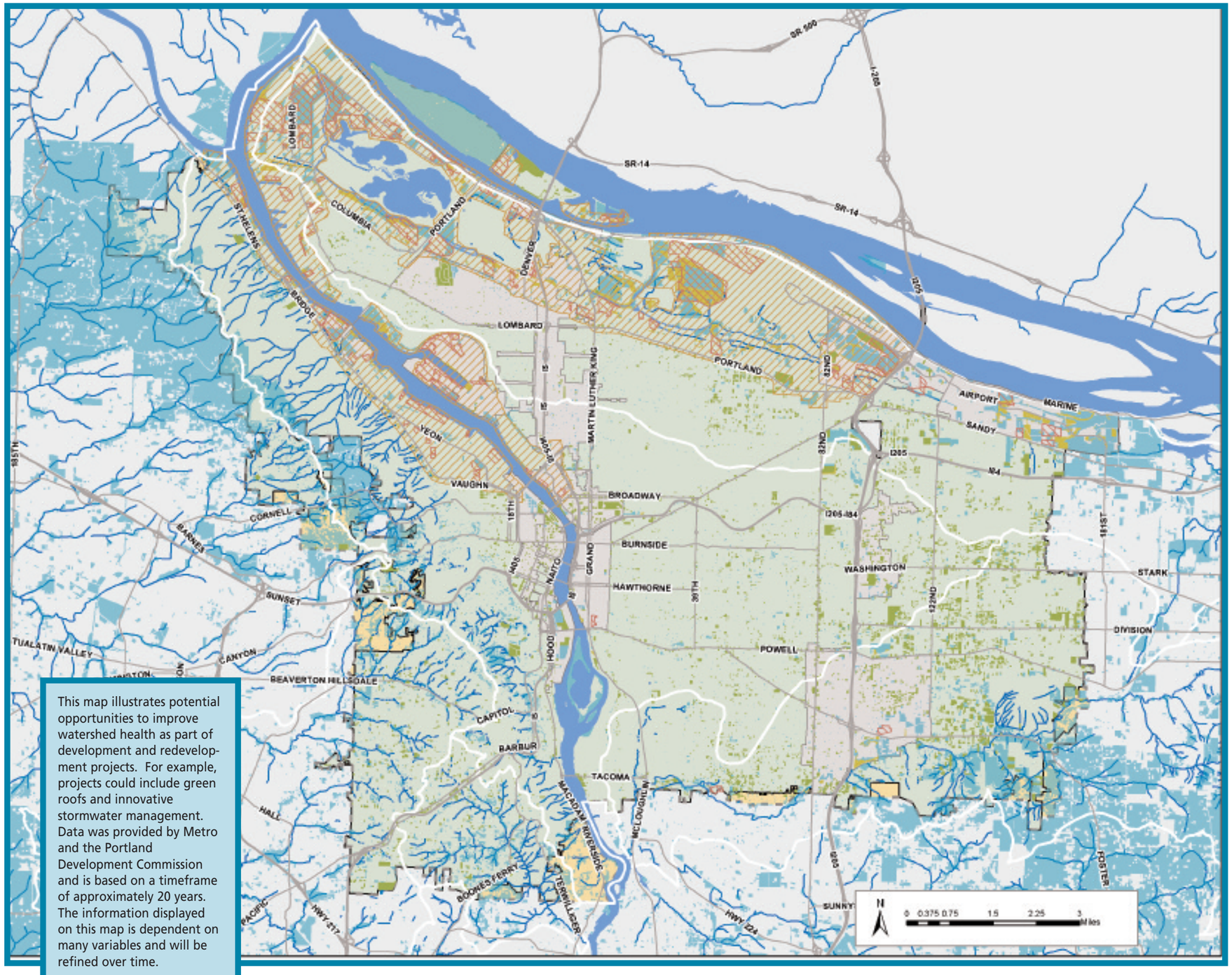
- Stormwater Management
- Revegetation
- Aquatic and Terrestrial Enhancement
- Protect Sites with High Watershed Value

The following strategy categories apply everywhere:
* Education
* Policy
* Operations and Maintenance

Figure 4.1

Actions for Watershed Health

Development and Redevelopment



This map illustrates potential opportunities to improve watershed health as part of development and redevelopment projects. For example, projects could include green roofs and innovative stormwater management. Data was provided by Metro and the Portland Development Commission and is based on a timeframe of approximately 20 years. The information displayed on this map is dependent on many variables and will be refined over time.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

Development/Redevelopment

- Heavy Industrial Districts
- Freight Hub Districts*
- Partially Buildable Vacant Industrial Land**
- Potential Infill and Redevelopment Sites (Metro)***
- Metro Vacant Lands 2003
- Urban Renewal Areas

*Freight hub districts represent industrial land of statewide economic importance, where Oregon's primary seaport, airport, rail lines, pipelines, and interstate highways converge.

