Bureau of Environmental Services • City of Portland

Palatine Subwatershed Improvement Strategies Report

2010

Willamette Watershed Team

Environmental Services
City of Portland
working for clean rivers

Dan Saltzman, Commissioner • Dean Marriott, Director

June 2010

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— CITY OF PORTLAND —
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ▪ Dan Saltzman, Commissioner ▪ Dean Marriott, Director

June 15, 2010

Dear Friends of Portland's Watersheds:

I am pleased to present this *Palatine Subwatershed Improvement Strategies Report* for the Willamette Watershed. This document helps guide the City of Portland's ongoing efforts to manage stormwater runoff and protect and restore our waterways and natural areas. The report describes the current conditions of the Palatine subwatershed and identifies opportunities to protect and improve watershed health.

In March 2006, City Council adopted the Portland Watershed Management Plan (PWMP). The plan describes the city's comprehensive, strategic, and integrative approach to improving watershed conditions. It identifies watershed health goals in hydrology, physical habitat, water quality and biological communities and outlines strategies and actions to meet these goals.

The *Palatine Subwatershed Improvement Strategies Report* builds upon the principles of the PWMP. Taking a watershed approach, we have identified opportunities to manage stormwater runoff, to protect and improve aquatic and terrestrial habitat and to revegetate our natural areas. This approach is based upon collaboration with landowners, neighborhood groups, non-profits and local agencies to achieve the greatest benefits from our collective actions.

Currently, we are developing Improvement Strategies Reports for each of the Willamette watershed's 27 subwatersheds. This report completes the Bureau of Environmental Services' Improvement Strategies inventory for all of southwest Portland. This report includes a list of 75 prioritized projects and recommendations. Building upon our collaborative efforts, a number of these projects are slated to be implemented including: oak habitat restoration on Elk Rock Island, invasive species work on Bishop's Close and other nearby properties, and outreach to park users about the special habitat features at Elk Rock Island.

In addition to guiding the work of our bureau, it is our hope that this report will provide residents and friends of the Palatine subwatershed an opportunity for community stewardship of their local stream basin. Together, we can work to improve water quality and watershed health, and to protect and restore our natural resources.

Sincerely,

Paul Ketcham

Paul Ketcham
BES Willamette Watershed Manager

South Subwatersheds Improvement Strategies

Palatine Subwatershed Improvement Strategies Final Report

Environmental Services
City of Portland
Watershed Services Group
Willamette Watershed

Final – June 15, 2010

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ACRONYMS

ACOE	Army Corps of Engineers
BMP	best management practice
BPS	Bureau of Planning and Sustainability (formerly Bureau of Planning)
BES	Bureau of Environmental Services
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
EDRR	Early Detection Rapid Response
EIA	effective impervious area
ESA	Endangered Species Act
GIS	Geographic Information Systems
IPM	Integrated Pest Management
IS	Improvement Strategies
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
NRI	Natural Resources Inventory
NPDES	National Pollutant Discharge Elimination System
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OWEB	Oregon Watershed Enhancement Board
PBOT	Portland Bureau of Transportation
PP&R	Portland Parks and Recreation
PWMP	Portland Watershed Management Plan
SHA	Special Habitat Area
SWMM	Stormwater Management Manual
SWCD	Soil and Water Conservation District
SWMP	Stormwater Management Plan
TCWTP	Tryon Creek Water Treatment Plant
TEES	Terrestrial Ecology Enhancement Strategy
TM	technical memorandum
TMDL	Total Maximum Daily Loads
USB	Urban Services Boundary
WRDA	Water Resources Development Act

Executive Summary

The Bureau of Environmental Services (BES) Willamette Watershed team has developed Improvement Strategies (IS) reports for the Willamette River watershed's south subwatersheds. The reports identify and prioritize opportunities to protect and improve watershed conditions in the Riverview and Palatine subwatersheds.

Improvement Strategies are groups of actions that individually and collectively improve watershed health. The actions are guided by the goals and objectives outlined in the Portland Watershed Management Plan (PWMP), a plan developed by the City of Portland in 2005 to improve watershed health and to protect and restore natural resources. The IS reports identify and rank recommended projects based on PWMP goals of improving hydrology, water quality, physical habitat, and biological communities.

The purpose of the Riverview and Palatine subwatershed IS reports is to provide a guide for City staff as well as other interested stakeholders such as local agencies, non-profits, and volunteer citizen groups, to focus resources and efforts on actions that will best benefit watershed health. Projects are organized by the following strategies: Stormwater Management, Revegetation, Aquatic and Terrestrial Enhancement, Protection and Policy, Operations and Maintenance, and Education, Involvement, and Stewardship.

The IS process is conducted at the subwatershed scale for a number of reasons. First, the subwatershed scale has been identified as the most effective for evaluating watershed improvements (Schueler and Holland 2000). Conditions that impact resources, such as impervious area, are more consistent and readily assessable at this scale. Second, it is more efficient to encourage and support community and individual stewardship at this scale (e.g., neighborhood groups are organized at a similar scale). Finally, this scale is fine enough to conduct thorough field assessments and allow accurate analysis of the extent to which the identified improvement opportunities can contribute to meeting each watershed objective.

