working for clean rivers

Actions for Watershed Health

2005 Portland Watershed Management Plan


COLUMBIA SLOUGH


FANNO CREEK


JOHNSON CREEK


TRYON CREEK


WILLAMETTE RIVER

DRAFT for review

ACTIONS for WATERSHED HEALTH

2005 Portland Watershed Management Plan

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

working for clean rivers

Dean Marriott, Director
Sam Adams, Commissioner

1120 SW Fifth Avenue, Portland Oregon 97204

503-823-7740

www.portlandonline.com/bes

PL 0558

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 management tools to track progress and measure results, with a focus on seeking net environmental improvement over time.

For Public Review October 2005

"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:

John Bolte and Said Iro, Oregon State University

Kendra Smith and Jill Ory, Clean Water Services

Thanks also go to all of the City staff that contributed to this plan as critical thinkers, technical experts and reviewers.

Environmental Services Project Staff:

Dawn Uchiyama, Project Manager
Shannon Axtell
Mindy Brooks
Marjorie Brown
Daniela Cargill
Kim Cox
Dave Collins
Sara Gardner
Jim Gladson
Nancy Hendrickson
Amber Clayton
Andrew Neuman
Chris Prescott
Claire Puchy
Maggie Skenderian
Josh Robben
Mike Rosen
Ry Thompson
Naomi Tsurumi
Ali Young
Mary Wahl

Technical Advisory Committee:

Jim Middaugh, Bureau of Environmental Services, Chair
Virgil Adderley, Bureau of Environmental Services
Shannon Buono, Bureau of Planning
Linda Dobson, Bureau of Environmental Services
Andi Gresh, Bureau of Environmental Services
Roberta Jortner, Bureau of Planning
Dave Kliewer, Bureau of Environmental Services
Eugene Lampi, Bureau of Environmental Services
Deborah Lev, Portland Parks and Recreation
Dawn Sanders, Bureau of Environmental Services

Watershed Science Advisory Group:

Debbie Deetz Silva, Columbia Corridor Association
Paul Fishman, SWCA Environmental Consultants for Portland Development Commission and the Port of Portland
Dorothy Sperry and Tom Bouillion, Port of Portland
Jeff Baker and Rod Thompson, The Confederated Tribes of Grand Ronde
Sherri Groh and Tom Downey, The Confederated Tribes of Siletz Indians
Patti Howard, Columbia River Inter-tribal Fish Commission
Joe Keating and Dorothy Shoemaker, Sierra Club
Paul Ketcham, Metro
Bruce McClelland, Multnomah Country Drainage District
Neil Mullane and Rob Burkhart, Oregon Department of Environmental Quality
Ben Meyer and Nancy Munn, NOAA Fisheries
Bob Sallinger, Portland Audubon Society
Deborah Stein, Portland Bureau of Planning
Derek Poon and Joel Salter, US Environmental Protection Agency
Bianca Streif, Nancy Lee and Jennifer Thompson, U.S. Fish and Wildlife Service
Dave Ward and Tony Nigro, Oregon Department of Fish and Wildlife
Travis Williams, Willamette Riverkeeper
Chuck Willis, Charlotte Goodman, Rock Peters, U.S. Army Corps of Engineers

Participation from :

Laura Porter, Eric Strecker, Kathi Futornik, Robert Schottman and Linda Bauer, Stormwater Advisory Committee
Christine Hurst and Walk Mintkeski, Johnson Creek Watershed Council
Tom Calabrese, Tryon Creek Watershed Council
Linda Robinson, Columbia Slough Watershed Council

Consultants:

Julie Wilson and Nate Lesuik, EnviroIssues

Graphic Design: Leslie Winter-Gorsline PL 0558 - October 2005

TABLE OF CONTENTS

"Portland is clearly committed to natural resource protection and sustainable development"

EXECUTIVE SUMMARY

The City of Portland is responsible for managing its urban watersheds. The Portland Watershed Management Plan (PWMP) will guide City decisions and projects to restore watershed health.

Urban watershed management is complex and includes a wide range of activities. Implementing this plan is challenging, but is also an exciting opportunity and a necessary step toward meaningful improvements in watershed health.

Portland is clearly committed to natural resource protection and sustainable development. The city has made great progress on many fronts, but there is still much work to do. With natural resource management responsibilities 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.

River Renaissance 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. The Plan focuses on developing partnerships and designing multi-objective projects. With the Plan's structure in place, Environmental Services can coordinate its work with citywide priorities, and all City bureaus can consider watershed health as they design and implement their projects.

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 management tools to track progress and measure results, with a focus on seeking net environmental improvement over time.

With a scientifically sound foundation, the watershed approach addresses environmental problems at their source and improves watershed health overall, instead of merely complying with individual regulations. This approach seeks efficiencies and greater flexibility to find creative, multi-objective solutions that meet multiple requirements.

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 the City values of 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. Ultimately this integrated approach will improve watershed conditions and community livability as it creates greenspaces and other public amenities.

Purpose

This plan describes the comprehensive approach to improving Portland's watershed conditions. This is this 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 as well as those within the 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, this Action Plan sets a City policy of commitment to improved watershed health and formalizes Portland's long-standing intent to protect and enhance its natural resources.

With natural resource management responsibilities spread across the City's bureaus, and much work yet to do, this plan creates the structure necessary to frame the issues while providing the context for all bureaus to make informed and effective natural resource management decisions.

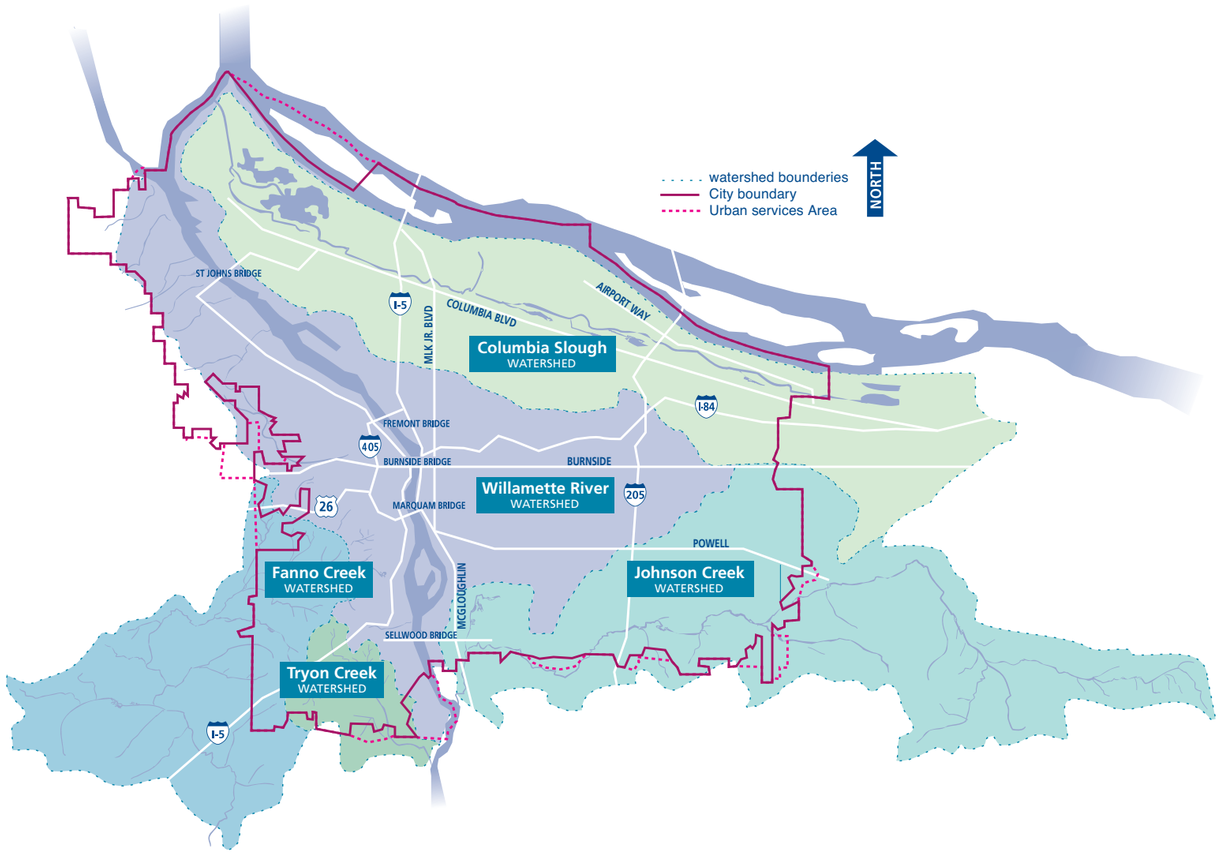
Organizational Scope

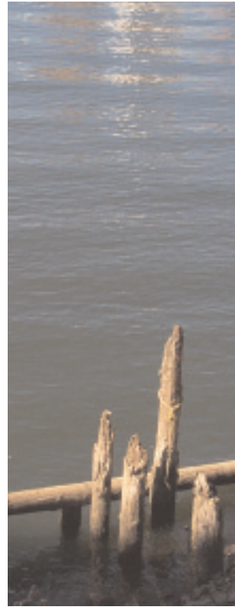
Environmental Services has the lead responsibility for developing this plan and management system, but changing how the City impacts watershed conditions relies on integration of these actions into all City activities. This plan is consistent with and complements other city system planning work, such as the Public Facilities Plan that addresses sewer pipe infrastructure, and the Transportation System Plan that addresses street infrastructure. This 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. Encompassing over 130 square miles, Portland is a small part of the Willamette River Basin. The city is divided into five watersheds representing its largest urban streams. The Columbia Slough watershed stretches 18 miles from Fairview Lake into the Willamette River near Kelley Point Park. Johnson Creek crosses several jurisdictions before entering the Willamette River near Milwaukie. Only part of Fanno Creek is in Portland, flowing west and south before it enters the Tualatin River. Tryon Creek flows through parts of southwest Portland before entering the Willamette near Lake Oswego. The Willamette River watershed, while not a true watershed, represents the area that drains directly to the Willamette River through small drainage ways, pipes, and streams.

Figure 1. City of Portland watersheds





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 definition of watershed health established in the Framework for Integrated Management of Watershed Health:

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.

Additionally the Plan:

- Uses a comprehensive approach to respond to several 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,and restores aquatic habitat.

❹ **Protection & Policy**

Preserves remaining natural areas and ensures sustainable development

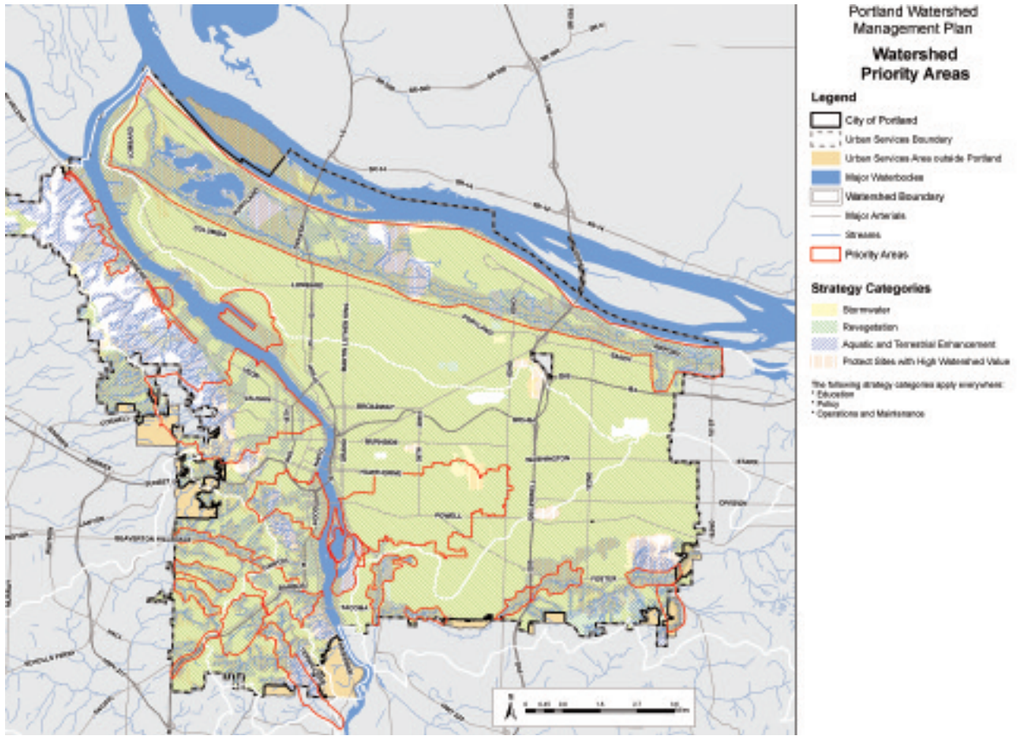
❺ **Operations & Maintenance**
Increases efficiency, reduces waste, and prevents pollution

❻ **Education, Involvement, & Stewardship**
Enhances public understanding, generates support, and ensures success

Central to the 2005 Plan's recommendations, the strategies are mapped to show where they can be applied throughout the City. 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 (same as Fig 4.7)



Improving watershed conditions depends on city wide 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 many efforts to improve watershed health in Portland. With broad endorsement, this plan creates a comprehensive, coordinated system approach to improving the watershed health.

What's in the 2005 Portland Watershed Management Plan

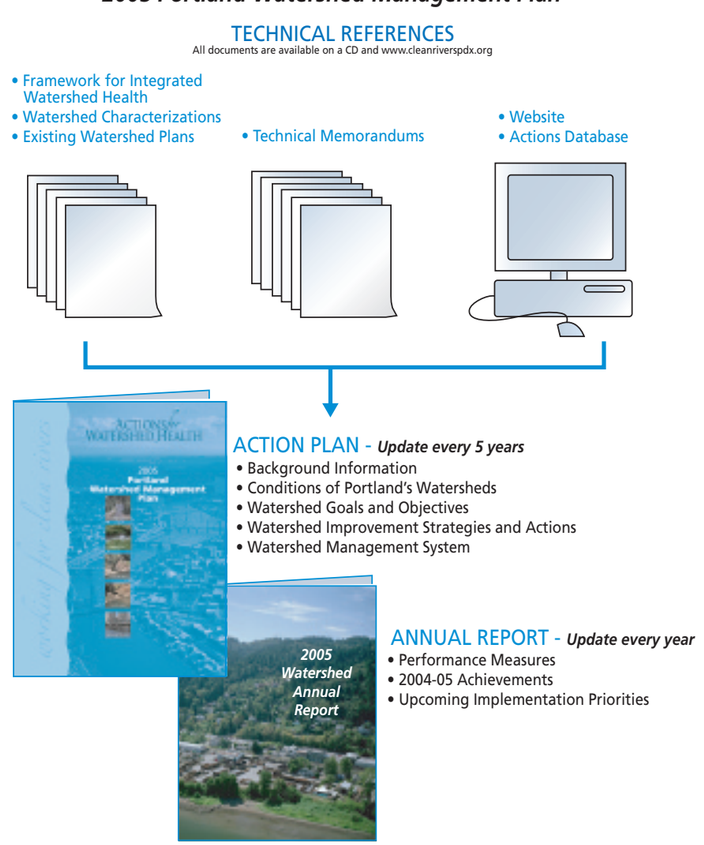
The plan summarizes the extensive technical work of many City work groups and community partners over the years, and provides guidance in implementing watershed improvements citywide (see Figure 3).

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).

Figure 3.

2005 Portland Watershed Management Plan



" Portland is clearly committed to natural resource protection and sustainable development "

CHAPTER 1: BACKGROUND

Multiple City bureaus have important natural resource management roles. The Environmental Services role is to provide sewage conveyance and treatment and stormwater drainage services to more than 500,000 people in an area that covers 85,000 acres. The Bureau operates and maintains 2,200 miles of pipes, 93 pump stations and two sewage treatment plants. Environmental Services also works to reduce stormwater pollution, restore native vegetation, and improve water quality in Portland's rivers and streams.