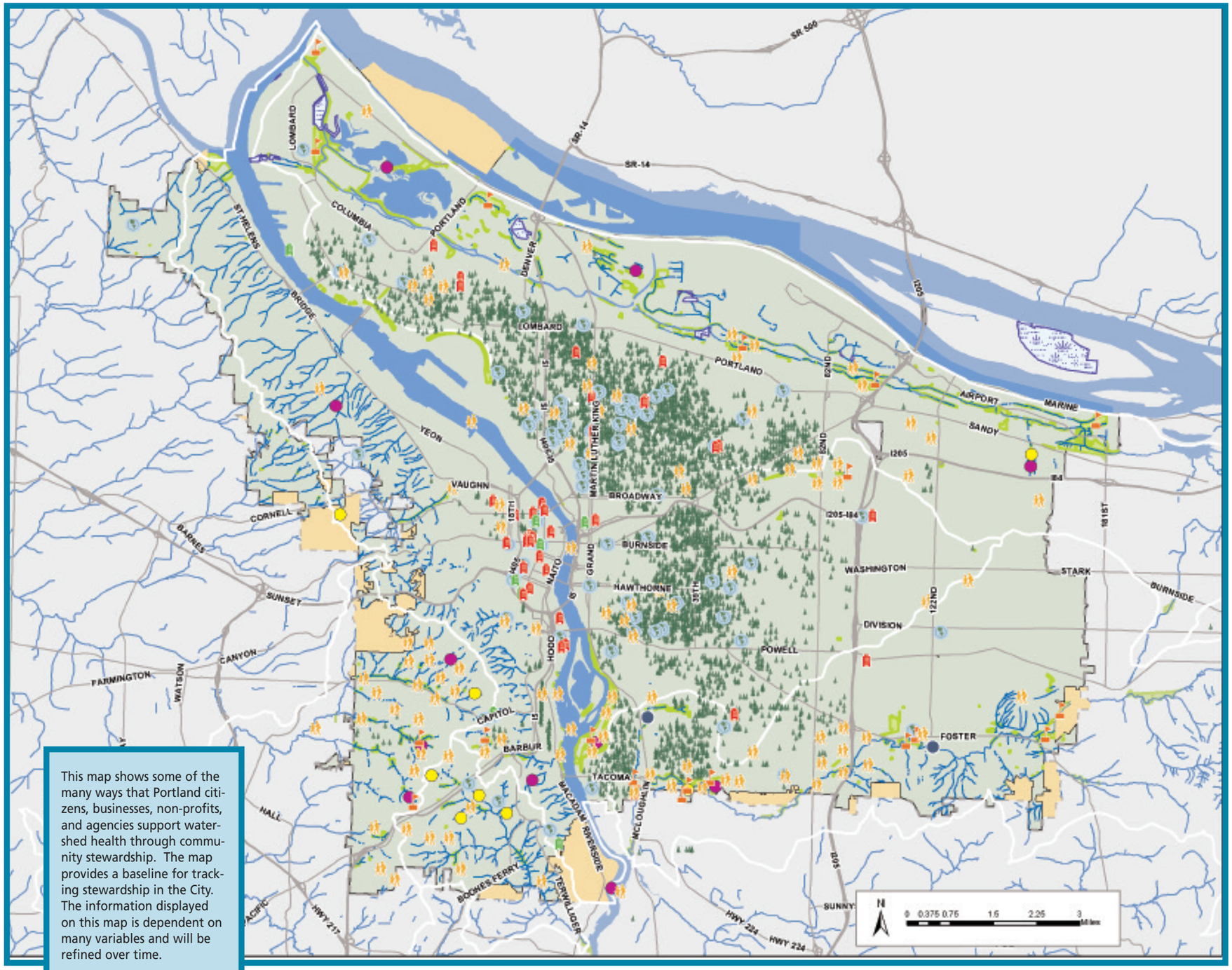
**This layer represents areas where development is allowed but limited and present opportunities for creative approaches to better integrate economic development and natural resource protection.

***This layer is not shown in industrial zones because it does not accurately represent redevelopment in these areas.

Figure 4.2

Actions for Watershed Health

Community Stewardship Opportunities



This map shows some of the many ways that Portland citizens, businesses, non-profits, and agencies support watershed health through community stewardship. The map provides a baseline for tracking stewardship in the City. The information displayed on this map is dependent on many variables and will be refined over time.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

Community Stewardship

- Sites Adopted by Schools
- Community Stewardship Grants
- Office of Sustainable Development (OSD) Awards
- LEED* Certified Building
- Registered for LEED Certification
- Friends Groups
- SOLV Projects
- Watershed Coucil Projects**
- Friends of Trees sites through 2003
- Revegetation Projects
- Port Mitigation Sites***

*Leadership in Energy and Environmental Design (LEED)