The reports identify recommended actions, grouped as geographic and/or programmatic clusters. The actions were assembled for their ability to address areas that have been identified as important assets to protect or problems to solve in order to improve local subwatershed conditions. Recommendations have been made for the following areas/programs in the Palatine subwatershed: Bishop's Close, Lewis and Clark Campus, Peter Kerr/Elk Rock and Elk Rock Island, Fielding Wetlands Corridor, and Early Detection Rapid Response (EDRR)/Invasives outreach. Potential projects and programs for these areas include:

Table 1: Recommended Actions Grouped to Improve the Palatine Subwatershed

	Bishop's Close	Lewis and Clark Campus	Peter Kerr/Elk Rock and Elk Rock Island	Fielding Wetlands Corridor	South Portland Invasives
Stormwater Management Projects	• Bishop's Close Green Stormwater Project (37) • Bishop's Close Stormwater Filters (53)	• Lewis and Clark NW Campus Stormwater Facility (28) • Lewis and Clark Facilities Parking Lot B Swale (39) • Lewis and Clark Facilities Parking Lot A Retrofit (40) • Lewis and Clark Templeton Rain Gardens (43) • Lewis and Clark Fir Acres Parking Lot B Vegetated Infiltration Basin (44) • Lewis and Clark SW Residence Hall Drive Rain Garden (47)			
Aquatic and Terrestrial Enhancement Projects	• Bishop's Close--Special Habitat Protection and Enhancements (17) • Bishop's Close--Aquatic Habitat Enhancements	• Lewis and Clark North Tributary Stream Enhancement (23) • Lewis and Clark South Tributary Stream Enhancement (25) • Lewis and Clark Stormwater Outfall and	• Elk Rock Island East Bay Aquatic Habitat Enhancement (11) • Elk Rock/Peter Kerr Native Vegetation Protection and Enhancement (26) • Elk Rock Island Rock	• Fielding Wetland TriMet Aquatic Enhancement (55)	

	Bishop's Close	Lewis and Clark Campus	Peter Kerr/Elk Rock and Elk Rock Island	Fielding Wetlands Corridor	South Portland Invasives
	(59)	Repair and Maintenance: Palatine (60)	Outcrop Vegetation Protection and Enhancement (29) • Elk Rock Island Oak Woodlands (North) Protection and Enhancement (31) • Elk Rock Island Grassland Habitat Protection and Enhancement (32) • Elk Rock Island Oak Woodlands (South) Protection and Enhancement (33)		
Revegetation Projects	• Bishop's Close "Parterres" Vegetation Enhancement (48) • Bishop's Close "The Point" Vegetation Enhancement (50) • Bishop's Close "Spring Walk" Vegetation	• Lewis and Clark Revegetation (16)	• Elk Rock Island Upland Coniferous Forest Restoration and Enhancement (24) • Elk Rock Island Low Elevation Deciduous Forest Vegetation Enhancement (30) • Elk Rock Island West Bay Riparian Vegetation Enhancement (34)	• Fielding Corridor Revegetation and Education, Involvement and Stewardship (5)	• Fielding Corridor Revegetation and Education, Involvement and Stewardship (5) • Berry Botanic Garden Riparian Enhancement (14) • Lewis and Clark Revegetation (16) • Tryon Creek Confluence (A)--Lower Reach (22)

	Bishop's Close	Lewis and Clark Campus	Peter Kerr/Elk Rock and Elk Rock Island	Fielding Wetlands Corridor	South Portland Invasives
	Enhancement (52)				• Lewis and Clark North Tributary Stream Enhancement (23) • Lewis and Clark South Tributary Stream Enhancement (25) • Elk Rock/Peter Kerr Native Vegetation Protection and Enhancement (26) • Elk Rock Island Rock Outcrop Vegetation Protection and Enhancement (29) • Elk Rock Island Low Elevation Deciduous Forest Vegetation Enhancement (30) • Elk Rock Island Grassland Habitat Protection and Enhancement (32) • Elk Rock Island Oak Woodlands (North)

	Bishop's Close	Lewis and Clark Campus	Peter Kerr/Elk Rock and Elk Rock Island	Fielding Wetlands Corridor	South Portland Invasives
					Protection and Enhancement (33) • Elk Rock Island West Bay Riparian Vegetation Enhancement (34) • Bishop's Close "Parterres" Vegetation Enhancement (48) • Bishop's Close "The Point" Vegetation Enhancement (50) • Bishop's Close - "Spring Walk" (52)
Protection and Policy Projects	• Bishop's Close Integrated Pest Management (12) • Peter Kerr--Adjacent Conservation Easements (45)		• Elk Rock Island East Bay Buffer and Aquatic Enhance-ment Property Acquisitions (3) • Elk Rock/Peter Kerr Natural Area Peregrine Falcon Eyrie Protection (27) • Peter Kerr--Adjacent Conservation Easements (45)	• Fielding Wetlands Conservation Easements (1)	• EDRR Policy • Invasive Species Policy • Bishop's Close Integrated Pest Management (12)

	Bishop's Close	Lewis and Clark Campus	Peter Kerr/Elk Rock and Elk Rock Island	Fielding Wetlands Corridor	South Portland Invasives
Education, Involvement and Stewardship Projects	• Bishop's Close Neighbor/ Landowner Educational Outreach (35)	• Lewis and Clark Stormwater Outreach (2) • Lewis and Clark Maintenance Outreach (3)	• Elk Rock Island Natural Area Education, Outreach and Stewardship (21)	• Fielding Corridor Restoration Public Outreach (10)	• Invasive Species Outreach • Naturescaping and Yard Tree outreach • Bishop's Close Neighbor/ Landowner Educational Outreach (35)
Operations and Maintenance					• Maintenance Staff Best Management Practice (BMP) Program

SECTION 1: PURPOSE

This report summarizes the Improvement Strategies (IS) process to improve and protect watershed health in the Palatine subwatershed, which is located at the southwestern-most portion of the lower Willamette Watershed. Improvement Strategies are categories of actions that can be taken to improve watershed conditions. The main element of this report is Section 6, which lists and ranks specific projects that have been identified through the IS process to improve the health of the Palatine subwatershed.