The role of the bureau's Watershed Services Group is to evaluate conditions in the City's urban watersheds and implement projects to improve watershed health. Watershed Services works closely with River Renaissance, other City bureaus, agencies, and citizens' groups, all of which 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 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 stormwater management systems. The approach in this Plan moves Portland toward a more sustainable urban environment, providing opportunities for several 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. The initiative 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.

The Watershed Plan focus is on improving watershed conditions in Portland, but it also recognizes the importance of regional efforts that include upstream and downstream communities and resources. Portland works with Metro, the Willamette Partnership, the Northwest Power and Conservation Council, Clean Water Services of Washington County, and 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. 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 and natural resource protection requirements (Table 1.1). The breadth of these regulations shows that stormwater management is a significant factor in watershed health. 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. (For more detailed information, please see Technical Memorandum (TM) 1.1)

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

Amended Stipulation and Final Order	CSO surface water protection
Safe Drinking Water Act	UIC groundwater 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	(goals 5 - Protection of Significant Natural Resources; 6 Air, Land and Water Quality; 7 Natural Hazards; 11 Public Facilities and Services and 15 Willamette Greenway). In Portland, the statewide planning goals are administered by Metro, the region's metropolitan planning organization. All city bureaus coordinate with Metro to address all the statewide planning goals.

Building on Experience

In the past, watershed projects responded to urgent issues, such as flooding along Johnson Creek or contaminated sediments in the Columbia Slough. Now, watershed management has expanded to encompass the broader landscape changes that degrade water quality.

The most recently published watershed plans are the Johnson Creek Watershed Action Plan (2003), Columbia Slough Watershed Council's Action Plan (2003), Fanno Creek Resources Management Plan (1998), and the Upper Tryon Creek Corridor Assessment (1997). 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 2000, Portland also published the Clean River Plan, which proposed implementing ten actions for healthy rivers and a comprehensive stormwater management approach. 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. The City has implemented many of these actions in the last five years, bringing about noticeable improvements in watershed health.

The Watershed Management Plan builds on those previous plans. It documents all of the City's watershed restoration, and the functional and organizational relationships between the elements. The individual watershed plans still play an important role in watershed management. They document detailed information about each watershed, and are the basis for 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 seen as independent, single focus efforts that don't consider any overlapping issues. Trying to satisfy these requirements one at a time often means lost opportunities to serve multiple objectives at once. (see Figure 1.1).

Each component of a watershed affects every other component, and the whole watershed system is connected by the hydrologic cycle. Evaporation from the ocean forms clouds, rain falls to earth to fill streams, and rivers flow back to the sea. Watersheds store, treat and distribute rainfall. Rain soaks into the ground, filters through wetlands, and eventually enters a stream or river. Impacts to any part of the watershed affect the whole. This is why cleaning up the Willamette includes finding better ways to deal with the rain that falls far from the river as well as cleaning up the river's sediments. Everything we do 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 (Figure 1.2).

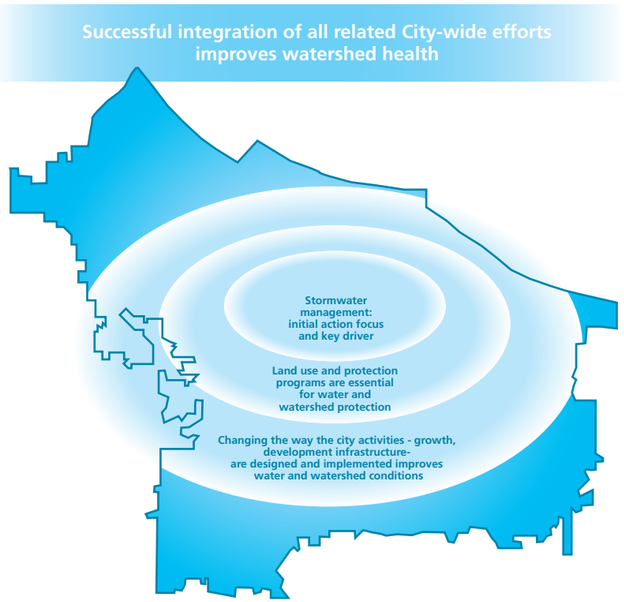
Figure 1.1 Traditional response to regulatory mandates

Figure 1.2 Integrated approach to meeting regulatory mandates

The Watershed Plan promotes techniques that make urban areas behave more like the natural world. Stormwater runoff can soak into the ground instead of flowing into sewer pipes. Native plants can help remove some pollutants, and other innovative technologies can help prevent the rapid flow of runoff from roofs and parking lots. Retrofitting existing development with landscape infiltration facilities can help protect Portland streams.

This holistic approach integrates the work of many efforts to improve watershed health. This approach to watershed management 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.

Figure 1.3 City-wide Efforts to Improve Watershed Health



" Characterizations of past and present help develop watershed goals and objectives "

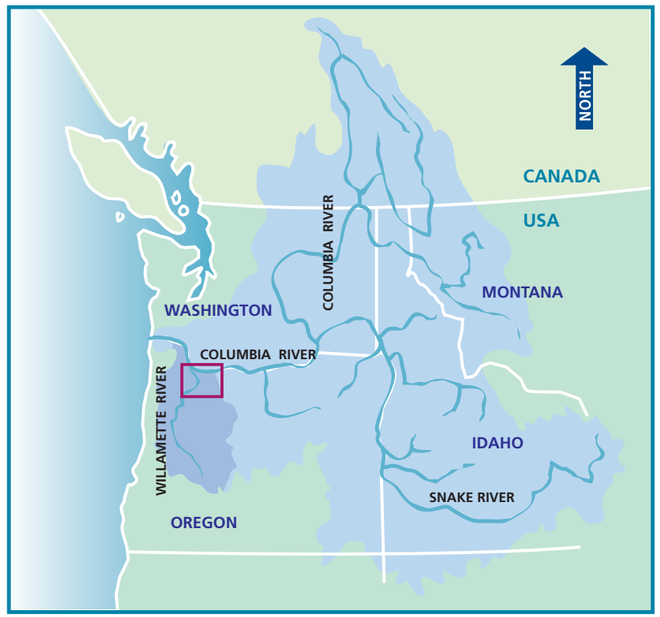
CHAPTER 2: WATERSHED CHARACTERIZATION

Watershed characterization is the process of collecting and analyzing data on historic and current watershed conditions. Once conditions are characterized and goals and objectives defined, we can 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.

Figure 2.1 Columbia Basin/Willamette Basin map



Regional Context

While the City of Portland encompasses 130 square miles, its streams and tributaries are part of an 11,478 square mile Willamette River Basin shared with many other upstream jurisdictions. 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 that extend to the river's edge.

The lands that drain the Columbia River Basin cross seven states and contain 219,000 square miles. Portland's small part of a large system is important to fish and wildlife habitat and the region's economy.

Citywide Perspective

Portland has grown from a small settlement to a large metropolitan area over the past 150 years. Portland's watersheds are now highly developed and urbanized, and urbanization has significantly altered watershed function. Streets, parking lots, roofs and other hard surfaces generate millions of gallons of stormwater runoff that can pollute rivers and streams if not properly managed.

City management of storm and sanitary sewers has advanced over the years. Raw sewage and industrial pollution is no longer legally dumped directly into rivers and streams. Portland has made significant progress in controlling combined sewer overflows (CSOs). The City has restored and protected important natural areas. But there are still many opportunities to improve the health of Portland's urban watersheds.

General Conditions:

- The Oregon Water Quality Index describes water quality in the Willamette River and its tributaries as fair to poor. 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, and dissolved oxygen.
- Bacteria levels in most City waterways regularly exceed state standards during large storms.
- 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.

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).

Stormwater Infrastructure

Portland's sanitary sewers, storm sewers, combined sewers, sumps and wastewater treatment plants protect the City's surface water and groundwater.

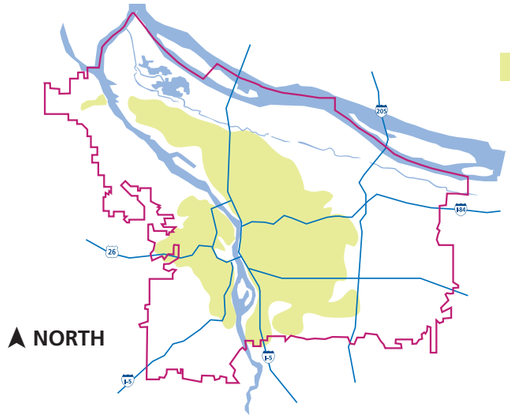
The combined system mixes sanitary sewage with stormwater runoff. When it rains, stormwater fills combined sewer pipes to capacity and they overflow to the Willamette River. These combined sewer overflows (CSOs) contain high bacteria levels and are a threat to human health.

The combined sewer area covers roughly the center of the City on both sides of the Willamette River, except for the downtown core. Combined sewers serve most of the central city and the surrounding older residential areas.

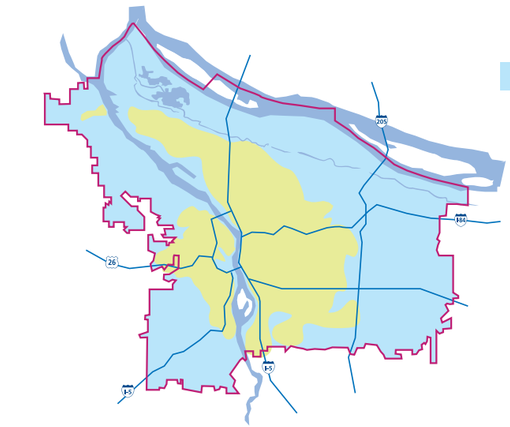
The stormwater system collects and safely conveys stormwater to local receiving waters. The stormwater system includes facilities that detain stormwater runoff to reduce high flows and facilities that remove stormwater pollutants.

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 has reduced CSO volume to the Willamette River by 40%. CSOs to the river will be reduced 94% when all construction is finished in 2011. The program will cost Portland sewer ratepayers an estimated $1.4-billion.

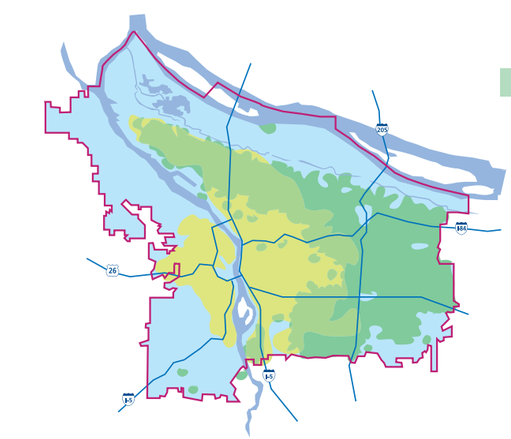
Figure 2.3. Portland's Stormwater Conveyance System



COMBINED SEWER areas ***(yellow area)*** 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.

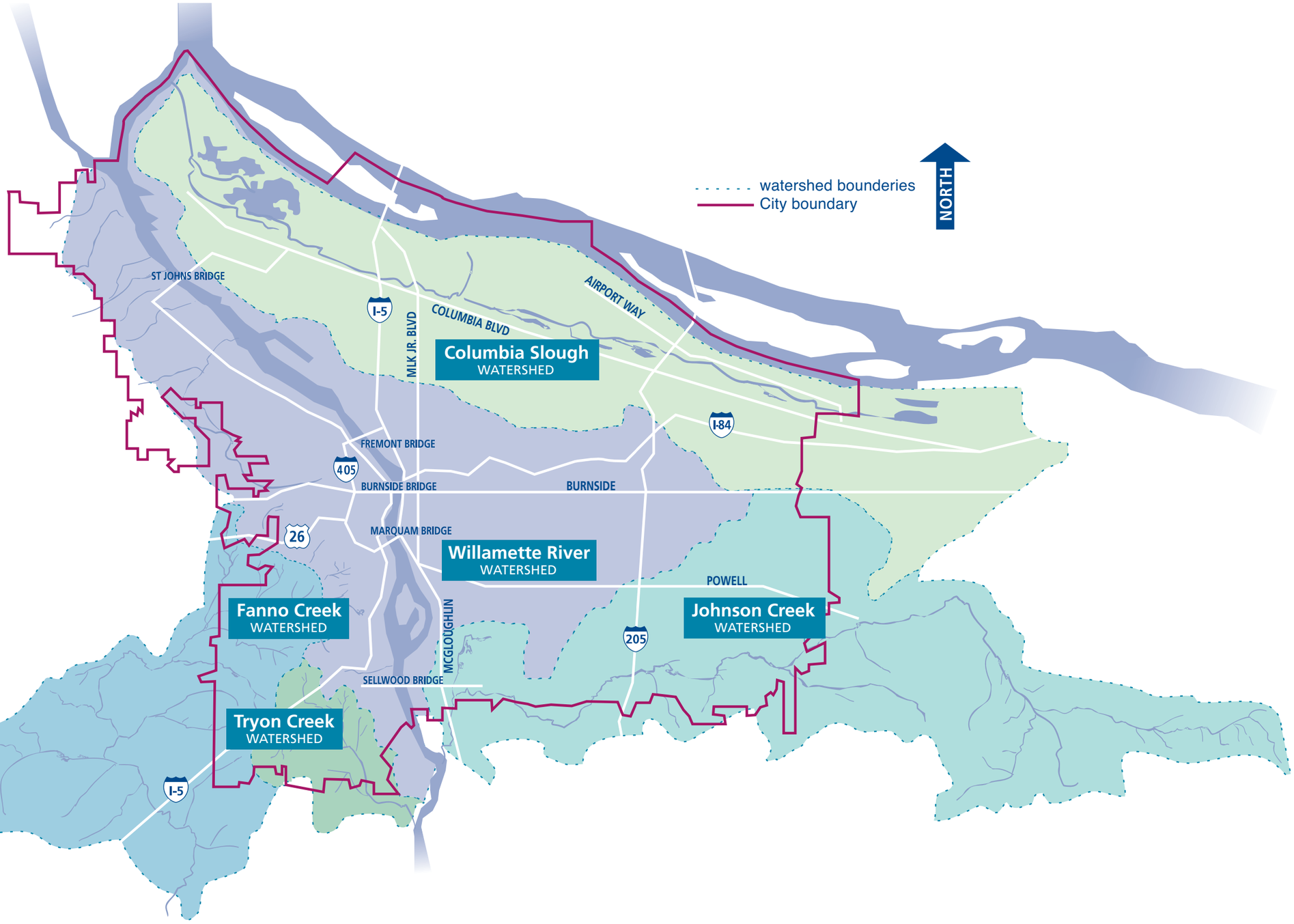


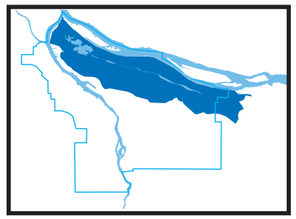
THE MUNICIPAL SEPARATE STORM SEWER PERMIT (MS4 or stormwater permit), with the Port of Portland and Multnomah County as co-permittees. The MS4 permit requires the city to reduce pollutant discharges to the city's storm system to the maximum extent practicable. The permit applies to all existing and future stormwater discharges from the municiple storm system within Portland's Urban Services Boundary ***(light blue area)***. 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 ***(overlapping green area)*** to protect groundwater resources. The UIC permit is regulated by the Safe Drinking Water Act.

Figure 2.4 Portland's watersheds





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 a 19-mile main channel that parallels the Columbia River, and 30 miles of secondary waterways. The Upper and Middle Slough waterways are highly managed, with piped surface water, levees, and a system of pumps for flood control. The Lower Slough is tidal and its floodplain is partially protected by levees. The watershed contains numerous industrial and commercial enterprises and is home to 160,000 Portland residents.

Increased stormwater runoff and peak flows during rainstorms have changed the behavior 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. 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 populations. 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 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.

Biological community health in the Columbia Slough has 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 non-native invasive species, such as Himalayan blackberry and reed canary grass, flourish in the watershed and threaten native vegetation and habitat.

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.

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.

There is more watershed restoration potential in increasing riparian canopy and managing hydrology within the existing channel to recreate natural conditions. Stormwater management and increased street tree canopy can significantly improve upland areas. 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 it 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.