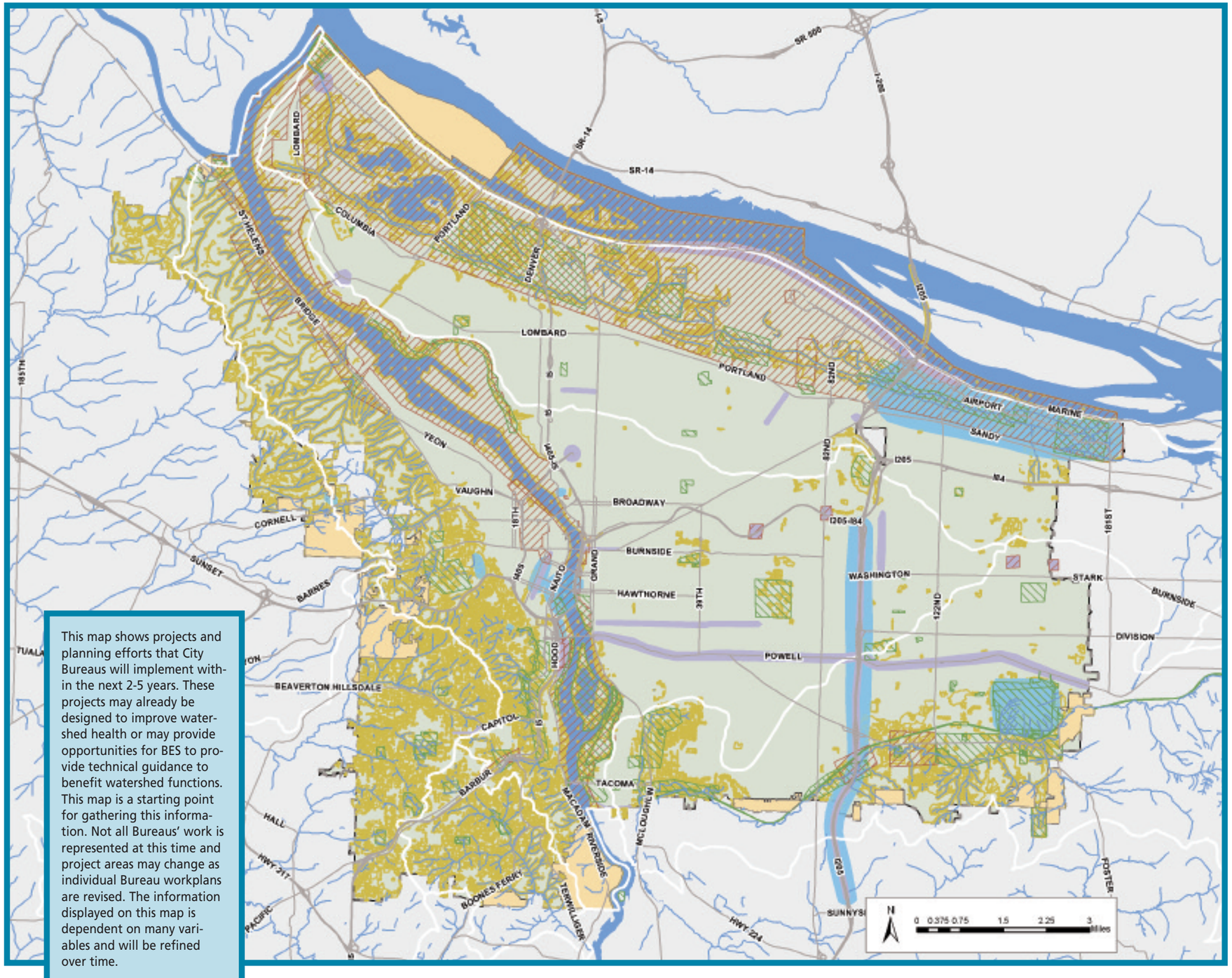
**Represents projects reported in November 2005.

***In addition to these mitigation sites, several miles of Port-owned riparian habitat have been restored and replanted.

Figure 4.3

ACTIONS for WATERSHED HEALTH

Bureau Collaboration Opportunities



This map shows projects and planning efforts that City Bureaus will implement within the next 2-5 years. These projects may already be designed to improve watershed health or may provide opportunities for BES to provide technical guidance to benefit watershed functions. This map is a starting point for gathering this information. Not all Bureaus' work is represented at this time and project areas may change as individual Bureau workplans are revised. The information displayed on this map is dependent on many variables and will be refined over time.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

Bureau Collaboration Plans and Projects

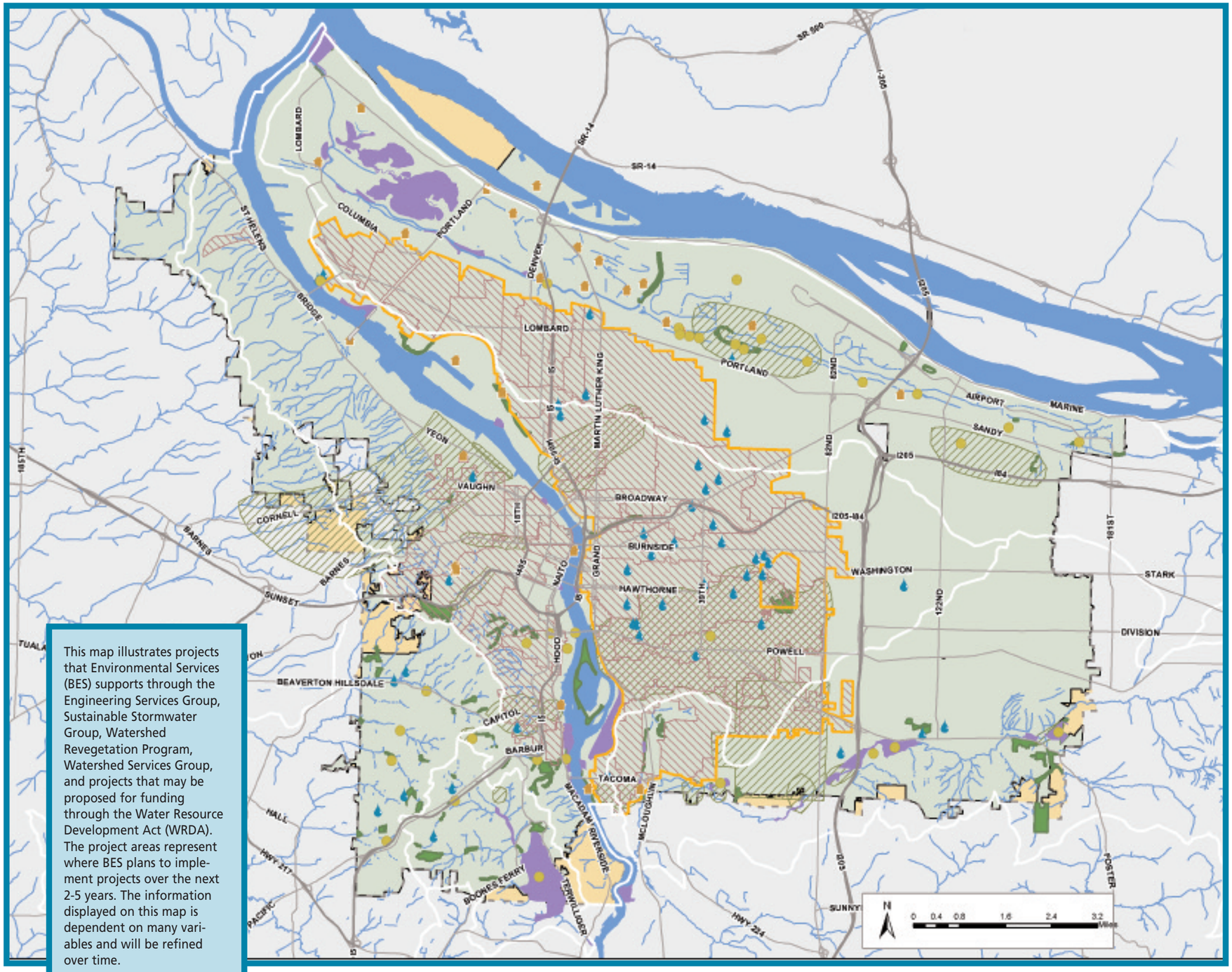
- Parks and open space projects and planning areas
- Planning efforts for Willamette River and Columbia Corridor areas
- Transportation Project Areas
- Water system project areas
- Natural Resources Inventory Update (draft)*