The IS process is guided by the 2005 Portland Watershed Management Plan (PWMP; City of Portland 2005a). The PWMP, adopted by Portland City Council in 2006, provides a long-term adaptive management approach for identifying, implementing, measuring, and evaluating improvements to watershed conditions. The PWMP uses a watershed approach to outline objectives and strategies for improving watershed health while meeting the City of Portland's (City) and the Bureau of Environmental Services' (BES) missions, BES service responsibilities, and environmental regulations. The watershed approach considers all activities that affect watershed conditions and maximizes the use of limited resources by looking for solutions that meet multiple objectives. This IS report provides the analysis necessary to identify implementation options and create recommendations that help to achieve these objectives in the Palatine subwatershed.

The IS process is conducted at the subwatershed scale to identify opportunities that will contribute to cumulative improvements for Portland's Willamette Watershed and the Willamette River channel as a whole. The subwatershed scale has been identified as the most effective for evaluating watershed improvements (Schueler and Holland 2000). Conditions that impact resources, such as impervious area, are more consistent and readily assessable at this scale. It is more efficient to encourage and support community and individual stewardship at this scale; citizens generally have higher levels of knowledge and interest in the conditions of their local area or stream basin. In addition, neighborhood associations are organized at a similar scale, providing stewardship opportunities for individual and community actions to improve watershed health. Finally, the subwatershed scale is fine enough to conduct thorough field assessments and allow accurate analysis of the extent to which the identified improvement opportunities can contribute to meeting each watershed objective.

The Palatine IS objectives are built off of the specific conditions that were identified in the Palatine Subwatershed Characterization (City of Portland 2009). Opportunities to improve watershed health have been identified through a comprehensive process that included data analysis, review of available information about current and historical subwatershed conditions, field assessments, stakeholder involvement, and City staff input. Potential opportunities are organized by the following strategies: stormwater management; revegetation; aquatic and terrestrial enhancement; protection and policy; operations and maintenance; and education, involvement, and stewardship.

SECTION 2: BACKGROUND

Improvement Strategies Process

The purpose of the IS process is to identify specific project and program opportunities to protect and improve subwatershed health. These specific opportunities, called actions, are identified through a series of steps that collectively make up the IS process. These steps, and their supporting technical memoranda for the Palatine subwatershed, are:

Table 2: Improvement Strategies Process and Work Products

Step	Technical Memoranda	Description
Project Management		Plans, schedules, and coordinates each step, and ensures they are completed in a satisfactory and timely manner.
Characterization	Palatine Subwatershed Characterization Summary Technical Memorandum (TM)	Reviews and documents existing subwatershed analysis, conditions data, and information on action opportunities.
	Palatine Subwatershed Pipe System Data Analysis and Review TM	
	Palatine Subwatershed Data Analysis and Review TM	
Stakeholder Input	Palatine Subwatershed Stakeholder Input Summary TM	Identifies all key stakeholders, keeps them informed, and obtains their input throughout the IS process.
IS Development	Improvement Strategies Development TM	Identifies opportunities to apply strategies and implement specific actions. Identifies and ranks subwatershed objectives. Completes field work to identify on-the-ground actions.
IS Evaluation	Improvement Strategies Evaluation TM	Prioritizes, maps, and evaluates actions identified in the IS Development step.
Reporting and Information Management	Palatine Subwatershed Improvement Strategies Report	Ensures all information collected is documented and shared appropriately to maximize the utility of the work.

Technical memoranda are available by contacting Anne Nelson of the Willamette Watershed Team at (503) 823-2584, or at anne.nelson@bes.ci.portland.or.us.

Characterization Overview

Palatine is a 792.2 acre subwatershed that begins at the southwesternmost point of the City of Portland limits. It is bounded by the ridgeline of the Tryon Creek watershed to the west, and by the Willamette River (approximate river mile 17.25 to 20.00) on the east. The northern extent begins just north of the Portland city limit line at the river and extends to just north of the Tryon Creek confluence with the Willamette River and the City of Lake Oswego (Figure 1, at the end of this section).

Approximately three-fourths of the Palatine subwatershed is unincorporated Multnomah County [area outside the City of Portland, but within Portland's Urban Services Boundary (USB)]. Portland's USB was adopted in cooperation with Multnomah County for the area that the City intends to provide urban services at some point in the future as the urban area expands. The remaining area, approximately one-fourth of the Palatine subwatershed, is outside of the USB in unincorporated Clackamas County. Some taxlots in Clackamas County are within the City of Lake Oswego's jurisdiction.

Slopes are varied throughout the subwatershed. The north-central portions and the bluffs above the Willamette River have slopes greater than 20 percent. In much of the remaining area, slopes are less than 15 percent.

Four streams, some with small tributaries, flow toward the Willamette River in this subwatershed. All have stream gradients greater than 30 percent, with some sections of tributaries reaching 60 percent. The streams are relatively unaltered and typically occupy their historic channels. Upper reaches flow through relatively intact riparian canopies. However, there are some culverted sections under residential streets. A substantial reach of the southernmost stream is culverted along SW Riverside Drive. The northernmost stream confluence is on public property, within Powers Marine Park. The other three stream confluences are on private property.

The subwatershed is made up of second growth forest in transition from an early to later succession stage. Douglas fir *(Pseudotsuga menziesii)* is the dominant tree species. Red alder *(Alnus rubra*), bigleaf maple *(Acer macrophyllum)*, western red cedar *(Thuja plicata*) and western hemlock

(Tsuga heterophylla) are found along the steeper slopes and in riparian areas. Native understory vegetation includes vine maple (*Acer circinatum),* western hazelnut *(Corylus cornuta)* and Indian plum (*Oemleria cerasiformus).* Oregon white oak (*Quercus garryanna*) and Pacific madrone *(Arbutus menziesii*) communities are found along the bluffs above the Willamette River, with black cottonwood *(Populus balsamifera ssp. trichocarpa*), red alder *(Alnus rubra*), Oregon ash *(Fraxinus latifolia*) and willow *(Salix species*) along the riverbank.