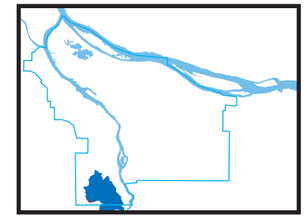
More than 80% of the Fanno Creek Watershed in Portland is zoned for single-family residential use. Impervious surfaces cover 33% of Portland's portion of the watershed. The Fanno Creek Watershed has steep slopes, steep stream gradients, and soils that are slow to infiltrate rain. These characteristics 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 woody debris 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 temperature is above the state standard in the summer because of lack of riparian vegetation and stormwater runoff from impervious surfaces heated by sunlight. 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 from fertilizers carried by stormwater runoff.

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%(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.

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. In the lower watershed, a riparian area along Tryon Creek is largely intact. 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.

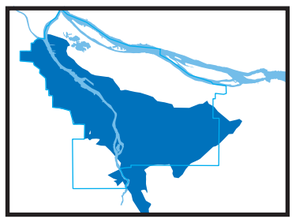
Tryon Creek water quality is rated as poor, with elevated temperatures in summer, periodic elevated levels of bacteria, elevated suspended sediments and nutrients, and ongoing contribution of pollutants from stormwater runoff.

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. Implementing source control and stormwater treatment actions, such as green streets, treatment swales, and stormwater detention, along these corridors would likely produce the greatest watershed health benefits.

Willamette River:



Portland's Willamette Watershed covers about 44,000 acres (69 square miles) and occupies about 0.5% of the 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 Portland's remaining open stream channel is 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.

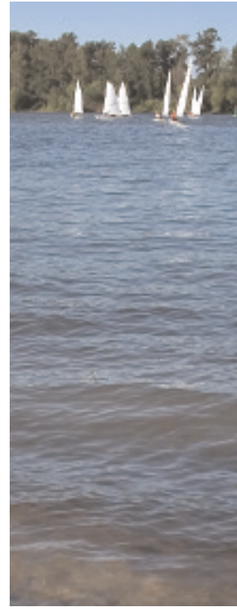
The increase in impervious area has increased wet season flows and decreased dry season flows for tributary streams. Alterations to stream and riverbanks and channels has reduced floodplain functions and increased stream velocities. Dams and reservoirs in the Willamette River Basin have altered the volume, 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 and adjacent uplands as migratory pathways and habitat.

Oaks Bottom Wildlife Refuge and Ross Island represent opportunities to link riparian and aquatic habitats in the southern half of the Willamette River in Portland. 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 have important riverside habitat. Off channel habitat could be increased in park areas that aren't in active use.



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.

" It is not necessary to recreate pre-development watershed conditions to have healthy watersheds "

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 definition of watershed health is based on a scientific foundation and four watershed health goals. The objectives are established by analyzing the conditions described in Chapter 2 in the context of the goals.

The strategies and actions detailed in Chapter 4 describe how the City will work toward these goals and objectives.

The Scientific Foundation

The scientific foundation of Portland's watershed approach is described in the City's Framework for Integrated Management of Watershed Health. The Framework describes watershed health goals, why the goals are desirable, scientific principles and restoration guidelines. The Framework and Portland's watershed management system will enable the City to adaptively manage elements of the watershed plan.

Defining Watershed Health

The Framework is built on the principle that urban areas do not have to cause damage to watershed health, that citizens 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. Here is how the Framework defines urban watershed health.

An underlying assumption of urban watershed management is that development does not have to pollute water and destroy habitat and natural systems. In fact, it is possible to protect and restore watersheds within the urban environment. Citizen commitment to healthy watersheds, rivers and streams is one of Portland's defining elements. 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 describe the functions and conditions of healthy urban watersheds.

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

There are four watershed health goals.

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.

* A normative flow has the magnitude, frequency, duration and timing essential to support salmonids and other native species and resources.

Watershed Health Objectives

Objectives are measurable outcomes. 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

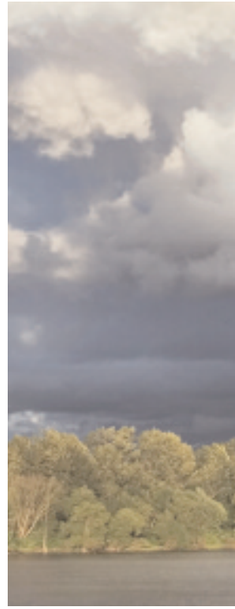
Goals	Portland Watershed Management Plan Objectives
Hydrology	***Stream Flow and Hydrologic Complexity:*** Protect and increase rainfall interception, infiltration, and detention to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.
	Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainageways, wetlands, riparian areas, and floodplains to improve stability and natural hydrologic functions.
	Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity to meet sewer design manual requirements.
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.
	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 where they 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 priorities 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 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 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 objectives currently establish desired trends. They will be refined in the future to include qualitative and quantitative desired future conditions, and quantitative targets and timelines for achieving them. 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 is described in more detail in Technical Memorandum (TM) 3.1



Summary

The watershed goals and objectives provide direction for the 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 management and all of 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. Achieving objectives will demonstrate the success of reaching watershed goals.

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

CHAPTER 4: STRATEGIES AND ACTIONS

This chapter presents strategies and actions the City will implement to protect and improve the watershed conditions identified in Chapter 2 and work toward the goals and objectives identified in Chapter 3. Projects in many parts of Portland can improve watershed function. The Watershed Priority Area map shows areas where watershed restoration projects are likely to have the greatest benefits. The City will concentrate on watershed projects in these areas (Figure 4.7) in the next two to five years. Strategies are the guiding principles for watershed restoration. The actions, which are organized by strategy, are the specific projects the City will implement to improve watershed health. The strategies and actions are proven approaches for improving watershed function. They correspond with the City's best management practices (BMPs) to meet Municipal Separate Storm Sewer (MS4) National Pollutant Discharge Elimination System (NPDES) requirements.

Watershed Improvement Strategies

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

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.

Swales, planters, ecoroofs and other facilities also filter stormwater pollutants and protect water quality.

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.

Revegetation restores habitat. As Portland developed, buildings and streets replaced green spaces. Revegetation provides food and cover for native wildlife.

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.

Aquatic and Terrestrial Enhancement Strategy

In developing river protection and restoration strategies, it is essential to focus on both terrestrial and aquatic components and processes that connect them within watersheds.

Aquatic and terrestrial enhancement improves hydrologic functions. Restoring channel complexity, natural stream meanders, off-channel wetlands, riparian forests and terrestrial natural areas 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.

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 before they reach the waterway. Through filtration, wetlands capture and treat nutrients and pollutants, stabilizing pH and the dissolved oxygen concentration of the receiving waterway.

River, stream, and wetland enhancement projects improve natural stream processes and enhance fish and wildlife habitat.

Restoring connectivity by removing or retrofitting impassible culverts, installing wildlife under crossings, 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 and removing development from the riparian and floodplain area also increases connectivity along stream corridors.

Operations and Maintenance Strategy

The City operates and maintains infrastructure to protect water quality, property and public health and safety.

Regular street sweeping prevents debris and pollutants from washing into the storm system

and streams. Enhancement projects that aren't properly operated and maintained lose effectiveness and could actually harm watershed health. Facilities that remove sediment, oil, grease and debris from stormwater need routine cleaning to remove accumulated sediment and pollutants. Monitoring and maintenance of revegetation projects protects new plantings and prevents the return of non-native, invasive plants.

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 health;
- Showing Portland residents how their individual behavior and actions can promote healthy watersheds;
- 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 private property owners to build ecoroofs, bioswales and other innovative stormwater management projects, and increases awareness and acceptance of green streets and other sustainable stormwater management projects on public property.

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.

Protecting existing vegetation, stream channels and wetlands, 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 lead to reductions in impervious areas will reduce stormwater volume and velocity, which protects streams and aquatic habitat. Land use and development policies can reduce habitat fragmentation, and increased landslide risk. Policies to avoid or minimize development in floodplains help protect public health and safety, reduce property damage, and retain natural floodplain functions.

Actions

Actions are specific steps that implement strategies. They include protection and improvement programs and on the ground projects. 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 PWMP TM 4.2 - 2005 PWMP Strategies and Potential Actions.

Table 4.1 Watershed Strategies and Actions

Strategy		Action
Stormwater	1.	Modify the storm drainage system to increase infiltration
	2.	Modify the storm drainage system to increase retention or detention of stormwater
	3.	Modify the storm drainage system to treat stormwater pollutants
	4.	Modify storm drainage system to separate flow from combined storm/sanitary sewer
Revegetation	5.	Increase the extent of canopy and other vegetative cover
	6.	Improve the quality and composition of vegetative cover
Aquatic and Terrestrial Enhancement	7.	Restore channel and floodplain function and stability
	8.	Restore or create river, stream, wetland, and terrestrial habitat structure and function
	9.	Restore habitat connectivity and access
	10.	Manage for appropriate native species
Protection and Policy	11.	Implement management of erosion, sediment, and pollutant discharge from construction sites
	12.	Implement management of stormwater for all new and redevelopment projects
	13.	Implement management of pollutant discharges for industrial and commercial sites
	14.	Protect sites and features with high watershed value
Operations and Maintenance	15.	Operate and maintain the storm sewer system, public rights-of-way, and other city facilities and infrastructure to remove and prevent pollutant discharges
	16.	Reduce illicit and non-stormwater discharges
	17.	Maintain and repair sewer systems to ensure conveyance for current demand and future growth
Education Involvement and Stewardship	18.	Provide education and technical assistance to city staff and industrial and commercial facilities to prevent pollution
	19.	Provide education, involvement, and stewardship on pollution prevention to organizations and the general public
	20.	Provide education, involvement, and stewardship on watershed function to city staff, the business community, organizations, and the general public

Nearly every action addresses multiple watershed objectives. For example, increasing the extent of canopy and other vegetative cover benefits the hydrology, physical habitat, water and sediment quality, and biological community objectives. These linkages and multiple benefits are why the City

pursues these actions and how the City will measure the success of projects relative to the objectives. Table 4.2 illustrates the contribution of the actions toward achieving the watershed objectives.

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.
This table does not include human health and safety objective or social objectives.

STRATEGIES	ACTIONS	GOALS: Hydrology — Stream Flow and Hydrologic Complexity	Hydrology — Channel and Floodplain Function	Hydrology — Stormwater Conveyance	PhysicaL Habitat — Aquatic Habitat	PhysicaL Habitat — Upland Habitat	Water and Sediment Quality — Stream Temperature	Water and Sediment Quality — Pathogens	Water and Sediment Quality — Urban Pollutants	Biological Communities — Fish and Other Aquatic Organisms	Biological Communities — Terrestrial Wildlife and Vegetation
STORMWATER MANAGEMENT	1. Increase infiltration	✔	✔	✔	✔		✔	✔	✔	✔	✔
	2. Increase retention or detention of stormwater	✔	✔	✔	✔			✔		✔	✔
	3. Treat stormwater pollutants						✔	✔	✔	✔	✔
	4. Separate flow from combined storm/sanitary sewer						✔	✔	✔	✔	✔
REVEGETATION	5. Increase vegetative cover	✔	✔	✔				✔		✔	✔
	6. Improve vegetative cover	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
AQUATIC AND TERRESTRIAL ENHANCEMENT	7. Restore channel and floodplain function	✔	✔	✔	✔		✔			✔	✔
	8. Restore or create habitat structure and function	✔	✔	✔	✔	✔	✔			✔	✔
	9. Restore habitat connectivity and access				✔	✔				✔	✔
	10. Manage for appropriate native species				✔					✔	✔
PROTECTION AND POLICY	11. Implement management of pollutant discharge from construction sites				✔			✔	✔	✔	✔
	12. Implement management of stormwater for all new and redevelopment projects	✔		✔			✔	✔	✔	✔	✔
	13. Implement management of pollutant discharge for industrial and commercial sites						✔	✔	✔	✔	✔
	14. Protect sites and features with high watershed value	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
OPERATIONS AND MAINTENANCE	15. Operate and maintain city facilities and infrastructure to remove and prevent pollutant discharges						✔	✔	✔	✔	✔
	16. Reduce illicit and non-stormwater discharges			✔			✔	✔	✔	✔	✔
	17. Maintain and repair sewer systems to ensure conveyance			✔				✔	✔		
EDUCATION, INVOLVEMENT AND STEWARDSHIP	18. Provide education and assistance to prevent pollution						✔	✔	✔	✔	✔
	19. Provide education, involvement, and stewardship on pollution prevention						✔	✔	✔	✔	✔
	20. Provide education, involvement, and stewardship on watershed function	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

The links in Table 4.2 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).

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 City developed the map using the decision-making tool Restore. Oregon State University developed Restore to aid watershed restoration in the Willamette basin. Several watershed councils and agencies in the Willamette basin have successfully used Restore. Restore requires three types of input: actions, objectives and geographic information (e.g., land use, impervious area, tree canopy cover, etc.).

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 should apply given the objectives. 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.

This map is a general representation of where the watershed improvement strategies apply across the City, and shows where these strategies will be applied over time. Readers who are interested in the detail behind the Watershed Improvement Strategies map can find more information in the PWMP Chapter 4 Technical Memorandums. (TMs 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.

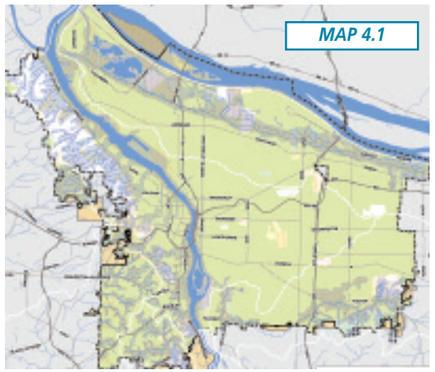
Revegetation
Watershed function in almost every part of the City would benefit from added vegetation or an improvement in the quality of the existing vegetation. The revegetation strategy does not apply in areas that are already heavily vegetated, such as Mt. Tabor and Forest Park. While some of these areas could benefit from an improvement in the quality of existing vegetation, they were shown as less of a priority because it is assumed that, given limited resources, efforts would be focused on more vulnerable areas.

Aquatic and Terrestrial Enhancement
The aquatic and terrestrial enhancement strategy applies in the parts of the City that contain streams or floodplain. This strategy does not apply in other parts of the City because the actions contained within this strategy are focused on streams and riparian areas.

Protect Sites with High Watershed Value
(Action within Protection and Policy Strategy) The Protection and Policy strategy applies throughout the City and is not mapped; with the exception of the action to protect sites and features with high watershed value. This action applies to important natural resource areas that could benefit from additional protection. It is important to note that this action is not meant as a comprehensive representation of all of the important natural resource areas in the City.

Figure 4.1. Watershed Improvement Strategies Map (page 45)

Implementation Opportunity Maps



The Watershed Improvement Strategies Map 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

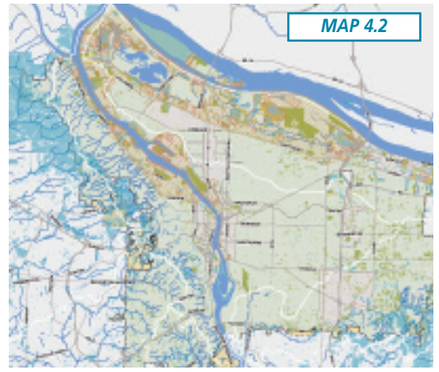


Figure 4.2 (Page 46)

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

The Portland Harbor Superfund site is a heavily industrialized stretch of the Lower Willamette River from Swan Island to the southern tip of Sauvie Island. Contaminants in river sediments included metals, pesticides, herbicides, 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.

Community Stewardship Opportunities

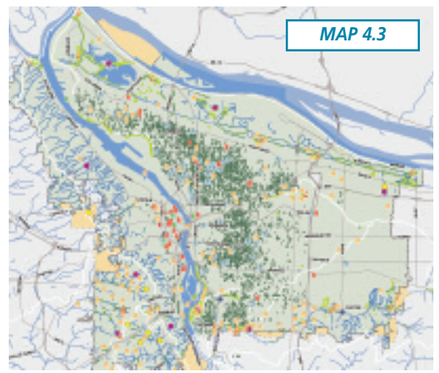


Figure 4.3 (page 47)

The Community Stewardship Map shows the distribution of stewardship activities, such as Community Watershed Stewardship Grant and SOLV projects. The purpose of the map is to track the trends in community involvement.