*The riparian and wildlife habitat resource inventories are still being evaluated for accuracy and consistency and should be consideredpreliminary. The inventories have not yet been adopted by the City of Portland.

Figure 4.4

Actions for Watershed Health

Environmental Services Opportunities



This map illustrates projects that Environmental Services (BES) supports through the Engineering Services Group, Sustainable Stormwater Group, Watershed Revegetation Program, Watershed Services Group, and projects that may be proposed for funding through the Water Resource Development Act (WRDA). The project areas represent where BES plans to implement projects over the next 2-5 years. The information displayed on this map is dependent on many variables and will be refined over time.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

BES Priorities

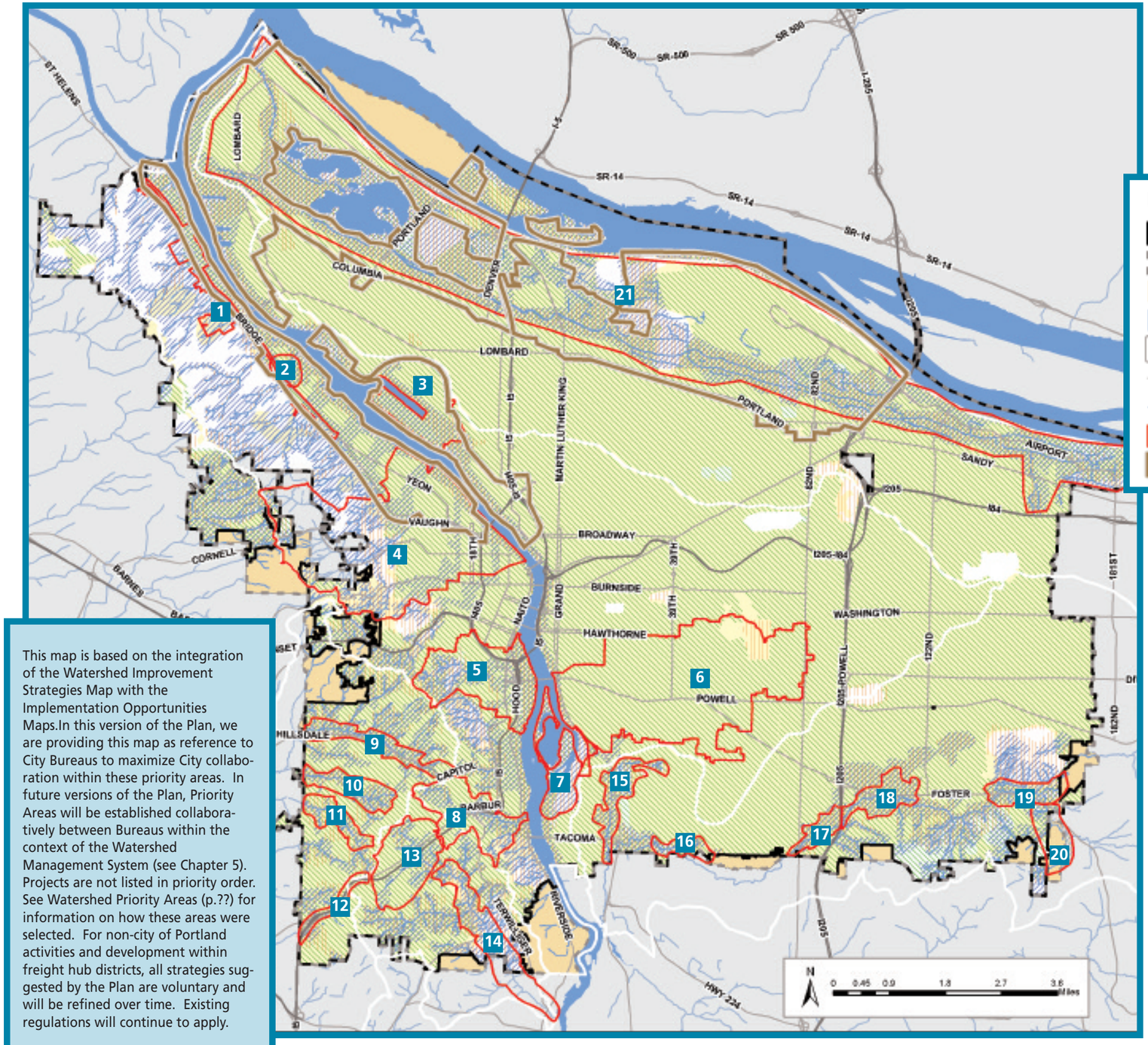
- Watershed Services Projects
- BES Sustainable Stormwater Projects
- Proposed Pump Stations
- Downspout Disconnection Planning Areas
- Combined Sewer Basins
- BES Engineering Services Projects
- Potential WRDA* Projects
- Prospective Revegetation Projects

*Water Resources Development Act

Figure 4.5

ACTIONS for WATERSHED HEALTH

Watershed Priority Areas



This map is based on the integration of the Watershed Improvement Strategies Map with the Implementation Opportunities Maps.In this version of the Plan, we are providing this map as reference to City Bureaus to maximize City collaboration within these priority areas. In future versions of the Plan, Priority Areas will be established collaboratively between Bureaus within the context of the Watershed Management System (see Chapter 5). Projects are not listed in priority order. See Watershed Priority Areas (p.??) for information on how these areas were selected. For non-city of Portland activities and development within freight hub districts, all strategies suggested by the Plan are voluntary and will be refined over time. Existing regulations will continue to apply.