The Palatine subwatershed has an abundance of large trees distributed throughout the subwatershed. Large-lot residential development, however, has fragmented the forest vegetation and relatively few contiguous forest areas exist. Still, the large number of mostly native trees and their overall distribution creates a significant overstory, especially when compared to other Willamette subwatersheds. A 2001 inventory of the unincorporated Multnomah County area of the subwatershed identifies a number of special status plant species as *potentially* occurring in the Dunthorpe area including white rock larkspur *(Delphinium leucophaeum),* Howell's montia (*Montia howellii),* Oregon sullivantia (*Sullivantia oregana*) and Columbia watermeal (*Wolffia columbiana*).

The vegetation, forested slopes, and ravines of the Palatine subwatershed provide diverse habitats for populations of birds and other wildlife. Trees line much of the Willamette River bank in this reach which help to shade the river and provides cover for migratory and resident species. The proximity to the river and high quality habitats such as Ross Island to the north, Tryon Creek State Natural Area to the west, and Elk Rock Island to the east, positions the Palatine subwatershed in the center of a significant bird and wildlife habitat corridor. Bird species observed include: black-capped chickadee, song sparrow, Oregon junco, winter wren, northern flicker, pileated woodpecker, bald eagle and peregrine falcon. Amphibians, reptiles, and small mammals are likely utilizing the riparian and upland forested areas.

Within the City of Portland, the Palatine subwatershed is zoned Institutional Residential and contains the Lewis and Clark College campus. Outside the city limits, unincorporated Multnomah County is zoned Single Family Residential and includes the Dunthorpe neighborhood, typified by single family homes on large, wooded lots separated by undeveloped, wooded areas. Zoning designations do not apply to areas in unincorporated Clackamas County. Development has primarily been low-density residential, with a few

higher density portions along the Willamette River bank around SW Riverwood Road and SW Fielding Road.

Within the USB, environmental overlay zones occupy 104.5 acres of the subwatershed. Environmental Protection (p) zones make up 36.1 acres (4.56 percent of the subwatershed). Conservation (c) zones comprise 68.4 acres (8.63 percent of the subwatershed). The River General (G) Greenway overlay zone applies along the Willamette River throughout the subwatershed within Multnomah County boundaries. The Greenway overlay zone is intended to protect, conserve, enhance, and maintain the natural, scenic, historical, economic, and recreational qualities of lands along the Willamette River.

The Palatine subwatershed is predominantly private land; relatively little is public (9.6 acres). Public land includes Powers Marine Park (1.0 acres), the Peter Kerr property (3.1 acres) managed by Portland Parks and Recreation (PP&R), and the Riverdale Elementary School (5.5 acres) managed by the Riverdale School District. Outside of the USB, TriMet owns approximately 5 acres along SW Fielding Road. Elk Rock Island (13 acres) is also public land. The island is outside of the USB and the Palatine subwatershed boundary, but is included in this report due to the importance of this resource as a special habitat area. Additionally, it is owned and managed by PP&R.

The main transportation corridor within the Palatine subwatershed is SW Riverside Drive (Highway 43) which runs parallel to the river. The corridor is a barrier between the uplands of River View Cemetery and the Willamette River to wildlife passage for both aquatic and terrestrial biological communities.

The sanitary and stormwater systems in the Palatine subwatershed are separated. Stormwater is conveyed through ditches or storm pipes that discharge to one of the four streams or directly to the Willamette River. The City of Portland, through an Intergovernmental Agreement with Multnomah County, maintains some of the stormwater infrastructure within the USB. Outside of the USB, stormwater flows through ditches maintained by the Clackamas County Transportation Department (Figure 3, at the end of this section).

Stormwater that is transported through public storm infrastructure and discharged into a water body is regulated under a permit issued by the Oregon Department of

Environmental Quality (DEQ) under the federal Clean Water Act (CWA). The permit, called the Phase I National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit, requires that the responsible jurisdiction develop and implement a Stormwater Management Plan (SWMP) in order to control pollutants from stormwater to the maximum extent practicable. Multnomah County is a co-permitee with the City of Portland for a MS4 NPDES permit that covers stormwater discharge from the area within the USB. Many of the projects identified in this subwatershed IS report will help meet MS4 objectives.

The Willamette River is the major receiving water for stormwater drainage from the Palatine subwatershed. The MS4 drainage basins in this subwatershed are under Multnomah County jurisdiction. There are nine MS4 basins that have been delineated in the Palatine subwatershed. All outfalls receive stormwater only (Table 3).

Table 3: Outfall Summary Information for the Palatine Subwatershed

MS4 Drainage Basin	Acres	Jurisdiction
ADH 815	0.78	Multnomah County
ADH 825	35.79	Multnomah County
ADH 830	1.37	Multnomah County
ADH 843	7.92	Multnomah County
ADH 848	1.33	Multnomah County
ADL 430	57.25	Multnomah County
ADL 479	48.54	Multnomah County
ADM 953	3.24	Multnomah County
ADN 080	32.94	Multnomah County

Sanitary flows in the Palatine subwatershed are conveyed through the Willamette Interceptor, the main sanitary sewer trunk line that connects to the Tryon Creek Wastewater Treatment Plant (TCWTP). The TCWTP is owned and operated by the City of Portland and located in Lake Oswego.