Community Stewardship Priority Programs (not mapped)

Neighborhood Liaison Program
City staff 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

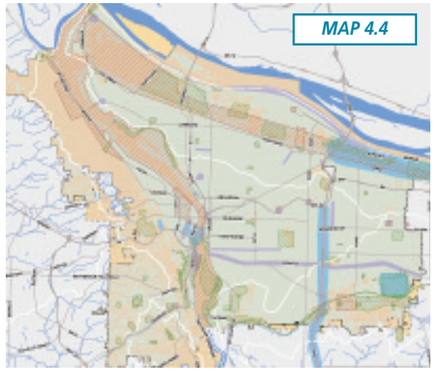


Figure 4.4 (page 48)

The Bureau Collaboration Map 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. These include neighborhood planning, street improvement and natural area improvement projects.

Bureau Collaboration Priority Programs (not mapped)

Parks Acquisition Strategy
Portland Parks and 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.

Regulatory Improvement Program
Since 2002, the City has worked to streamline and update its building and land development regulations and permitting processes through the Bureau of Development Services Regulatory Improvement Workplan (RIW). Current RIW projects include:

- Regulatory Improvement Code Amendment Package: Code amendment packages ensure continuing improvements to the City codes.
- Regulatory Rethink Project: This is a review of the City's existing regulatory tools used to implement Comprehensive Plan goals.
- Environmental Code Improvement: This project clarifies and simplifies existing environmental regulations while continuing to protect and conserve significant natural resources within the City's environmental overlay zones.

Green Streets
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.

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

Environmental Services Opportunities

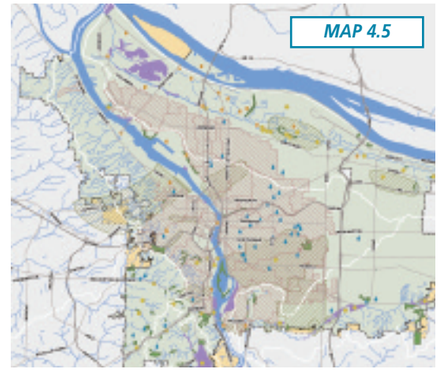


Figure 4.5 (page 49)

The Environmental Services Map 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 basin predesigns to revegetation projects.

Environmental Services Priority Programs (not mapped)

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, 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.

Public Facilities 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.

Watershed Priority Areas

The Watershed Priority Areas Map highlights sites The City could focus on in the next two to five years to improve watershed health.

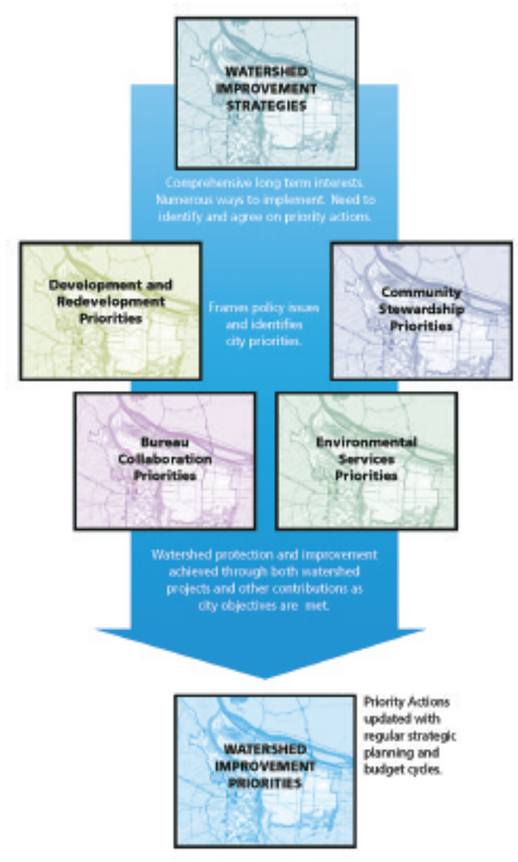


Figure 4.6
Portland Watershed Improvement Priorities

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 (see 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 Sciences University (OHSU) in the Marquam-Woods subwatershed is developing a Stormwater Master Plan.

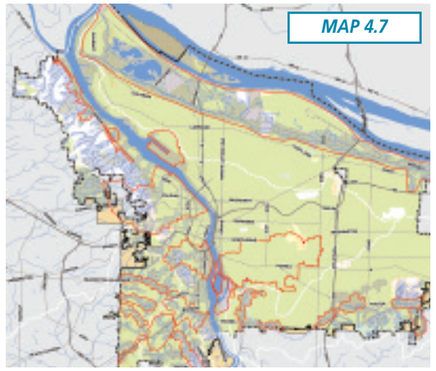
Watershed Priority Areas Map

Figure 4.7 (page 50)

The Watershed Improvement Strategies Map (Figure 4.1) shows all locations where strategies could be applied over the long term. The Implementation Opportunity maps (Figures 4.2 - 4.5) show existing program 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 4.7).

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.

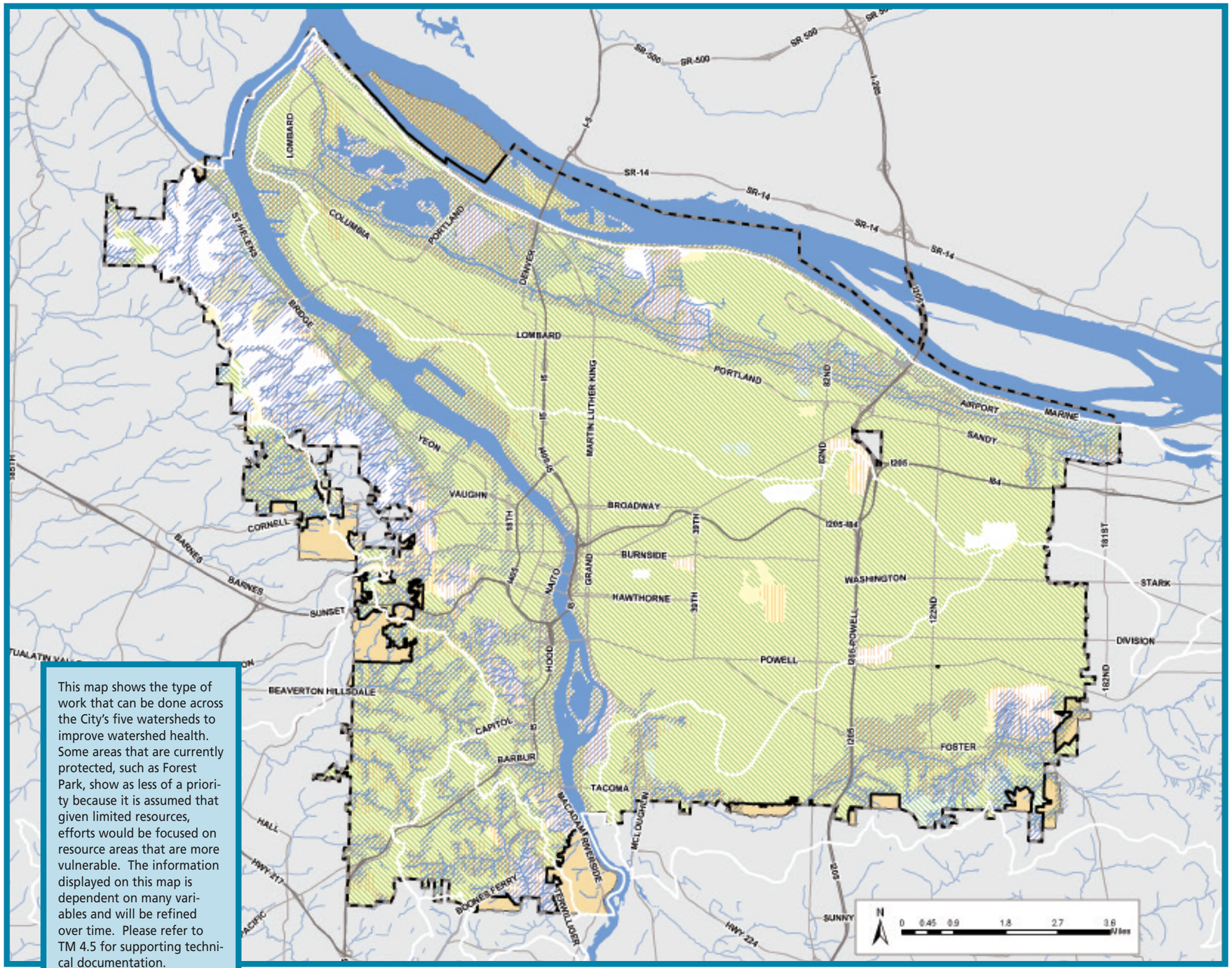


Summary

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 should 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 4.7) for the next two to five years.

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. The information displayed on this map is dependent on many variables and will be refined over time. 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

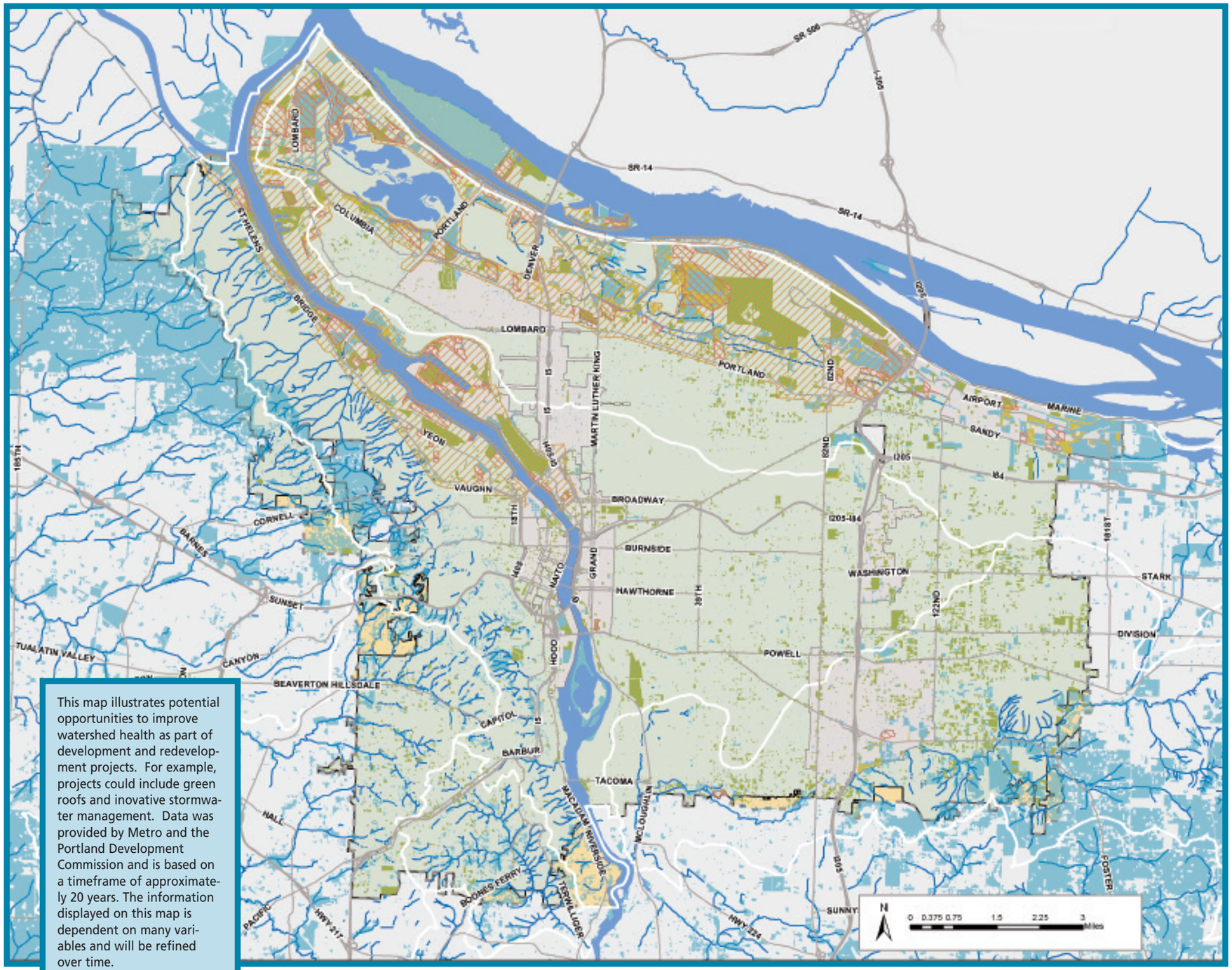
- Stormwater Management
- Revegetation
- Aquatic and Terrestrial Enhancement
- Protect Sites with High Watershed Value

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 inovative 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

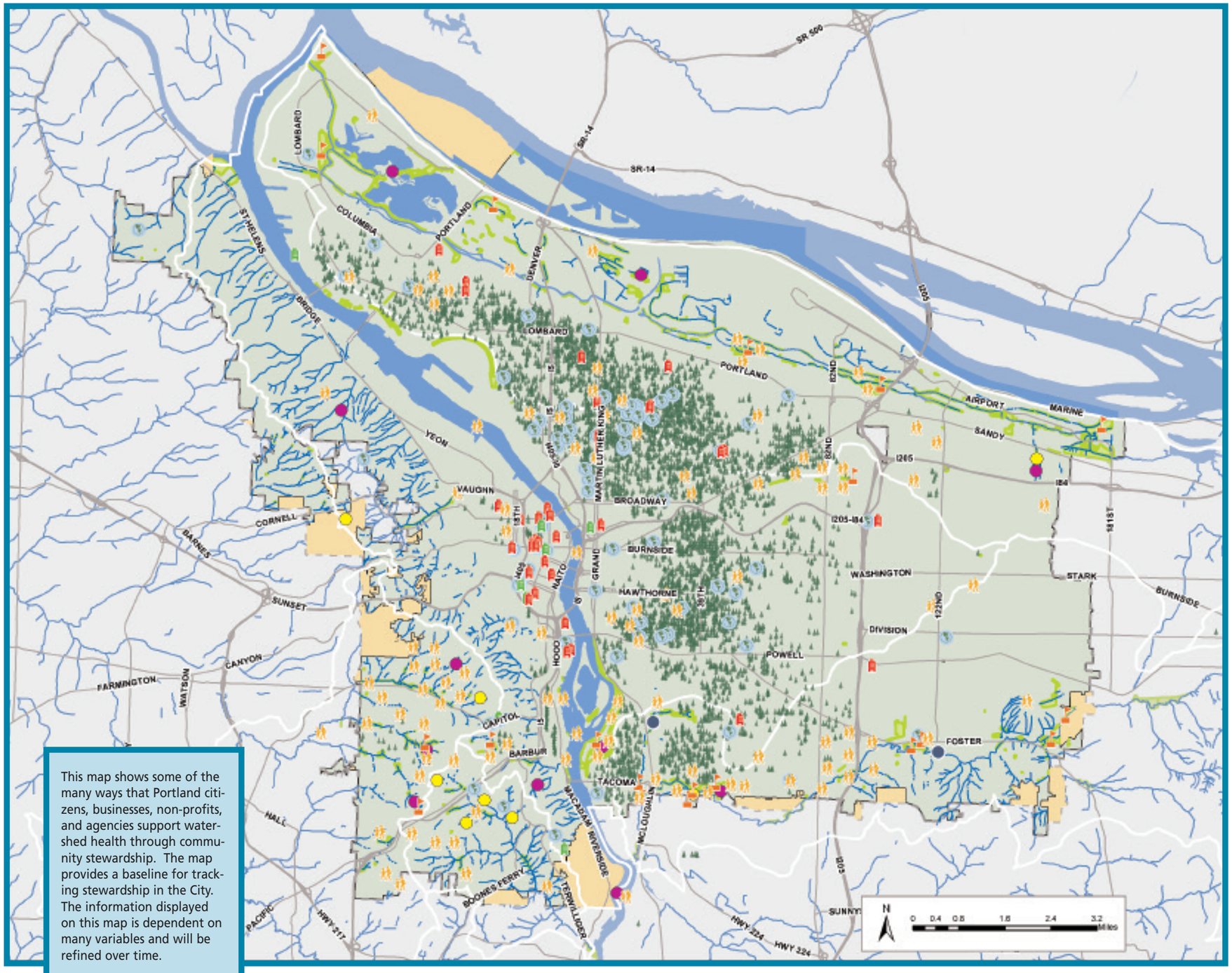
Development/Redevelopment

- Heavy Industrial Districts
- Freight Hub Districts
- Tier F Vacant Land
- Likely to Develop 2000-2025
- Metro Vacant Lands 2003
- Urban Renewal Areas