Legend

- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams
- Priority Areas
- Freight Hub Districts

Strategy Categories

- Stormwater
- Revegetation
- Aquatic and Terrestrial Enhancement
- Protect Sites with High Watershed Value

The following strategy categories apply everywhere:
* Education
* Policy
* Operations and Maintenance

ID	AREA NAME	WATERSHED*
1	Linnton Village and Hillside Study	WR
2	Doane Creek and Lake	WR
3	Swan Island Subwatershed	WR
4	NW Neighborhoods Predesign	WR
5	Marquam Woods Subwatershed	WR
6	Taggart Subwatershed	WR
7	Ross Island / Oaks Bottom	WR
8	Stephens Subwatershed	WR
9	Beaverton Hillsdale Stormwater Projects	F/T
10	Vermont Creek Stormwater Projects	F/T
11	Woods Creek Stormwater Projects	F/T
12	I-5 Stormwater Projects	F/T
13	Upper Tryon Stormwater Projects	F/T
14	Lower and Middle Tryon Stream Restoration	F/T
15	Crystal Springs	JC
16	Tideman/Johnson Stream and Wetland Restoration	JC
17	West Lents Stream Restoration	JC
18	East Lents Floodplain and Wetland Restoration	JC
19	Lower Powell Butte Restoration Area	JC
20	Kelley/Mitchell Creeks Stream Enhancement	JC
21	Columbia Slough Floodplain Priorities	CS

* Willamette River WR - Columbia Slough CS - Johnson Creek JC - Fanno/Tryon Creeks F/T

Figure 4.6

Summary

The strategies and actions to improve watershed function (Table 4.1) described in this chapter will move the City closer to achieving its watershed objectives (Table 4.2). The City used the decision support tool Restore to develop the Watershed Improvement Strategies map, which shows where the City could apply actions that meet multiple watershed objectives.

City staff and private citizens can use the Watershed Improvement Strategies map (Figure 4.1) and the Watershed Management Plan to incorporate watershed strategies and actions into their projects. The Plan also identifies specific opportunity areas shown in the Implementation Opportunity maps (Figures 4.2 to 4.5). The Watershed Priority Area map shows the areas of focus for watershed improvement work (see Figure 4.6) for the next two to five years.

The City will apply the System to all watershed management activities

CHAPTER 5: MANAGEMENT SYSTEM

The City will implement watershed improvement strategies and actions, monitor progress toward watershed goals and objectives, and conduct research and analysis to continually improve future watershed management decisions using the watershed management system (System).

The System applies the goals, objectives, strategies and actions identified in this Plan to City watershed management activities. It applies the Plan to watershed monitoring and requires the City to update technical documents, revise the Plan, and continually improve watershed management decisions. The System describes how these changes will contribute to watershed health within the Environmental Services Watershed Services Group and how the Plan will be applied to other City work groups and activities over time.

Implementation of the watershed management system will apply the Plan to all watershed management activities. It means working collaboratively to apply the Plan to other City bureaus to ensure that other City projects such as new streets and programs such as land use zoning and City code updates all contribute to improving watershed health. Working incrementally, implementation ultimately means ensuring that all City activities that affect watersheds are performed in a fashion that helps protect and improve watershed health.

Monitoring allows the City to measure the implementation and effectiveness of specific actions, measure progress in improving watershed health, and address regulatory compliance requirements. On-going research and analysis improves our understanding of the watershed and strengthens analytical tools to help identify and select the best actions to improve watershed health. Using principles of adaptive management, the System ensures that data gathered from monitoring, research and analysis will be used to update the Plan and its supporting technical documents on a regular schedule and improve future watershed management decisions.

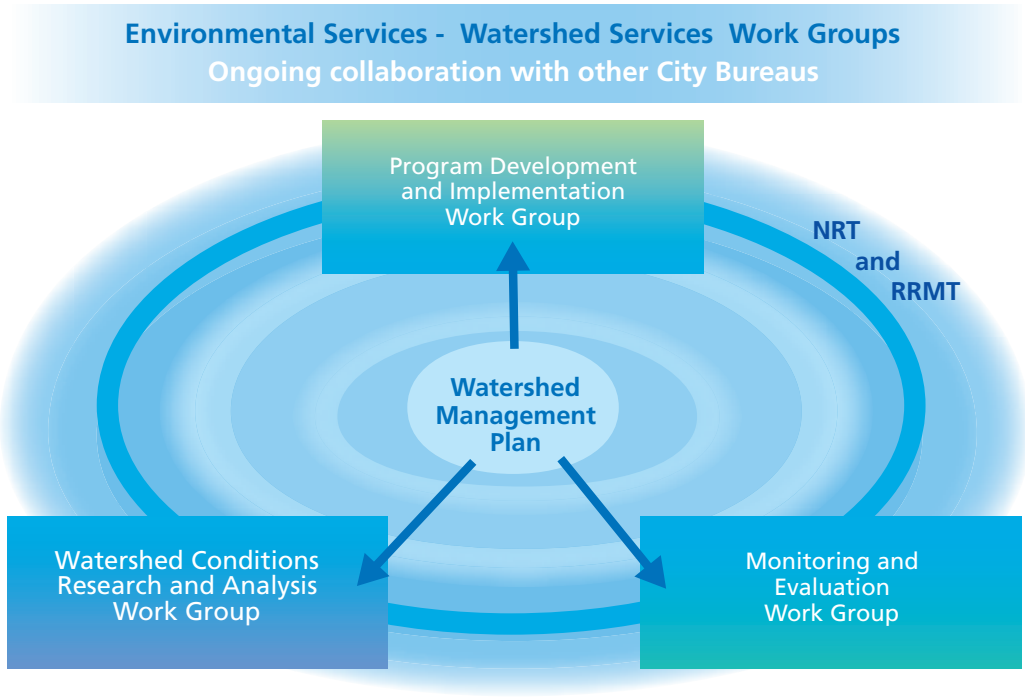
The City will issue periodic compliance reports to regulatory agencies and an Annual Report of Watershed Plan implementation.