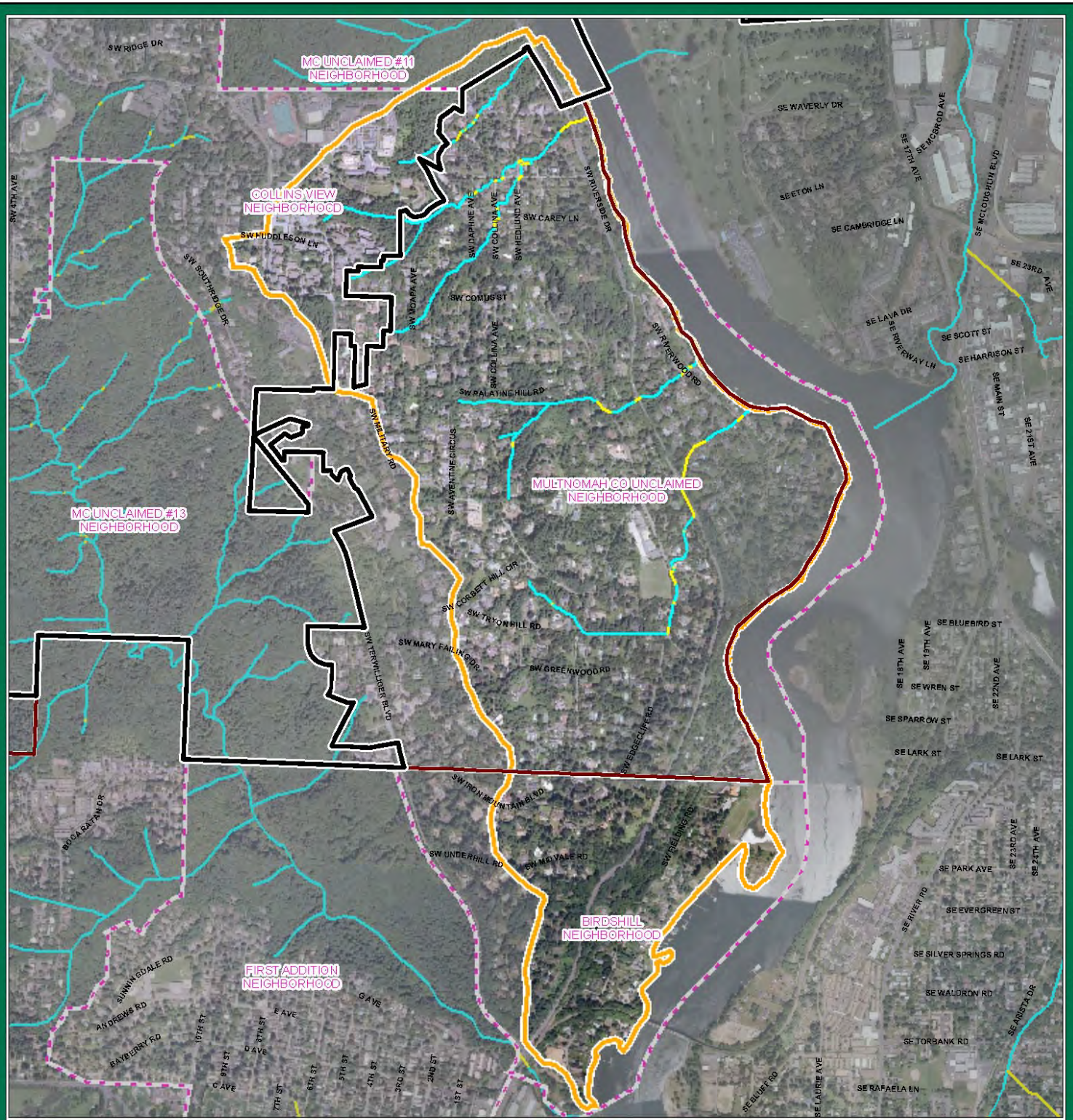
Most of the flow connecting to this line is served by the Dunthorpe-Riverdale Sanitary Service District No. 1 (District). The District is governed by Multnomah County; Multnomah County contracts with the City of Portland for sewage conveyance and treatment, collection system maintenance, and engineering services.

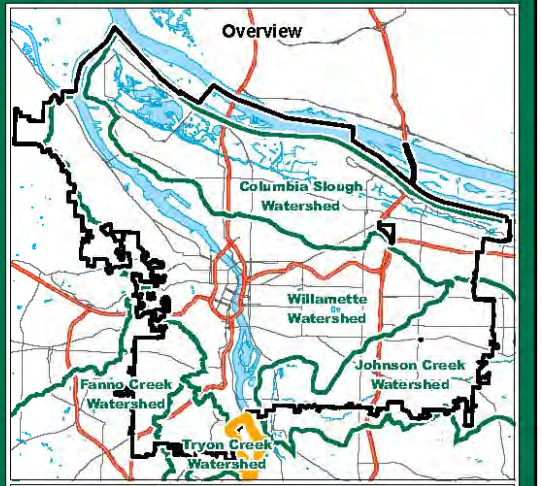
Lewis and Clark College is located outside of the District, but the sanitary discharges of the North and South campus flow into the District. The college pays the City of Portland directly for sanitary services, but the sewage flows through the District's facilities.

Private property owners that are located along the edge of the District boundary, but not included in the District, have private septic systems for the treatment of their sanitary

flows. When a septic system begins to fail, it is common for a property owner to request to be annexed into the District.

A small number of properties (including those within Clackamas County) also discharge sanitary flow directly to the Willamette Interceptor, but are not part of the District.