Figure 4.2

Actions for Watershed Health

Community Stewardship Oppertunities



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

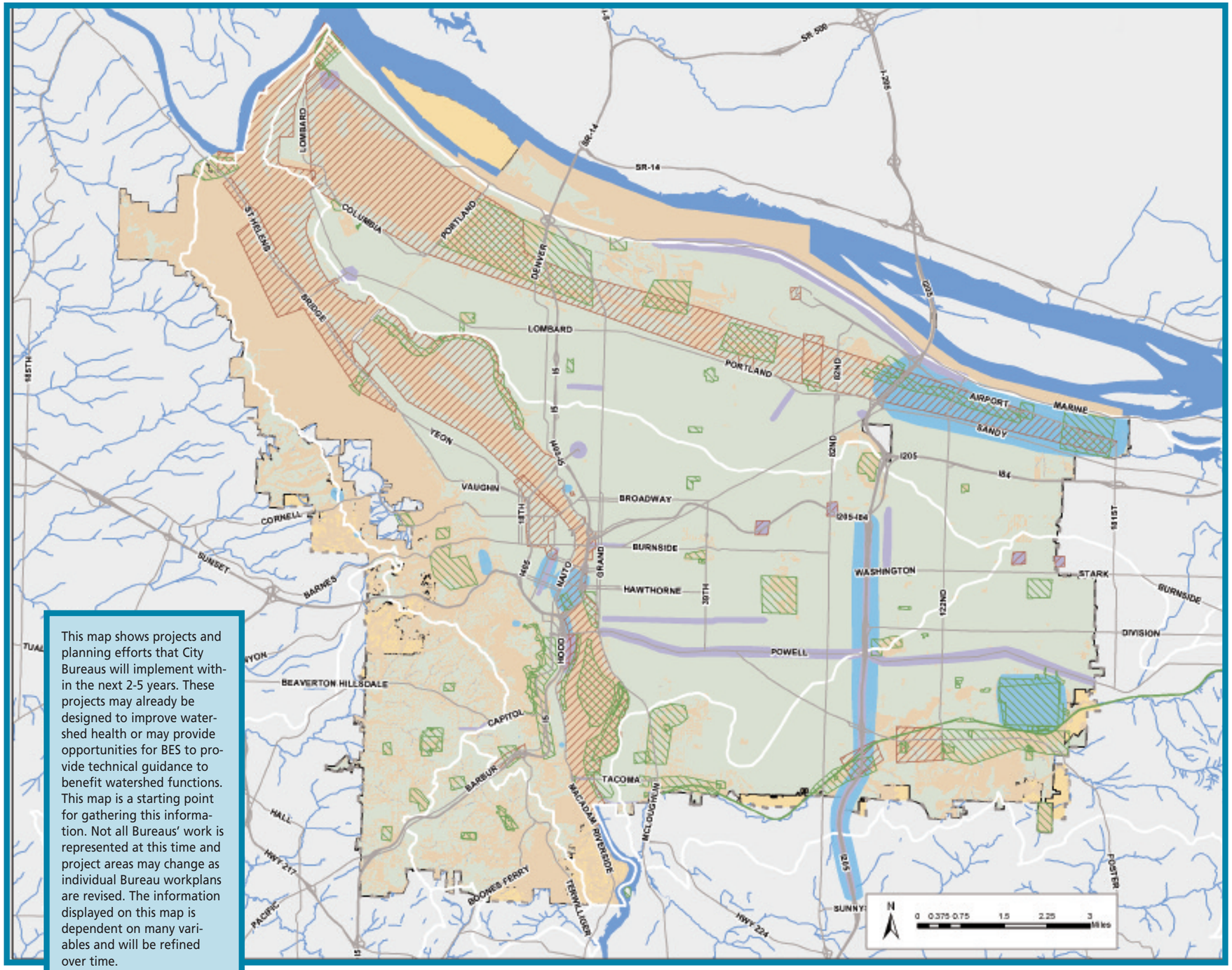
- Sites Adopted by Schools
- Community Stewardship Grants
- OSD Awards
- LEED Certified Building
- Registered for LEED Certification
- Friends Groups
- SOLV Projects
- Watershed Coucil Projects*
- Friends of Trees sites through 2003
- Revegetation Projects

*Represents projects reported at the time of printing.

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

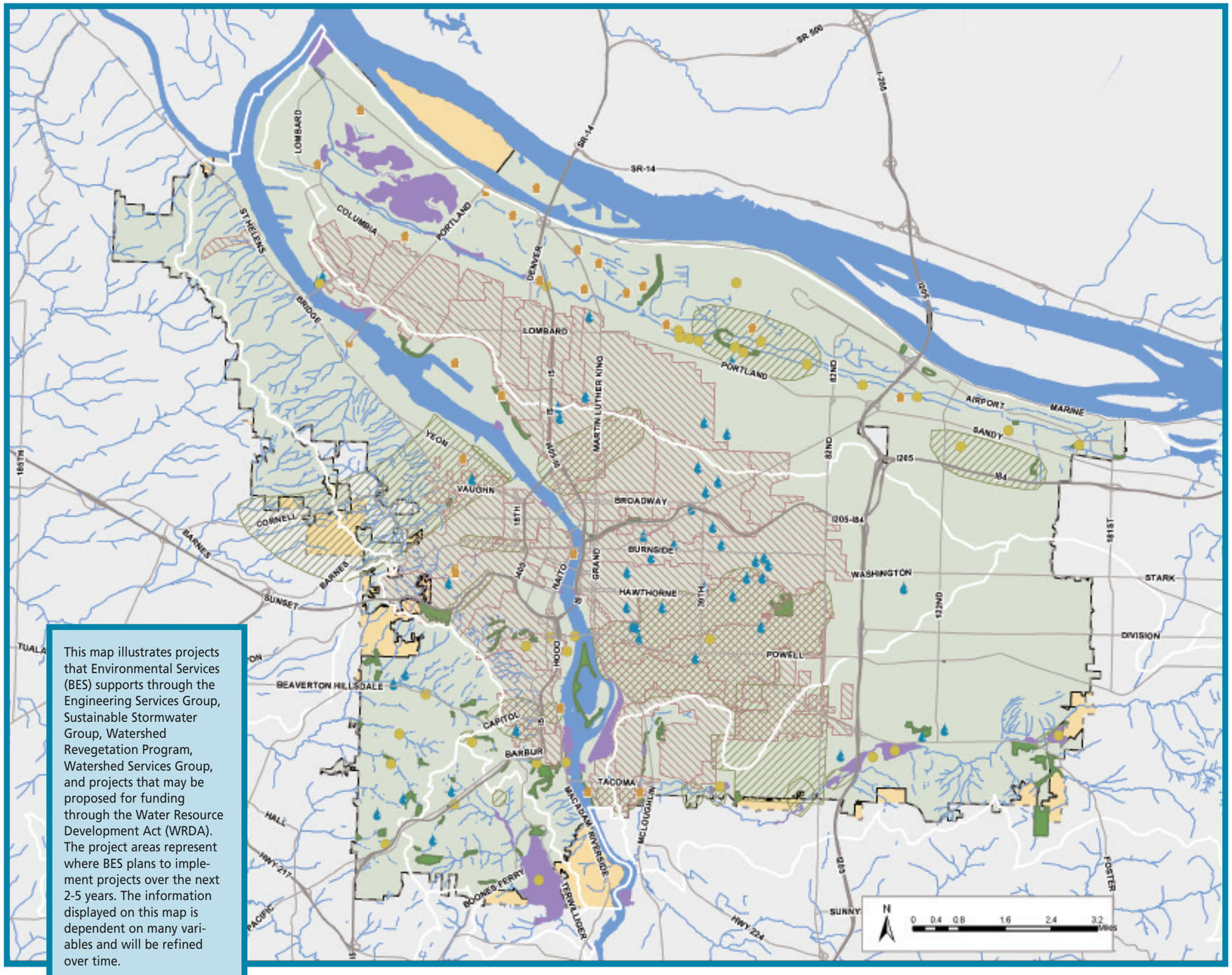
Bureau Collaboration Plans and Projects

- Parks Projects and Plan Areas
- BOP Priority Project Areas
- PDOT Priority Project Areas
- Water Bureau CIP Projects
- Natural Resources Inventory Update (draft)

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

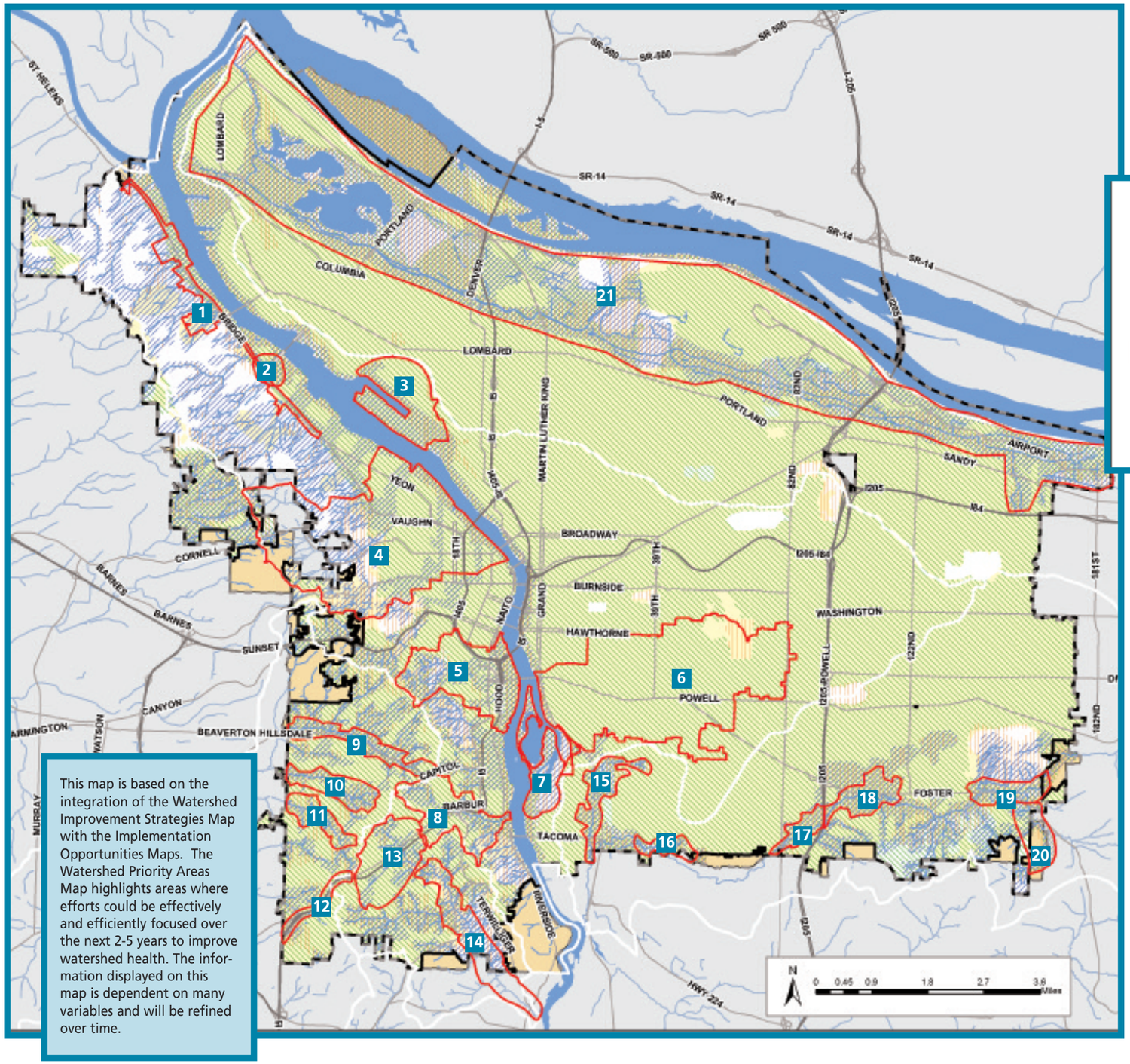
- City of Portland
- Urban Services Boundary
- Urban Services Area outside Portland
- Major Waterbodies
- Watershed Boundary
- Major Arterials
- Streams

BES Priorities

- Watershed Services Projects
- BES Sustainable Stormwater Projects
- Proposed Pump Stations
- Combined Sewer Basins
- BES Engineering Services Projects
- Potential WRDA Projects
- Prospective Revegetation Projects

Figure 4.5

Watershed Priority Areas



This map is based on the integration of the Watershed Improvement Strategies Map with the Implementation Opportunities Maps. The Watershed Priority Areas Map highlights areas where efforts could be effectively and efficiently focused over the next 2-5 years to improve watershed health. 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
- Priority Areas

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 Neighborhood Plan	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 4.7

"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 be enacted within the Environmental Services Watershed Services Group and how the Plan will be incrementally applied to other City work groups and activities over time.

The City will apply the System to all watershed management activities and work with other City bureaus to ensure that other City projects and programs contribute to watershed health.

The City will measure the effectiveness of specific actions, measure progress in improving watershed health, and address regulatory compliance requirements. Ongoing research and analysis improves understanding of watersheds and refines tools used to identify the best actions to improve watershed health. The System will use adaptive management to ensure that monitoring, research and analysis results are used to regularly update the Plan and its supporting technical documents to improve future watershed management decisions.

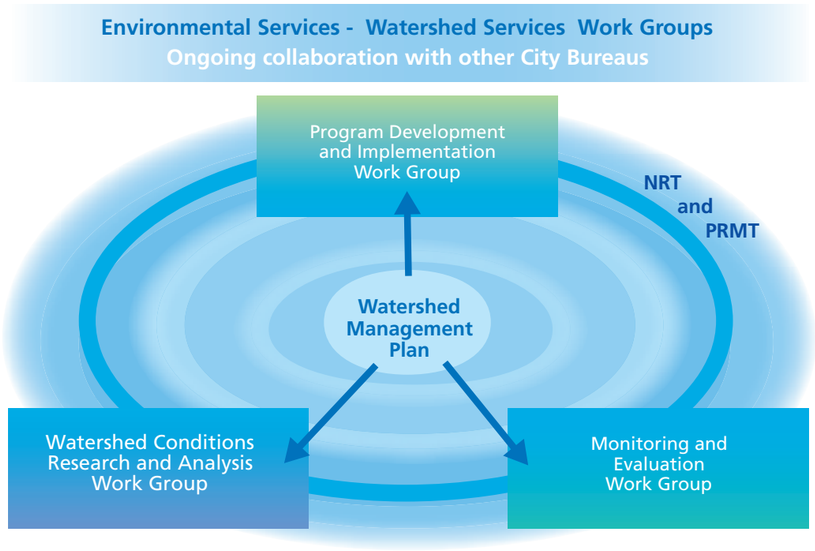
The City will issue periodic compliance reports to regulatory agencies and summary reports of Watershed Plan implementation.

Functional Working Groups

Environmental Services will create three work groups to ensure that the Plan is applied to all Bureau watershed management activities within two years. An Environmental Services Watershed Services manager will chair each group.

Over the next five years, Environmental Services will use existing inter-bureau coordination and City procedures to apply Plan goals, objectives, strategies and priority actions incrementally to other City activities that effect watershed health. The City's Natural Resources Team (NRT) coordinates natural resource activities. 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.

Figure 5.1 Watershed Management Work Grou



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.

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.

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.

The 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.
- 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 maintenance and other infrastructure projects that further Plan goals and objectives.
- Develop a database to track project opportunities, prioritize and select opportunities, and track implementation.
- Produce annual reports on implementation and performance.