Watershed Management System Working Groups

Environmental Services Implementation

Environmental Services will create three work groups to ensure that the Plan is applied to all watershed management activities within two years. An Environmental Services Watershed Services manager will chair each group. Working group chairs will meet regularly and inter-bureau working groups will collaborate on many tasks.

Figure 5.1 Watershed Management Work Groups



The Program Development and Implementation Working Group will apply the Plan goals, objectives, strategies and priority actions to the development of current and future Environmental Services Watershed Services Group programs. This group will develop procedures and criteria for selecting projects that advance the goals and objectives of the Watershed Plan.

The Watershed Conditions Research and Analysis Working Group will refine measures to track improvements in watershed health, and they will use the data to develop new project selection criteria.

The Monitoring and Evaluation Working Group will apply Watershed Plan goals, objectives, strategies, and priority actions to watershed monitoring activities. Monitoring assesses the effectiveness of specific actions, and gauges progress toward improved watershed health. This working group will lead the effort to develop a detailed monitoring strategy.

Integrated City-wide Implementation

The Watershed Management System acknowledges the need for a clear, consistent and comprehensive framework for implementation across all City of Portland bureaus. To successfully integrate a watershed approach into city operations, activities and programs, a multi-bureau watershed implementation team is needed. This team could be an extended version

of the existing Natural Resources Team but with broader representation (including Transportation, Portland Development Commission, and sustainable Development representatives). In the near term, it should be charged with determining how to implement the plan across City bureaus, as well as refining watershed health performance measures. The River Renaissance Management Team (RRMT) manages the River Renaissance Initiative. The two teams will help apply the Watershed Plan to other City activities. The City can also promote the Watershed Plan as bureaus update their five-year operating budgets each year and through the Managing for Results initiative.

Short-term Tasks

Over the next few years, these three working groups will develop tools and procedures to ensure that all Environmental Services Watershed Services activities advance the goals and objectives of the Plan and that the Bureau uses the Plan to prioritize and select all its activities. These tasks are short-term in the sense that working groups expect to make substantial progress early on. Some of the tasks however, will be worked on over the next few years.

Improving our understanding of the watershed and refining and developing methods to improve watershed management decisions are ongoing tasks. This work will give us new methods to quantify the environmental benefits of stormwater and stream restoration projects, and benchmarks to guide project implementation and measure benefits.

Program Development and Implementation Working Group

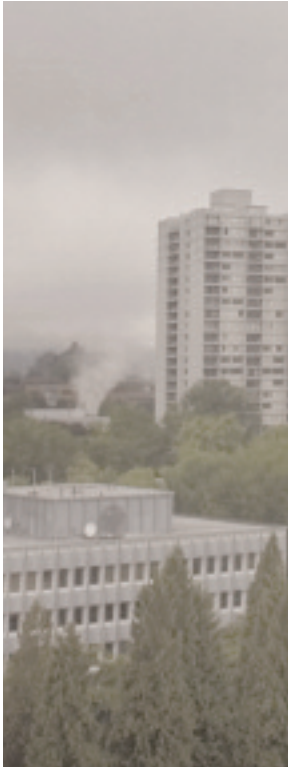
- Collaborate with the other two working groups to develop procedures to review, prioritize, and select Watershed Services Group projects that promote the goals and objectives of the Plan. This will include pre-screening all proposed Environmental Services Capital Improvement Projects (CIP) before submission to the CIP committee each August.
- Develop procedures and criteria to guide development of the Watershed Services Group five-year operating budget to ensure that all activities further the goals and objectives of the Plan.
- Establish procedures and criteria to develop, review, and prioritize all Watershed Services Group work plans to ensure that activities further the goals and objectives of the Plan.
- Collaborate with Environmental Services' Engineering Services staff on the update of the 1999 Public Facilities Plan (System Plan).
- Collaborate with City bureaus on development of terrestrial wildlife strategies.
- Revise Bureau CIP project selection criteria to ensure that Plan goals and objectives are considered in future project selection.
- Work with Environmental Services Engineering Services staff to develop criteria for operations and maintenance and other infrastructure projects that advance Plan goals and objectives.
- Coordinate with Watershed Councils and Stewardship Groups to promote communication and collaboration.
- Develop a database to track project opportunities, prioritize and select opportunities, and track implementation.
- Produce annual reports on implementation and performance.

Watershed Conditions Research and Analysis Working Group

- Work with the Program Development and Implementation Committee to develop criteria to prioritize Watershed Services Group activities.
- Begin work to address data gaps identified in the Plan development process. These are documented in the Plan Technical Memoranda. In particular, address terrestrial habitat issues.
- Develop environmental measures to track progress toward improvements in watershed health.
- Refine watershed analysis tools to improve understanding of Portland watersheds and help target Watershed Services activities to most efficiently and effectively improve watershed health.
- Develop methods and tools to measure and describe benefits of plan strategies and actions (e.g. stormwater swales, revegetation) and ecological protection and restoration. Results can be used in cost/benefit analysis to describe the benefits of these types of projects beyond cost savings.
- Expand methods and tools to quantify the value of ecosystem services. These results can be used in project prioritization and selection.
- Update watershed characterizations and other technical documents that support the Plan to reflect new data and analysis. This includes incorporating data gathered from monitoring activities.
- Review Plan goals, objectives, strategies and priority actions in light of new data and updated technical documents. Working with the Program Development and Implementation Working Group, update the Plan as needed.