Legend

- City of Portland
- Urban Services Boundary
- Subwatershed Boundary
- Neighborhood Boundaries
- Open Channel Streams
- Stormwater Pipe or Culvert
- Combined Stormwater/Sewer Pipe

1 inch equals 1,500 feet

0 1,500 3,000 Feet

N W E S

City of Portland
Environmental Services
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-1
Palatine
Subwatershed Overview

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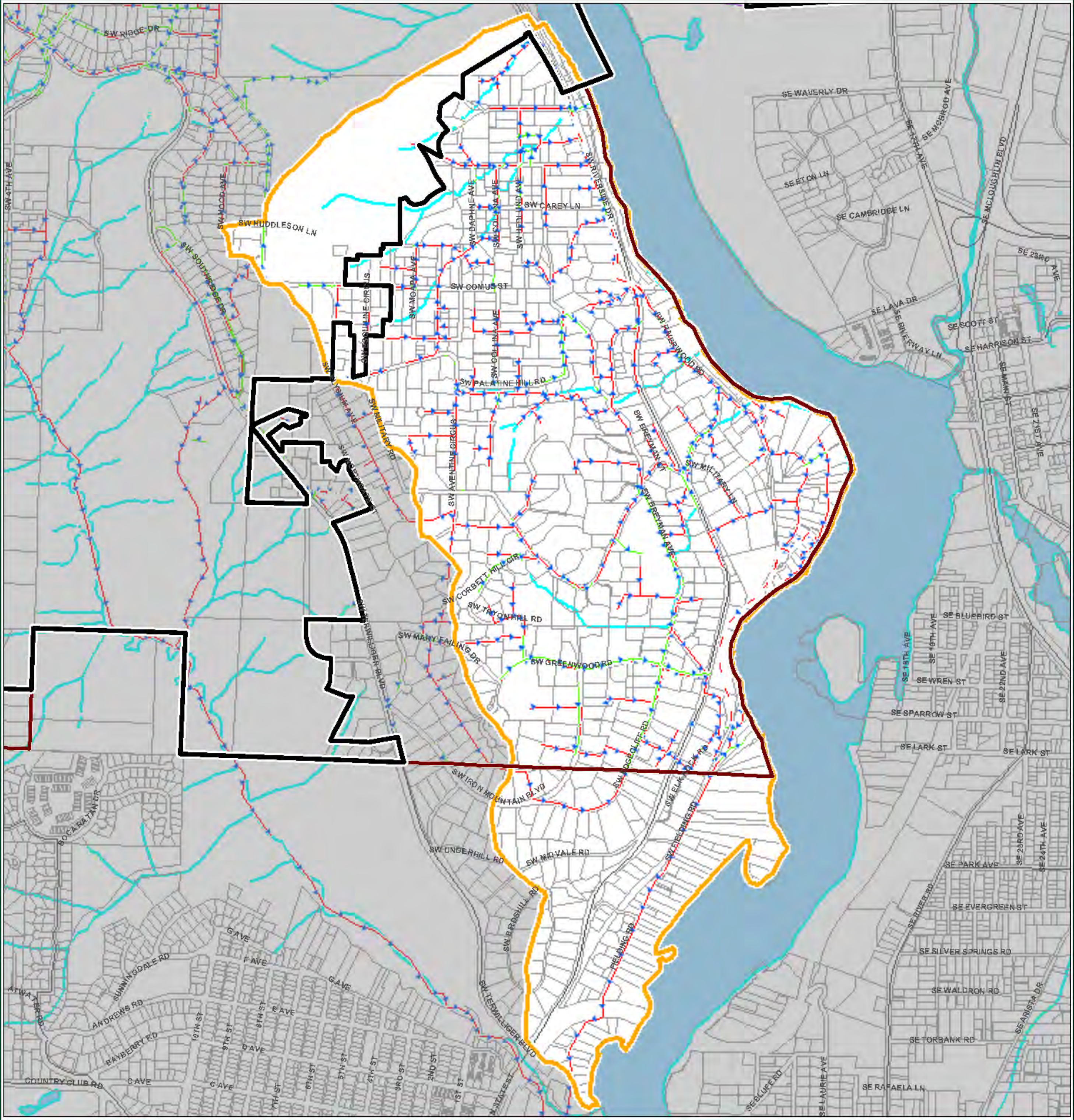

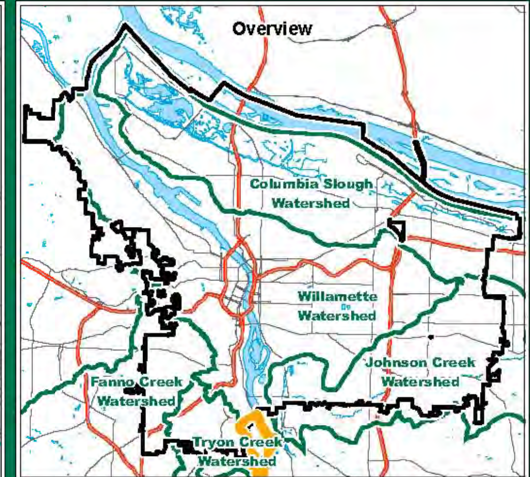

Legend

- City of Portland
- Urban Services Boundary
- Subwatershed Boundary
- Existing Taxlots
- Freeways
- Open Channel Streams

Existing Sewer System

- Sanitary Sewer Pipes
- Sanitary Pressure Mains
- Combined Sewer Pipes
- Stormdrain Pipes

1 inch equals 1,500 feet

0 — 1,500 — 3,000 Feet

N / S / E / W

City of Portland Environmental Services
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-2
Palatine
Infrastructure