The 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.
- Develop targets 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 stormwater retrofits (e.g. swales, planters) 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.

The Monitoring and Evaluation Working Group

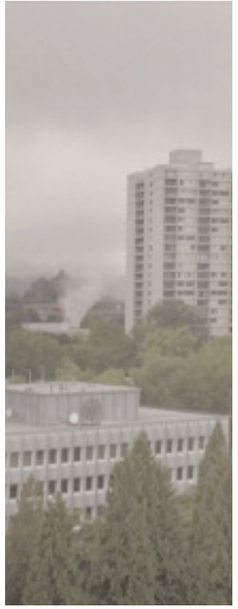
- Develop a monitoring strategy that integrates the Plan with existing monitoring conducted to meet Environmental Services regulatory reporting commitments. The monitoring strategy must describe the incremental inclusion of environmental measures as the Watershed Conditions Research and Analysis Working 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 communicate bureau work, monitor progress, invest resources strategically for results, and use performance measures to track progress, provide accountability, and improve performance.

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 that help 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. The most efficient and effective way to improve watershed health is to encourage all City bureaus to apply the Plan to the design, prioritization and selection of projects and programs.

The working groups will start working immediately on several long-term tasks, which are listed below.



The 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.

The 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 analyzes to describe the benefits of these types of projects beyond cost savings.

The Monitoring and Evaluation Working Group

- Collaborate with other City bureaus to continue and expand coordination of monitoring activities.

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 FT 2005 and highlights selected projects planned for the upcoming year. Data on environmental conditions gathered through monitoring activities will also be available through a separate reporting process. 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 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, enables more precise estimates 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.

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 sea or lake.

Characterization - A thorough 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 streams or rivers.

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 – Part of the water cycle involving the combination of evaporation and plant transpiration by which plants give off vapor containing waste products.

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 mistakes.

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 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.

NPDES - National Pollutant Discharge Elimination System: 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 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.

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 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 permits from DEQ.

working for clean rivers

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

2005 Watershed Plan Annual Report

Introduction

Watershed Plan Context

The City of Portland's watershed approach is designed to improve Portland watershed health through actions that address multiple watershed problems at once. Rather than focusing separately on single issues such as flooding, combined sewer overflows (CSOs), or contaminated sediments, this holistic watershed approach considers all of the activities in the urban landscape that affect watershed conditions.

The watershed approach relies on integrating the activities of multiple city bureaus, and maximizes the use of limited resources by looking for solutions that meet multiple objectives. The approach includes management tools to measure results and track progress with a focus on addressing environmental problems at their source and improving watershed health overall, not merely complying with individual regulations. The City's watershed approach will incorporate City values such as public safety, economic vitality and community stewardship into decision making and, over time, will inform the activities of every City bureau and program that has an effect on watershed health.

As a municipal government, Portland has the utility service and regulatory responsibility for managing our stormwater, which plays a large part in defining the health of our watersheds. The Portland Watershed Management Plan establishes a citywide system to guide a wide range of decisions. This plan sets a policy course that expresses Portland's commitment to improve watershed health and protect and enhance its natural resources.

The City of Portland is continuously implementing programs and projects to achieve watershed health objectives while continuing to grow and develop. In order to do this work, City bureaus work together to implement actions. The City also works with watershed councils, community groups, business organizations and other jurisdictions, both in Portland and upstream of Portland's watersheds. Improving watershed health is truly a citywide effort.

Role of the Annual Report

The Watershed Plan Annual Report details how the City is working to implement the strategic vision of the Watershed Plan and the City's progress toward achieving that vision.

This report documents citywide activities in Fiscal Year 2005 (FY 2005, covering July 2004 through June 2005). The report also details some key programs and projects to be implemented in the coming years to illustrate how the City will continue working toward the objectives.

For more information on the development of the Annual Report, please refer to Technical Memo AR.

Performance Measures

Annual progress towards the Watershed Plan strategic vision is reported using a set of performance measures. Performance measures were developed to capture the range of activities being conducted so that annual achievement could be reported in a quantifiable way.

Performance measures do not measure the performance of a specific project; rather, they measure the performance of the City at implementing the strategies and actions known to improve watershed health (see inset for performance measures). Ultimate changes to environmental conditions are also being monitored and reported through a separate process (as described in Chapter 5).

For more information on the development of performance measures, please refer to Technical Memo AR.

Performance Measures

Stormwater Strategy Performance:
- Stormwater Flow Management
- Stormwater Pollution Management

Aquatic and Terrestrial Enhancement Strategy Performance:
- Aquatic Enhancement
- Terrestrial Enhancement

Revegetation Strategy Performance:
- Revegetation
- Street Trees

Protection and Policy Strategy Performance:
- Development Management
- Site Protection

Operations and Maintenance Strategy Performance:
- System Improvements
- System Maintenance

Education, Involvement, and Stewardship Strategy Performance:
- Education
- Involvement
- Outreach

2005 Watershed Achievement

Achievement by performance measures for FY 2005 is summarized in the following section. For many performance measures, reporting is limited to quantifying activities conducted (for example, number of stormwater flow management projects). Where available, the watershed benefits of these efforts are also reported (for example, total acres of impervious are mitigated for by projects conducted). Future annual reports will move towards using watershed benefits to quantify achievement.

The individual activities conducted, which contributed to this reporting, are listed in the Appendix.

2005 Stormwater Strategy Performance:

Stormwater Flow and Pollution Management

- Installed 1310 linear feet of swale
- Installed an additional 156 swales and planters
- Installed 7 additional projects to mitigate impervious area (swales, planters, pavers)
- Reviewed 207 industrial files to evaluate impacts to stormwater system
- Inspected 99 industries to identify BMPs to minimize or remove exposure to stormwater
- Administered 254 stormwater permits
- Corrected 11 illicit discharges

2005 Aquatic and Terrestrial Enhancement Strategy Performance:

Stream and Terrestrial Enhancement

- Enhanced 11,350 feet of streambank and 81 acres – this includes both aquatic and terrestrial habitat

2005 Revegetation Strategy Performance:

Revegetation

- In partnership with public and private entities, planted:
  - 36,100 trees
  - 63,550 shrubs

- In partnership with Watershed Councils and SOLV, planted:
  - 7,771 trees and shrubs

Street Trees

- In partnership with Friends of Trees, planted:
  - 1,500 street trees
  - 9 large canopy trees

FY 2005 Protection and Policy Strategy Performance:

Development Management

- Addressed 1,600 calls to the spill protection hotline (503-823-7180)
- Conducted 10,345 erosion control inspections
- Opened 290 erosion control complaints
- Closed 267 erosion control complaints

Site Protection

- Acquired 30 acres for restoration and protection

FY 2005 Operations and Maintenance Strategy Performance:

System Improvements

- Used bio-diesel in all city diesel trucks
- City bureaus continue to follow Integrated Vegetation Management and Integrated Pest Management Policies to reduce pollutants and cost
- City bureaus continued application of trenchless liner repair system

System Maintenance

- Constructed, repaired or replaced 330 inlets, 2680 feet of inlet lead, 4941 feet of culverts
- Inspected all 122 public pollution reduction facilities
- Inspected 319 private stormwater management facilities
- Inspected 364 outfalls
- Inspected and cleaned 922 sumps
- Inspected and cleaned 16,500 catch basins
- Inspected and cleaned 11,700 feet of swales and ditches

FY 2005 Education, Involvement, and Stewardship Strategy Performance:

- Awarded 24 Stewardship Grants
- Conducted or sponsored over 40 events
- Trained 427 teachers and volunteers
- Reached 1150 tree volunteers
- Reached 17,950 K-12 students

FY 2006 and Beyond: Example Watershed Activities

The Portland Watershed Management Plan's Chapter 4 lays out a variety of strategies and actions to protect and improve watershed health. It also identifies where these activities could be best applied throughout the City over the long-term and where they could most likely influence or be incorporated into other City priorities and efforts. This information is based on the best science and analysis currently available and used to produce the Watershed Priority Map that highlights the priority areas for applying these activities.

The products of the Plan provide a watershed context for current and future City efforts so that they can most effectively and efficiently contribute towards the watershed health objectives. The pursuit of these actions will continue in FY 2006 and beyond in the form of a variety of ongoing programs and individual projects, as well as changes to the way many other City activities are conducted. Although the City implements or coordinates on hundreds of activities each year that benefit watershed health, this work remains only a portion of the long-term effort towards protecting and improving watershed health.

This section provides further detail on and 8 example programs and 7 example priority projects to be completed, continued, or pursued in FY06 or beyond. Many of these examples represent efforts that achieve progress towards several strategies and actions. The program examples apply citywide; the site-specific projects fall within the Priority Areas identified on the Priority Areas Map. It is important to note that these selected activities illustrate the type of work being conducted. They represent only a small fraction of the work conducted by the City, as evidenced by the broader sampling of activities reported for FY 2006, and an even smaller fraction of the work long-term implementation needed to reach the watershed health goals.

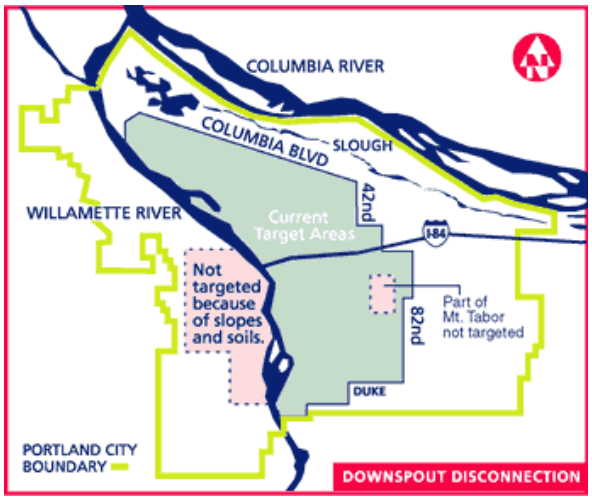
Example Programs

BES Downspout Disconnection Program

Strategies Addressed: Stormwater

The Downspout Disconnection Program focuses on disconnecting downspouts at residential properties in areas of the City east of the Willamette River served by the combined sewer.

The program disconnects thousands of residential downspouts each year. This resulted in the infiltration and water quality treatment of stormwater runoff from hundreds acres that would otherwise enter the combined sewer system. In addition, information on disconnection is provided to thousands of people through presentations at community events and at community meetings and thousands more have been reached through an ongoing media campaign. Disconnection efforts enlist the help of hundreds of volunteers and community organizations.



Priority downspout disconnection area


Potential on-site stormwater disposal design for a disconnected downspout

Removing the stormwater runoff from the combined sewer system and allowing it to infiltrate helps reduce CSOs and improves overall water quality. Since 1996, more than 44,000 homeowners have disconnected downspouts, removing over a billion gallons of roof water per year from the combined sewer system. Not only does this help reduce the delivery of pollutants to waterways from combined sewer overflows, it also helps reduce the size of the big pipes Portland's Environmental Services is building to control CSOs. Smaller pipes mean savings for Portland sewer ratepayers who are funding the CSO program. Portland has already reduced annual CSO volume by three billion gallons and the 44,000 homeowners who have disconnected downspouts are an important part of that success.


Residential downspout being disconnected

Whitaker Ponds Nature Center

Strategies Addressed: Education, Involvement, and Stewardship
Revegetation
Aquatic and Terrestrial Enhancement

The 2005 Columbia Slouah Reaatta

Whitaker Ponds is a great example of what collaborative partnerships can achieve. The 12-acre Whitaker Ponds site was a junkyard and illegal dumping grounds on the banks of the Columbia Slough in north Portland. Portland's Bureau of Environmental Services teamed up with Metro, Portland Parks and Recreation, the Columbia Slough Watershed Council, and the Trust for Public Lands to purchase and restore the site. Whitaker Ponds is now an environmental learning center managed by Portland Parks and Recreation and home to the Columbia Slough Watershed Council office, library, and its small staff. The site is used to provide youth and adult education programs, public access to open space to the Slough, community involvement events, and volunteer restoration opportunities.

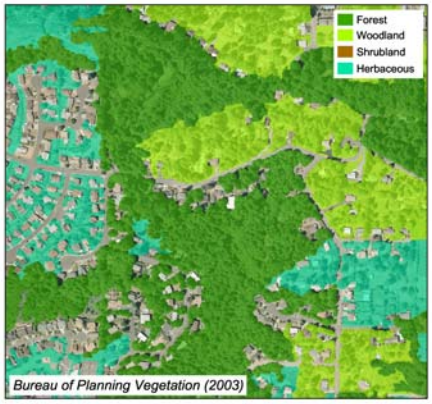
The murals at the site were painted by several groups of students to illustrate the Slough, neighbors, and neighborhoods around the Columbia Slough

The property is managed by Portland Parks and Recreation Natural Areas Program as home to numerous city and public involvement, education, and stewardship efforts. Events are sponsored by the Bureau of Environmental Services and The Columbia Slough Watershed Council. The site also serves to promote community involvement, volunteer efforts, recreation, and public access. In 2005, the site served as an outdoor environmental classroom for hundreds of North and Northeast school students to learn about watershed function, water quality, stream restoration, and the ecology of the Columbia Slough watershed. Involvement and volunteer events at the site were participated in by hundreds citizens. In addition, revegetation and aquatic restoration projects were implemented on the site in 2005 by volunteer efforts.

The ongoing operation of this site and annual events provide public education, involvement, and restoration benefits that contribute to nearly every watershed objective. These efforts result in restoration of aquatic habitat and hydrologic function, pollutant source reduction, native forest restoration, water quality treatment, increased habitat connectivity, and citizen understanding of watershed practices. The site is home to numerous native aquatic, bird, reptile, and mammal species.

Natural Resource Inventory Update

Strategies Addressed: Protection and Policy

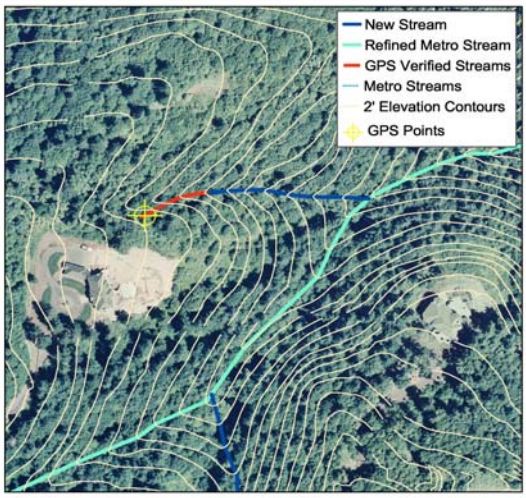


This project mapped existing vegetation cover throughout the city

The Natural Resource Inventory Update project will incorporate new stream and vegetation data and recent scientific information into a supplemental citywide inventory of riparian resources and wildlife habitat. The revised inventory is intended to inform and support a broad array of City planning projects, program implementation and updates, and the identification of priority areas for land acquisition, restoration, and public education. The inventory focuses on areas that include streams and rivers, wetlands, and other water bodies, floodplains, steep slopes, and significant riparian and upland vegetation in Portland's watersheds.

The inventory update project is underway and will be completed over the next two years. The Planning Bureau is leading this effort, in consultation with City bureaus, agencies, and technical experts. The Bureau is also coordinating with community stakeholders and preliminary products will be made available to community stakeholders for review and comment.

This is a supplemental citywide inventory of riparian resources and wildlife habitat. The updated inventory will incorporate new data, recent scientific information, and updated tools and technologies. The updated inventory will inform the development and implementation of City policies, plans, programs, and projects to protect, conserve and restore the City's significant natural resources. The inventory will also be helpful in developing strategies for compliance with multiple regional, state, and federal regulatory obligations (e.g., Metro Nature in Neighborhoods Program requirements, Clean Water Act Stormwater and TMDL requirements, Endangered Species Act, etc.)



Stream locations throughout the city were verified and updated as part of this project

.