Monitoring and Evaluation Working Group

- Develop a monitoring strategy that integrates the Plan with existing monitoring conducted to meet Environmental Services regulatory reporting commitments. The monitoring strategy must describe the incremental inclusion of environmental measures as the Watershed Conditions Research and Analysis Working Group develops them. This strategy will place regulatory-related monitoring into a broader watershed health context.
- Review monitoring results regularly to ensure that monitoring is effective and captures data needed to assess progress toward improved watershed health.
- Monitor the effectiveness of specific projects and technologies. This information can be used to help select best management practices (BMPs) for future projects and help predict benefits.
- Adjust monitoring activities to address new regulations or monitoring requirements.
- Ensure the Watershed Conditions Research and Analysis Working Group and the Program Development and Implementation Working Group use data gathered from monitoring in their work.



Long-term Tasks

Portland is committed to natural resource protection and sustainable development. The Mayor has directed bureaus to break down institutional barriers and collaborate to improve efficiency and effectiveness. Citywide initiatives, such as Managing for Results, promote collaboration. Managing for Results is an approach to keep the City focused on its mission and goals and to integrate performance information into decision-making, management and reporting.

We now have the opportunity to use the Portland Watershed Management Action Plan to help guide activities of all City bureaus. This is essential to achieving the Plan's goals and objectives because the activities of many City bureaus affect watershed health. Other City bureau activities are already underway to improve watershed conditions, including property acquisition and updating natural resource inventories to meet land use goals. Environmental Services collaborates with other City bureaus on these activities. Over the next five years existing inter-bureau coordination and city procedures will be refined to apply the Plan to other city activities that affect watershed health. The most efficient and effective way to improve watershed health is to apply the Plan to the design, prioritization and selection of all city projects and programs.

The working groups will start work immediately on several long-term tasks, which are listed below. These tasks are long-term in the sense they will start immediately but are expected to proceed through collaboration and lead incrementally to broader application of the Plan to other City bureau activities.

Program Development and Implementation Working Group

- Continue and expand collaboration on inter-bureau projects to help improve watershed health.
- Facilitate application of the Plan to other City bureau natural resources projects.
- Assure the results of other bureaus natural resource efforts are integrated into the watershed management system.
- Facilitate application of the Plan to other City bureaus working on the River Renaissance Initiative.
- Work with other City bureau managers and staff, through the annual operating budget process, to develop procedures and criteria for formulating and evaluating their operating budgets to ensure that they contribute to improving watershed health.
- Work with other City bureau managers and staff to review and revise their bureau CIP selection criteria to ensure that Plan goals and objectives are considered in future formulation and selection of CIP projects.
- Work with other City bureau managers and staff through the City's Managing for Results Initiative to develop and track critical indicators of City activities that affect watershed health.

Watershed Conditions Research and Analysis Working Group

- Conduct research on watershed health in collaboration with other City bureaus.
- Develop methods and tools to measure and describe benefits of stormwater retrofits (e.g. swales, planters) and ecological protection and restoration in collaboration with other City bureaus. Results can be used in cost/benefit analyses to describe the benefits of these types of projects beyond cost savings.

Monitoring and Evaluation Working Group

- Collaborate with other City bureaus to continue and expand coordination of monitoring activities.
- Identify design storm standards that support normative flow and evaluate impacts of existing stormwater management policy on achieving watershed health goals and objectives.

Reporting

As part of the System, the City will provide periodic reports. The Annual Report included in the Plan summarizes projects and other activities implemented in FY 2005 (July 1, 2004 - June 30 2005) and highlights selected projects planned for the upcoming year. Data on environmental conditions gathered through monitoring activities will also be available through future annual reports. The City will continue providing periodic reports to regulatory agencies as part of its compliance responsibilities.

The Annual Report describes how the City is working to implement the Plan and describes progress toward Plan strategic visions using watershed health performance measures. Performance measures quantify annual achievement, such as the number of acres of impervious surface mitigated through implementation of stormwater facilities. Performance measures show how effectively the City implements strategies and actions to improve watershed health.

Future Annual Reports will estimate the watershed health benefits from implementation of the Plan's strategies and actions. Estimates will become more precise over the next five years. Data gathered from monitoring project performance and watershed conditions (e.g. stream flow and temperature) improves understanding of the benefits of implementing the Plan, but will be reported separately. This data, along with improved analytical tools, will enable more accurate assessment of watershed health benefits.

The City will periodically update City Council on progress toward implementing Plan strategies, actions and tasks.

Summary

The System, through three working groups, provides the structure and tasks needed to prioritize and select Environmental Services activities; monitor progress toward goals and objectives; and conduct research and analysis to continually improve future watershed management decisions throughout the City.

GLOSSARY

Adaptive Management – A dynamic planning and implementation process that applies scientific principles, methods and tools to improve management activities incrementally as decision makers learn from experience and better information and analytical tools become available. Involves frequent modification of planning and management strategies, goals, objectives and benchmarks. Requires frequent monitoring and analysis of the results of past actions and application of those results to current decisions.

Benthic – Relating to the bottom of a river stream.

Characterization - A documentation of existing (baseline) and historical conditions within a watershed, along with anticipated trends in those conditions. Involves describing problems, watershed assets and the causes and sources of those problems and assets.

Confluence – A flowing together of two or more waterbodies.