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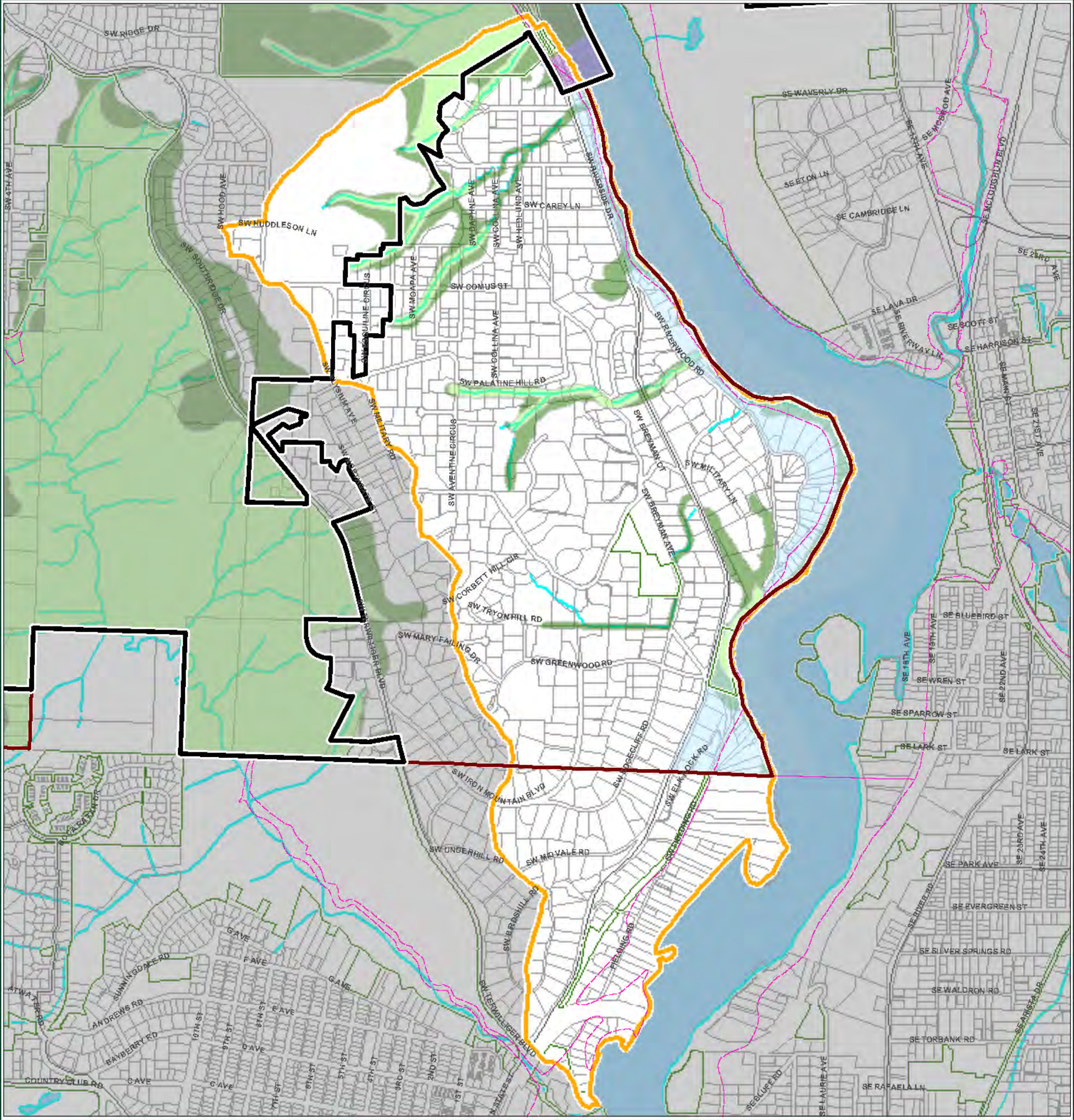

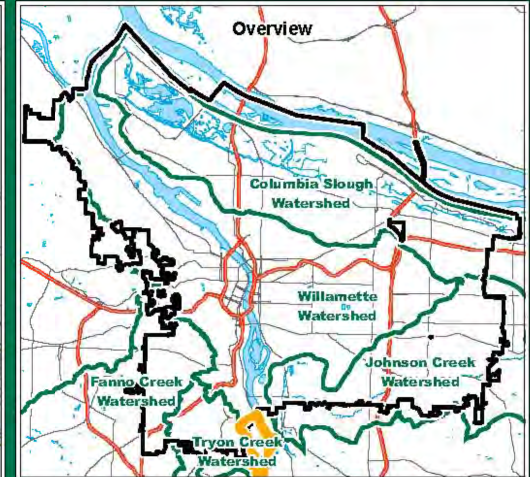

Legend

- City of Portland
- Urban Services Boundary
- Subwatershed Boundary
- 100yr Floodplain
- Parks and Open Spaces
- Existing Taxlots
- Freeways
- Open Channel Streams

Environmental Zones

- Conservation
- Protection

Greenway Zones

- g River General Overlay Zone
- n River Natural Overlay Zone
- r River Recreational Overlay Zone
- q River Water Quality Overlay Zone
- gq River General Overlay Zone / River Water Quality Overlay Zone
- nq River Natural Overlay Zone / River Water Quality Overlay Zone
- rq River Recreational Overlay Zone / River Water Quality Overlay Zone

1 inch equals 1,500 feet

0 — 1,500 — 3,000 Feet

City of Portland Environmental Services
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-3
Palatine
Natural Resources

Project No.	Date Printed:
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SECTION 3: SUBWATERSHED CONDITIONS

This section describes significant asset and problem areas in the Palatine subwatershed. These areas were identified during a detailed review of existing information on subwatershed conditions. This review and subsequent analysis are documented in the following technical memoranda (TM):

- *Palatine Subwatershed Characterization Summary TM*
- *Palatine Subwatershed Pipe System Data Analysis and Review TM*
- *Palatine Subwatershed Data Analysis and Review TM*

Technical memoranda are available by contacting Anne Nelson of the Willamette Watershed Team at (503) 823-2584, or at anne.nelson@bes.ci.portland.or.us.