Sustainable Stormwater Management Program and NE 131st and Fremont Green Street Project

Strategies Addressed: Stormwater

The Sustainable Stormwater Management Program provides design and technical assistance to property owners, developers, engineers and architects to promote onsite stormwater management. The SSMP demonstrates methods that manage stormwater at its while providing environmental and economic benefits. These methods applied by retrofitting commercial / industrial properties and streets with stormwater control measures including swales, planters, and rain gardens. Key efforts of the SSMP are monitoring demonstration projects to evaluate their performance and cost effectiveness for water quantity and quality improvements and to actively engage in outreach efforts to other city bureaus, property owners, watershed managers, and neighborhood associations. The program also provides incentives to public and private property owners to manage stormwater on site.

A prime example of a facility implemented through this program is the landscaped curb extension at NE 131st and Fremont. This facility utilizes natural watershed processes such infiltration, interception, evapotranspiration, detention, and filtration to manage stormwater runoff at its source. This project was the first of its kind to both manage street runoff and accommodate a ramp crossing for (handicap) accessibility. Approximately 400 square feet of asphalt was removed on either side of the ramp and vegetated with a variety of plants. Stormwater enters the vegetated portion on the west side through a curb cut, and is allowed to flow under the ramp to the east vegetated portion via a steel grate.

Construction of the NE 131st and Fremont Green Street

The SSMP is administering a U.S. Environmental Protection Agency (EPA) grant of $1.25 million to fund over 25 innovative public and private projects throughout the city that demonstrate sustainable, low-impact stormwater management solutions. An additional appropriation from EPA for nearly $1 million will be administered through the SSMP for additional innovative projects.
The NE 131st and Fremont Green Street was the first collaborative process between the BES Sustainable Stormwater Management Program, PDOT, and the Columbia Slough watershed group. The Columbia Slough Watershed group helped fund the project (approximately $22,000) and assisted with community outreach efforts to the Argay neighborhood. The SSMP designed the project with input from PDOT. The City's BOM constructed the project beginning in late August 2005 and finishing the first of September. Portland Parks and Recreation installed the landscape and will continue to maintain it during the 2-yr plant establishment period.

This project manages approximately 5000 square feet of stormwater runoff from the surrounding impervious area. The soil and vegetation slows the flow of runoff, filters sediments and pollutants, and allows the stormwater to soak into the ground, reducing the burden on the combined sewer system and recharging groundwater. This project is viewed as the first of many citywide collaborative projects with PDOT to manage stormwater runoff from streets while enhancing pedestrian safety and adding an attractive element to neighborhoods and the urban environment.

Urban Forestry Program Street Tree Planting and Maintenance

Strategies Addressed: Stormwater
Education, Involvement, and Stewardship

Portland Parks and Recreation maintains and manages Portland's urban forest. Their Urban Forestry Program has primary responsibility is to plant, inspect, and maintain the 140,000 publicly owned trees in parks, along streets and around public buildings. The program also continues to identify planting opportunities and needs and coordinate the management and administration of the urban forest between the City agencies and neighborhood associations, private property owners, non-profit groups that care for, and affect, the urban forest. The Neighborhood Tree Liaison Program conducts classed on general tree care, tree biology, tree planting, preservation, and identification. Neighborhood Tree Liaisons also work with neighborhood associations as a resource for tree information.

Even residential areas with established street tree canopy require maintenance

These programs achieve training, education, involvement, and outreach for hundreds of residents and students. City collaboration and funding to schools, neighborhood associations, and organizations such as Friends of Trees allows for the planting of hundreds of street trees throughout the city each year.

Street trees can be incorporated in to redevelopment projects to provide shade, aesthetic, and water quality benefits

Street trees have significant benefits towards every watershed goal. The leaves of a mature street tree intercept an average of 760 gallons of rainfall a year, stabilizing soil, reducing erosion, and mitigating flooding. The average tree cleans 330 pounds of carbon dioxide from the atmosphere through direct sequestration in the tree's wood and from reduced power plant emissions due to cooling energy savings. An average tree also absorbs ten pounds of pollutants from the air each year, including four pounds of ozone and three pounds of particulates.

An average street tree provides an estimated $273 a year in reduced costs for air conditioning, erosion control, stormwater control and treatment, and air pollution. Unlike structural investments that depreciate, a tree's value increases with each passing year. Street trees also contribute to contribute to neighborhood livability by reducing city noise and glare, and by calming and slowing traffic and have enormous economic benefit. Trees increase home property values 7 to 21 percent, depending on the number and size of the trees.

Street trees provide habitat for migratory birds, and other wildlife and street tree planting and outreach programs provide ongoing benefits of public education and involvement.

Willing Seller Property Acquisition Efforts

Strategies Addressed: Protection and Policy
Aquatic and Terrestrial Enhancement

The City of Portland is working with Metro to develop a unified proposal regarding natural area acquisition priorities. This is an interbureau effort involving BES, Parks, BOP, and BDS to identify sites with high value natural resources, that are priorities for multiple bureaus, and that are at greatest risk from likely development. Metro is proposing an open spaces bond measures to raise funds to allow for acquisition of high priority sites from willing sellers. In addition to this effort, the City currently acquires property from willing sellers for several purposes, such as high value properties that increase the connectivity of Forest Park, properties needed for stormwater facilities, and flood-prone properties along Johnson Creek through the Johnson Creek Willing Seller Land Acquisition Program. Acquired properties are generally cleared of all structures and protected from future development through deed restrictions. These properties are then often used to expand the natural areas parks system.

Current City acquisition efforts involve the collaboration of all City natural resource bureaus. Property acquisitions are collaborations with willing sellers and often involve the donation of part or all of the value of the property by landowners interested in supporting the natural resource elements of our city. The Metro bond measure will likely go before voters in November 2006.

This property was purchased through collaboration of multiple City bureaus in 2004 to expand the West Hills natural areas managed by Portland Parks and Recreation

Flooded homes along Johnson Creek in the February 1996 flood

Acquisition and protection of high-value lands is a multi-objective watershed approach that provides solutions to a broad suite of issues. They help protect water quality and natural hydrology functions, provide fish and wildlife habitat, stabilize soils and downstream streambanks, protect against property damage on floodplains, create restoration opportunities, and expand public recreation opportunities through natural area aesthetics and trail systems.

Stormwater Collection and Conveyance System Cleaning

Strategies Addressed: Stormwater

Cleaning the stormwater collection and conveyance system provides source control of stormwater contaminants for more than 28,000 acres served by combined sewer system and 66,000 acres served by separated storm system. Cleaning the stormwater collection system includes cleaning of streets and curbs on selected arterial and residential streets in separated areas that drain directly to the City's streams and Willamette River and maintenance for BES stormwater collection and conveyance infrastructure, including all pipes, culverts, trash racks, sumps, inlets, and stormwater facilities.

Debris and pollutants collect in stormwater inlets, blocking flow and eventually continuing on into the pipe system if not cleaned regularly

Street sweepers collect pollutants and sediments from street surfaces before they become stormwater contaminants

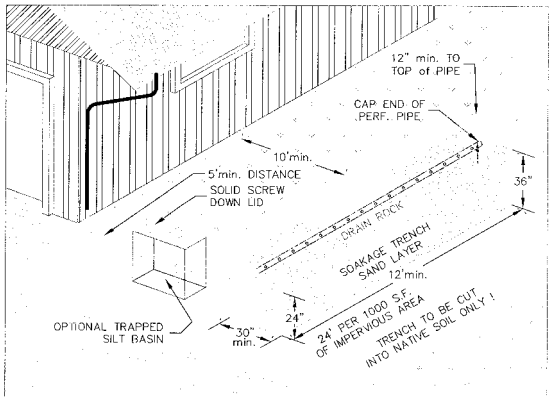
This work is done by the Environmental Group of the Bureau of Maintenance. In the 2004 fiscal year the group cleaned 715 sumps and sediment manholes, 11,400 catch basins, 132,300 linear feet of ditch, and 24,800 linear feet of culverts. A total of 12,900 maintenance visits were conducted and all 77 detention and water quality pond pollution reduction facilities were inspected.

These efforts result in keeping thousands of pound of metals, oils and grease, sediment, nutrients, and other contaminants out of stormwater.

Stormwater Management Manual Implementation

Strategies Addressed: Protection and Policy

Stormwater management is a key element in maintaining and enhancing the environment within Portland. The City of Portland has developed a comprehensive Stormwater Management Manual to provide design professionals with specific requirements for reducing the impacts of stormwater runoff and pollution resulting from new development and redevelopment within Portland. The manual's requirements apply to all development, both public and private, over 500 square feet in impervious area. Infiltration of stormwater is required to the maximum extent practicable and vegetated facilities are prioritized for all non-rooftop impervious areas.



Soakage trenches are a common method of stormwater disposal in East Portland

The first Stormwater Management Manual was implemented in July 1999 and has been updated a number of times since. The current version of the manual was implemented in September 2004. Manual requirements are applied through the development review process by BES Development Services and BDS Site Development. Field inspections of private facilities during construction are conducted by BDS in conjunction with other site inspections. After construction BES inspects private facilities to ensure proper functioning and maintenance (however there is not enough staff to inspect all facilities every year, so only a small percentage of all facilities are being regularly inspected). The Stormwater Advisory Committee is a group of professionals and citizens appointed by City Council to oversee revisions to the manual.

Flow-through planters provide water quality treatment of stormwater runoff

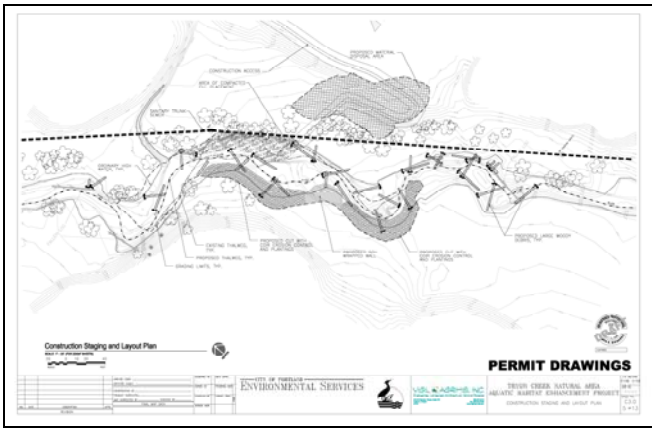
The Stormwater Management Manual is one tool that the City uses to meet federal water quality requirements. By requiring pollution reduction, flow control and, where possible infiltration, for new and re-development within the City, we protect the health of our streams and rivers. Retaining and treating stormwater on site prevents erosion in small creeks, reduces temperatures and pollutant loading, protects groundwater, and contributes to prevention of combined sewer overflows. DEQ has approved of the manual as an approach to protect groundwater resources in sensitive areas. The manual is also an important component of the CSO program, reducing flows to the combined system and sewage overflows to the Willamette River.

Example Projects

Tryon Creek Pipe Protection & Stream Enhancement Project

Strategies Addressed: Operations and Maintenance
Aquatic and Terrestrial Enhancement

This project is a bioengineered bank restoration project along a portion of a 27-inch concrete sanitary pipe that was exposed along the northern bank of Tryon Creek in Tryon Creek State Natural Area. The project consists of two main components: constructing a bioengineered stream bank out of logs and other natural materials to protect the sanitary pipe, and subsequent stream enhancement work to improve instream habitat for resident salmonid species.



Stream habitat restoration design

The second phase of this project is being constructed in FY 2006, following completion of the first phase in September of 2004. This project is being implemented by the BES Watershed Services and Maintenance Engineering groups in collaboration with a variety of agencies and public groups. Funding came from BES Maintenance Engineering, BES Watershed Services, River Renaissance, a NOAA grant, a Nature Conservancy grant, and the BES Revegetation Program. Match resources came from Oregon State Parks, Tryon Creek Watershed Council, and the Friends of Tryon Creek State Park. Other partners were Portland Parks Urban Forestry (moving large wood) and PDOT (survey work).


Logs placed in creek to protect sanitary sewer pipe

This project will result in the protection of the sanitary sewer infrastructure at the site and the enhancement of about 300 feet of Tryon Creek. The enhancement includes in-stream habitat improvements, restoration and native planting of about 7 acres of critical riparian habitat, and citizen involvement in restoration activities. The project will improve water quality (sediment filtration and stream temperature), vegetative structure, flood storage capacity, bank stability, riparian and floodplain connectivity, and in-stream refugia.

Environmental Code Improvement Project

Strategies Addressed: Protection and Policy

The purpose of this project is to make Portland's existing environmental regulations clearer, simpler, and more cost-effective and equitable, while continuing to protect significant natural resources and providing additional incentives for restoration. The code improvements will apply to new development and redevelopment within the environmental overlay zones of the City of Portland and of the Multnomah County urban pockets.

Environmental zoning protects this high value resource site along the Columbia River

In August 2005 the City Council adopted the recommended package of code amendments, administrative rules and follow-up tasks. The changes went into effect on September 26, 2005. The Bureau of Planning led the project, and the effort included extensive collaboration with the Bureaus of Development Services, Parks and Recreation and Environmental Services, other agencies, community organizations, neighborhood leaders and residents. Stakeholders helped define problems and opportunities, and develop goals, criteria, and solutions. Staff estimates that program changes can be accommodated within existing budgeted resources.

The Environmental Code Improvement project provides an ongoing vehicle for making improvements to the City's codes. This project will advance watershed health objectives for protection of natural resources, stormwater management, and community stewardship. Project benefits include reduced cost and time required for to obtain permits for specified resource enhancement projects, public recreational trails, and small rights-of-way and stormwater outfalls. The code changes remove regulatory impediments to site restoration and encourage enhancement of degraded site. Simplified permitting options are only available for projects that meet standards designed to prevent adverse impacts on natural resources. A new approach for enforcing environmental violations will accelerate site remediation and discourage repeat violation. Extensive stakeholder participation in the project resulted in overall acceptance and support for the outcome, and an improved perception of the program as a whole.

Protected site in West Hills of Southwest Portland

SW Texas Green Street Project

Strategies Addressed: Protection and Policy
Aquatic and Terrestrial Enhancement
Stormwater

The SW Texas Green Street Project will include the construction of a series of stormwater facilities to treat, detain and dispose of drainage from a 17-acre basin. The proposed design incorporates swales along streets to improve water quality and relieve neighborhood stormwater problems (including basement flooding), acquisition of a 0.62-acre wetland at the Stephens Creek headwaters, and creation of a wetland stormwater facility on the site. The project is located on SW Texas between 26th and 28th Avenue, in the Stephens Creek subwatershed of the Willamette River Watershed.

Aerial view of project area with 0.62-acre parcel to be acquired highlighted with red box

Current conditions looking west on SW Texas St. from intersection with SW 26th Street

The project is currently in the design phase with construction anticipated to begin May 2006. Construction will be complete by the fall of 2006. This project is being jointly managed by BES and the Office of Transportation. Design work on the project will also include consultation with the Bureau of Water Works. The project is being funded through a combination of grant, BES capital and operating funds and a local improvement district. The local improvement district will pay for the street improvements, estimated at $940,000. BES will pay for the stormwater improvements with $225,000 in operating funds (the land acquisition), $77,000 from an Innovative Wet Weather Program grant, and $711,000 in capital improvement funds.

This project is located in a high priority subwatershed in the City's Willamette Watershed plan area. Stephens Creek is one of the last free-flowing streams of its size draining directly to the Willamette in the City, outside of Forest Park. The mouth of Stephens Creek has been identified as high value and critical off-channel habitat area for Willamette River fish communities. Studies show that this area is one of the most productive in the City for fish community diversity and abundance for Chinook, Coho, and Steelhead. Since it is a separated basin, stormwater from the entire Stephens subwatershed flows to the outfall at the mouth of the creek. BES identified alteration of streamflow conditions and the associated water quality problems (e.g. temperature, sediment, and suspended solids), caused primarily by impervious surfaces and development in the upper reaches of the subwatershed, as the highest priority problem in the basin. This project will treat, detain and clean water from a 17 acre drainage area.