Connectivity – Connected, contiguous open space that allows wildlife to move between habitats. Non-contiguous habitat is unable to support the same density of species diversity and population as a similarly contiguous area of land.

Ecoroof – A lightweight roof system of waterproofing material with a thin soil and vegetation protective cover. Ecoroofs can be used in place of traditional roofs to reduce impervious area.

Evapotranspiration – Loss of water from the soil by evaporation and by transiration of the plants that grow thereon.

Flow - The volume of water, often measured in cubic feet per second (cfs), flowing in a stream.

Groundwater - Any water naturally stored underground in aquifers, or that flows through and saturates soil and rock, supplying streams, springs and wells.

Hydrologic Cycle - The cycle by which water evaporates from oceans and other bodies of water, accumulates as water vapor in clouds, and returns to oceans and other bodies of water as precipitation or groundwater. Also known as the water cycle.

Hydrology - The study of the properties, distribution, and movement of water on, in and above the earth.

Impervious Surface - A hard surface area, as a paved road, roof, sidewalk or structure which either prevents or slows the entry of water into the ground. Water runs off the surface in greater quantities or at an increased rate of flow than it does in natural conditions prior to development.

Mitigation - The creation, restoration or enhancement of a wetland or other natural resource to maintain the functional characteristics and processes of an area, such as its natural biological productivity, habitats and species diversity; unique water features; and water quality.

Naturescaping – Landscaping that uses native plants that require less watering and chemicals to provide habitat for birds, insects and other wildlife.

Reach - A section of stream between two specified points, usually with consistent features and characteristics.

Retrofitting - Structural stormwater management measures for urban watersheds designed to help reduce the effect of impervious areas, minimize channel erosion, reduce pollutant loads, promote conditions for improved aquatic habitat, and correct past efforts that no longer represent the best science or technology.

Riparian - Of, on, or relating to the banks of a natural course of water like a stream or river.

Sedimentation – The process of depositing soil or organic material.

Stormwater Runoff - Water from rainfall and other precipitation that flows into drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as shallow groundwater.

Sumps - A drain which dissipates stormwater into subsurface soil. Water enters through a grate at the surface and drains into the surrounding soil through drain holes. Also known as Underground Injection Controls (UICs)

Swale – Also known as bioswale. A long, narrow vegetated depression used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground and/or flows through the facility.

Acronyms

BES - Bureau of Environmental Services

CERCLA - Comprehensive Environmental Response, Compensation and Liability Act (Superfund): A law passed by the U.S. Congress that (1) created requirements concerning inactive hazardous waste sites, (2) holds liable persons responsible for releases of hazardous waste, and (3) established a trust fund to provide for cleanup when no responsible party can be identified.

CSO - Combined sewer overflow: In areas with combined sewers that convey both sewage and stormwater in a single pipe, stormwater runoff fills sewer pipes to capacity during rainstorms, causing overflow of sewage and stormwater into a waterbody.

CWA - Clean Water Act: A law passed by the U.S. Congress in 1972 that makes the discharge of pollution into surface or ground waters without a permit illegal, and that encourages the use of the best achievable pollution control technology to reduce the impact of discharged effluent.

DEQ - Oregon Department of Environmental Quality: The state regulatory agency responsible for the protection of Oregon's environment. DEQ's responsibilities include protecting and enhancing Oregon's water and air quality, for cleaning up spills and releases of hazardous materials and for managing the proper disposal of hazardous and solid wastes. The federal Environmental Protection Agency (EPA) delegates authority to DEQ to operate federal environmental programs within Oregon such as the federal Clean Air, Clean Water, and Resource Conservation and Recovery acts.

DDT – DichloroDiphenylTrichloroethane: An insecticide used to control mosquitoes and other insects. DDT is very toxic, very persistent in the environment, and accumulates in the tissues of animals and humans. DDT was banned from use in the United States in 1972; however, it is still found in the environment and it is still used in other parts of the world.

EPA – U.S. Environmental Protection Agency: An independent federal agency established to coordinate programs aimed at reducing pollution and protecting the environment.

ESA - Endangered Species Act: A law passed by the U.S. Congress in 1973 that established programs for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The U.S. Fish and Wildlife Service maintains the list of threatened and endangered species.

MS4 - Municipal Separate Storm Sewer System: A publicly-owned conveyance or system of conveyances that discharges to waters of the U.S. and is designed or used for collecting or conveying stormwater, but is not a combined sewer, or part of a publicly-owned treatment system.

NRT - The City's Natural Resource Team

NPDES - National Pollutant Discharge Elimination System: Wastewater and Surface water quality program authorized by Congress as part of the 1987 Clean Water Act, and administered by the state Department of Environmental Quality. NPDES provides guidance to municipalities and state and federal permitting authorities on how to meet wastewater and stormwater pollution control goals as flexibly and cost-effectively as possible.

PCB - Polychlorinated Biphenyls: Toxic, persistent chemicals used in electrical transformers and capacitors for insulating purposes, and in gas pipeline systems as lubricant. The sale and new use of these chemicals were banned in 1979.

RRMT - River Renaissance Management Team

TM - Technical Memorandums

TMDLs - Total Maximum Daily Loads: A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources; the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources to ensure that the waterbody can be used for the purposes the state has designated.

UIC - Underground Injection Controls: An injection system that distributes or injects fluids such as stormwater runoff or wastewater below the surface of the ground. Some types of injection systems, such as those injecting hazardous waste and large cesspools, are prohibited. Some systems that are relatively low risk must be registered and meet a performance standard of not adversely impacting groundwater quality. Other systems must be registered and obtain general or individual Water Pollution Control Facility permits from DEQ.

ACTIONS *for* WATERSHED HEALTH

2005 Portland Watershed Management Plan

Published March 2006

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CITY OF PORTLAND

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