Degraded wetland on parcel to be acquired – blackberry will be removed and the site regraded to restore natural conditions and functions

Lents Crossing

Strategies Addressed: Aquatic and Terrestrial Enhancement
Operations and Maintenance

The Lents Crossing project's main purpose is to protect an exposed sewer pipe in Johnson Creek. The Lents Interceptor runs from east of I-205 to a pump station at McLoughlin Blvd. The 60 inch pipe was built in 1922 and carries up to 20 million gallons a day of combined sewer and stormwater during winter months and about 6 million gallons a day of sewage during the summer. The pipe was installed 5 feet below the bottom of Johnson Creek when it was constructed. Because of major alterations to the creek in the 1930s and increased development over time, the creek has down-cut considerably and low summer flows now run under part of the pipe. The exposed pipe poses a threat to public health and safety.

Exposed Lents Interceptor sewer pipe crossing Johnson Creek

To remedy this situation, BES will reinforce the pipe, even out the grade of the creek with the adjacent floodplain in Tideman Johnson Park and place large wood and rock in the creek to protect the pipe and help slow stream flow. Large wood jams and rock will be placed in three locations, and scattered less densely throughout the project reach of the creek.

The project includes some minor improvements to Tideman Johnson Park to help protect sensitive natural areas and direct traffic to areas more suitable for access. The project will re-grade areas of the Park so the creek will have better access to the floodplain. The project designers have made a particularly focused effort to minimize the amount of tree loss. The trees that are taken down will be used as structures in the creek.

Lents Crossing construction is projected for April through November 2006. The work will be done during the in-stream work window for Johnson Creek when flows are the lowest and there is the least potential for damage to fish habitat. BES is leading the project construction. Parks staff are leading planning, natural resource and maintenance work within the parkland portion of the project. Funding provided by BES and Parks Capital Improvement Project funds in FY 06 to construct project and park infrastructure improvements.

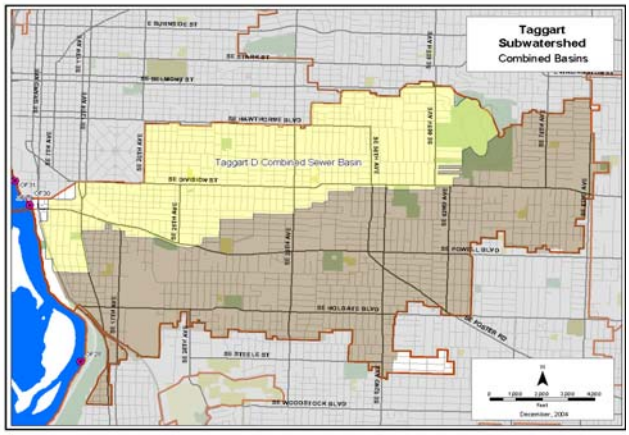
BES Outreach staff are working with four Neighborhood Associations (Ardenwald/Johnson, Woodstock, Eastmoreland and Brentwood/Darlington), nearby residents and the Johnson Creek Watershed Council, to assure stakeholders are given updates throughout various phases of the project.

This restoration project will not only protect the pipe, but will greatly improve habitat for fish and wildlife. Approximately 2,000 cubic yards of material will be removed, making way for 800 linear feet of newly created stream channel and floodplains -- providing stormwater interception, storage and filtration functions -- improving water quality. Three logjams will enhance these areas as habitats for salmon by adding structural complexity - including more than 150 logs and 45-50 boulders. In total - nearly 1,800 linear feet of stream channel will be improved and shaded as 1,500 newly planted native trees mature providing habitat for herons, songbirds and other wildlife species.

Integrated Taggart D Pre-design

Strategies Addressed: Operations and Maintenance
Stormwater

The Taggart D combined sewer basin has a history of significant basement flooding problems and poor sewer pipe condition. BES is responsible for maintaining sewer service and such problems have traditionally been approached by conducting a pre-design project that is focused on finding piped solutions, such as increasing the size of sewer pipes to reduce basement flooding and replacing pipes that are in poor condition. The Integrated Taggart D Pre-design, however, is taking a different approach. BES is aiming to address multiple objectives through one pre-design, accomplished by developing packages of solutions that resolve basement flooding, address pipe rehabilitation needs, and improve watershed health.



Taggart Subwatershed and Taggart D Combined Sewer Basin

Staff responsible for the Integrated Taggart D Pre-design work within BES, in the Engineering Services and Watershed Services groups. Staff from other City bureaus, including Planning, PDOT, and Parks, sits on advisory teams. In October 2005, staff had identified four preliminary alternatives to address the basin's problems. Solutions found in these alternatives include pipe replacement, pipe upsizing, stormwater solutions (e.g., green streets, stormwater planters), revegetation and pollution prevention techniques. Next, staff will present these alternatives to the advisory teams for their review and feedback. The revised versions will move forward to the Alternative Evaluation phase. In this phase, each alternative will be measured against the project goals. Ultimately, an alternative that most effectively meets the project goals will be selected and recommended for implementation. BES staff will introduce the project to Neighborhood and Business Associations in the Taggart D basin in October and November of 2005, and will return to present more detailed information as it becomes available. The Integrated Taggart D Pre-design is scheduled to be complete by December 2006.

This curb extension is an example of the stormwater solutions that may be applied in the Taggart D basin.

This pre-design will result in:

- A reduction in basement flooding in the Taggart D basin.
- A reduction in the volume of stormwater that enters the combined sewer system.
- Improvement of failing infrastructure.
- Improvement of surface and groundwater hydrology.
- Improvement of the quality of stormwater discharged to the Willamette River.
- Improvement of sustainability and community livability.

Big Four Corners Restoration Project
Strategies Addressed: Revegetation
Aquatic and Terrestrial Enhancement
Protection and Policy

This project includes acquisition and restoration of 70- and 44-acre parcels located at the confluence two branches of the Columbia Slough known as the Big Four Corners. Historically much of this site was a complex of lakes, ponds and sloughs. This project will enable the City to protect improve high quality habitat for native fish and wildlife populations while enhancing enjoyment of the area by recreational boaters, hikers and wildlife watchers. These sites are adjacent to 47 acres of other City of Portland properties currently managed as natural area.

Project boundaries shown in red, surface waters and wetlands in blue

This is the last large contiguous patch of native, remnant floodplain habitat in this eastern region of the watershed, amidst rapid industrial development. This region of the Columbia Slough Watershed, the Big Four Corners region, has been ranked highly by City of Portland's Bureau of Planning for existing natural resource value. The Portland Watershed Management Plan also identifies the Big Four Corners area as a priority area to pursue watershed actions to meet habitat and biological community goals. Because this property is a significant piece of the Big Four Corners Habitat Area, and because of the cool water that flows into the Slough along its property line, acquisition of this parcel is a high priority project in the Columbia Slough Watershed Council Action Plan. Neighborhood activists have long advocated for protection and restoration of this property.


Beaver are just on of the many species that the project area provides habitat for

The parcel will be purchased in fall of 2005 and restoration work will begin in the winter of 2006 and continue for 5 years. The purchase and restoration of the site will be funded through the collaboration of the Bureau of Environmental Services, Portland Parks and Recreation, a grant from the Oregon Watershed Enhancement Board, and the donation of a portion of the property's value by the landowner.


This project will remove and replace invasive species such as Himalayan blackberry with native species

Benefits of this project include the protection and restoration of 114 acres and the restoration of 10,000 feet of bank. This will further the City's efforts to comply with the anticipated temperature TMDL listing for the Columbia Slough by revegetating a riparian-forested buffer, providing shade to surface waters and decreasing water temperatures. The project will achieve a 50-70% canopy when completed and provide connectivity to 47 acres of adjacent City-owned natural area. The area also provides interception infiltration of rainwater and flood storage. In addition, it provides erosion control and sediment trapping, pollution nutrient retention and removal, recreation, aesthetics, fish and wildlife habitat, and increased native plant diversity.

Beaverton Hillsdale Corridor Pre-design Project
Strategies Addressed: Stormwater
Revegetation
Aquatic and Terrestrial Enhancement
Protection and Policy

This is a pre-design project that includes assessment of actions focusing on water quality, stormwater management, instream, riparian and upland habitat improvements, land acquisitions, stream enhancement, culvert and stormwater outfall retrofit and revegetation. This project encompasses the Fanno Creek mainstem, Beaverton Hillsdale Highway, and the drainage area associated with it.

This pre-design project is scheduled to be completed by the summer of 2007. The project pre-design will be managed within the BES Watershed Services Group in coordination with, and input from, other BES groups such as Engineering Services, the Endangered Species Act Program, the City's MS4 permit, Maintenance Engineering, the public and others as determined. This project is a subproject of a broad Fanno/Tryon predesign project funded by BES for fiscal years 2006 and 2007.

Development encroaching on Fanno Creek

Albertsons/Rite Aid parking lot during a wet weather event. Fanno Mainstem riparian area is in background and flows behind Albertsons along the shipping and receiving area.

The elements of this project selected for design and implementation will provide water quality benefits towards meeting the basin TMDLs and nearly all of the Portland Watershed Management Plan objectives to improve watershed health.

Annual Report Appendix

This table details all project and program activities conducted in 2005.

Strategy	Activity	Number	Units
Stormwater	Installed	1,200	linear feet of swale on SW Hewett Blvd
Stormwater	Installed	30	linear feet of swale on SW Sunset Drive
Stormwater	Installed	80	linear feet of swale on SW Orchid Drive
Stormwater	**Installed**	**1,310**	**linear feet of swale**
Stormwater	Installed	120	swales at New Columbia
Stormwater	Installed	30	infiltration planters at New Columbia
Stormwater	Installed	2	infiltration swales at Lents III LID
Stormwater	Installed	2	streetside planters on SW Gaines in South Waterfront
Stormwater	Installed	2	curb extension swales at NE Siskiyou and SE Ankeny
Stormwater	**Installed**	**156**	**swales and planters**
Stormwater	Installed	1	Westmoreland Pavers
Stormwater	Installed	1	Rebuilding Center
Stormwater	Installed	1	Mississippi Commons
Stormwater	Installed	1	New Seasons swales at SE Division
Stormwater	Installed	1	Astor Elementary School
Stormwater	Installed	1	Atkinson School disconnection and swale
Stormwater	Installed	1	SW 12th & Montgomery planters and pavers
Stormwater	**Installed**	**7**	**projects**
Stormwater	**Reviewed**	**207**	**industrial files to evaluate impacts on the stormwater system**
Stormwater	**Inspected**	**99**	**Industries to identify BMPs to minimize or remove exposure to stormwater**
Stormwater	Administered	111	permits for direct discharges to waterways
Stormwater	Administered	143	Permits for industries and associated tenants with permitted discharges to the municipal stormwater system
Stormwater	**Administered**	**254**	**Stormwater permits**
Stormwater	**Corrected**	**11**	**illicit discharges**
Aquatic and Terrestrial Enhancement Strategy	enhanced	10	acres
Aquatic and Terrestrial Enhancement Strategy	enhanced	28	acres
Aquatic and Terrestrial Enhancement Strategy	enhanced	34	acres
Aquatic and Terrestrial Enhancement Strategy	enhanced	2	acres
Aquatic and Terrestrial Enhancement Strategy	enhanced	7	acres
Aquatic and Terrestrial Enhancement Strategy	**Enhanced**	**81**	**acres**
Aquatic and Terrestrial Enhancement Strategy	enhanced	2,440	linear feet of streambank

Strategy	Activity	Number	Units
Aquatic and Terrestrial Enhancement Strategy	enhanced	4,306	linear feet of streambank
Aquatic and Terrestrial Enhancement Strategy	enhanced	1,740	linear feet of streambank
Aquatic and Terrestrial Enhancement Strategy	enhanced	50	linear feet of streambank
Aquatic and Terrestrial Enhancement Strategy	enhanced	2,817	linear feet of streambank
Aquatic and Terrestrial Enhancement Strategy	**Enhanced**	**11,353**	**linear feet of streambank**
Revegetation	planted	9,291	trees
Revegetation	planted	2,460	trees
Revegetation	planted	19,754	trees
Revegetation	planted	1,000	trees
Revegetation	planted	3,600	trees
Revegetation	**planted**	**36,105**	**trees**
Revegetation	planted	14,687	shrubs
Revegetation	planted	13,010	shrubs
Revegetation	planted	29,114	shrubs
Revegetation	planted	1,700	shrubs
Revegetation	planted	5,039	shrubs
Revegetation	**planted**	**63,550**	**shrubs**
Revegetation	planted	2,000	trees and shrubs
Revegetation	planted	3,200	trees and shrubs
Revegetation	planted	1,666	trees and shrubs
Revegetation	planted	109	trees and shrubs
Revegetation	planted	450	trees and shrubs
Revegetation	planted	296	trees and shrubs
Revegetation	planted	50	trees and shrubs
Revegetation	**planted**	**7,771**	**trees and shrubs**
Revegetation	planted	1,008	Street tree plantings
Revegetation	planted	500	Street tree plantings
Revegetation	**planted**	**1,508**	**street trees**
Revegetation	**planted**	**9**	**large canopy trees**
Protection	**Addressed**	**1,600**	**calls to the spill hotline (823-7180)**
Protection	**Conducted**	**10,345**	**Erosion control inspections**
Protection	**Opened**	**290**	**erosion control complaints**
Protection	**Closed**	**267**	**erosion control complaints**
Protection	Acquired	8	acres
Protection	Acquired	22	acres
Protection	**Acquired**	**30**	**acres**
Operations and Maintenance	**converted**	**all**	**city diesel-powered trucks to biodiesel**
Operations and Maintenance	**Continued**		**to follow IVM and IPM**
Operations and Maintenance	**Continued**		**use of trenchless liner repair system**
Operations and Maintenance	**C**onstructed, repaired, or replaced	**330**	**inlets**

Strategy	Activity	Number	Units
Operations and Maintenance	**C**onstructed, repaired, or replaced	**2,680**	**linear feet of inlet lead**
Operations and Maintenance	**C**onstructed, repaired, or replaced	**4,941**	**linear feet of culvert**
Operations and Maintenance	**Inspected**	**122**	**public pollution reduction facilities (2x each)**
Operations and Maintenance	**Inspected**	**319**	**private stormwater management facilities**
Operations and Maintenance	**Inspected**	**364**	**outfalls**
Operations and Maintenance	**Inspected and Cleaned**	**922**	**sumps**
Operations and Maintenance	**Inspected and Cleaned**	**16,500**	**catch basins**
Operations and Maintenance	**Inspected and Cleaned**	**11,700**	**linear feet of swales and ditches**
Operations and Maintenance	**Removed**	**11 million gallons**	**non-stormwater discharge from the Portland Building**
Education, Involvement, Stewardship	**A**warded	**24**	**Stewardship grants**
Education, Involvement, Stewardship	Conducted	1	Bureau wide Earth Day event
Education, Involvement, Stewardship	Conducted	1	Naturescaped Yard Tour
Education, Involvement, Stewardship	Conducted	11	Naturescaping Basics workshops
Education, Involvement, Stewardship	Conducted	4	Naturescaping Site Planning I workshops
Education, Involvement, Stewardship	Conducted	1	ReThink training series
Education, Involvement, Stewardship	Conducted	6	tree walks
Education, Involvement, Stewardship	sponsored	6	events
Education, Involvement, Stewardship	sponsored	1	events
Education, Involvement, Stewardship	sponsored	6	events
Education, Involvement, Stewardship	sponsored	1	events
Education, Involvement, Stewardship	sponsored	1	events
Education, Involvement, Stewardship	**sponsored**	**39**	**Events**
Education, Involvement, Stewardship	Reached	7,312	K-12 students
Education, Involvement, Stewardship	Reached	5,555	K-12 students
Education, Involvement, Stewardship	Reached	1,709	K-12 students
Education, Involvement, Stewardship	Reached	3,374	K-12 students

Strategy	Activity	Number	Units
Education, Involvement, Stewardship	**Reached**	**17,950**	**K-12 students**
Education, Involvement, Stewardship	Reached	600	Tree Volunteers
Education, Involvement, Stewardship	Reached	554	Tree Volunteers
Education, Involvement, Stewardship	**Reached**	**1,154**	**Tree Volunteers**
Education, Involvement, Stewardship	Trained	228	teachers
Education, Involvement, Stewardship	Trained	31	Volunteers
Education, Involvement, Stewardship	Trained	140	Volunteers
Education, Involvement, Stewardship	Trained	28	Volunteers
Education, Involvement, Stewardship	**Trained**	**427**	**teachers and volunteers**