Palatine Subwatershed Significant Asset Areas

For the purposes of this report, asset areas are areas that provide important or unique watershed benefits. Designation as an asset area generally follows recommendations made by two previous City efforts: 1) the City's Draft Natural Resource Inventory: Riparian Corridors and Wildlife Habitat Project Report (NRI), a citywide project to revise and update existing information on natural resources in Portland [Bureau of Planning and Sustainability (BPS)] and 2) the City's Terrestrial Ecology Enhancement Strategy (TEES), that identifies priority wildlife, plant species and terrestrial habitats for protection, conservation, and/or restoration. TEES prioritizes key management and control issues (City of Portland 2007a). Assets were also identified through internal and external stakeholder input.

Sanitary and stormwater infrastructure is also an asset. All pipes within the basin are part of a separated sewer and stormwater system. Stormwater infrastructure includes 8,596 feet of storm pipes and 49 culverts totaling 2,648 feet in length. Sanitary pipes total 66,569 feet in length.

The Palatine subwatershed has a number of unique assets, such as a low level of impervious area. The distribution of low density, single family homes sited on large, wooded lots throughout the subwatershed results in a low total impervious surface. The amount of impervious area in a subwatershed is important to watershed health. High levels of impervious area contribute to increased stormwater runoff volumes and velocities that can cause streambank instability, erosion, undercutting, in-stream sedimentation, and channel incision. Studies have shown that impervious cover greater than 10 percent impairs watershed health by reducing urban stream stability and results in unstable and eroding stream channels (Booth 1991). Although Palatine's current 15 percent impervious cover exceeds this threshold, it is at the lower limits. Maintaining this rate will protect watershed health in the Palatine subwatershed. Stormwater management project opportunities such as green streets and ecoroofs that will help reduce effective impervious area (EIA) are outlined in Section 6.

Additional assets in the Palatine subwatershed are described geographically below (Figure 4, at the end of this section).

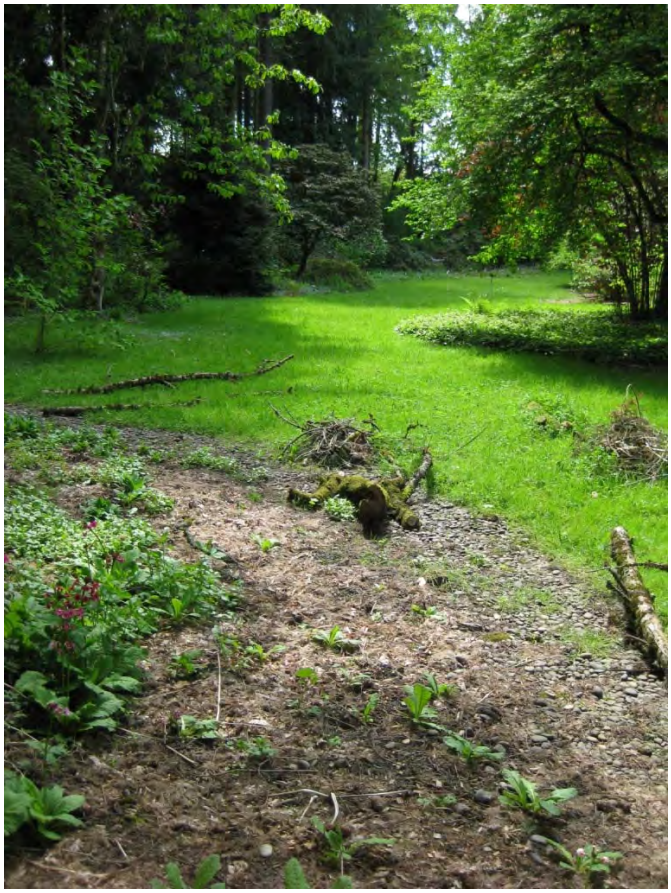
Willamette River Channel and Shoreline

The Willamette River serves as a migratory path for anadromous fish, birds, and other wildlife. The City's Draft NRI identifies the river's beaches and shallow water habitat as Special Habitat Areas (SHA; City of Portland 2007b). Special Habitat Areas contain sensitive or unique natural features that may support sensitive or threatened fish or wildlife species. The City's TEES identifies the river corridor as a site with high restoration value.

The Willamette River in Portland has been designated as critical habitat for Chinook salmon and steelhead, which are provided protection under the Endangered Species Act (ESA). The Ross Island to Sellwood reach of the river, just north of the Palatine subwatershed, has been identified as an important rearing and refuge complex for juvenile salmonids as they migrate from spawning habitats in the upper Willamette and Clackamas rivers. The reach has diverse and abundant shoreline vegetation, gently sloping beaches, and a natural riverbed relative to other river reaches within the City.

Berry Botanic Garden

Berry Botanic Garden is a 6 acre privately-owned botanical collection at 11505 SW Summerville Avenue (see photo). The garden is dedicated to native plants, particularly rock plants and rhododendrons, as well as seed collection and rare plant conservation. The garden is open to the public and offers conservation, horticulture, and education programs. Two forks of an unnamed tributary meet in the forested area of the property and provide food and cover resources for area wildlife.



Bishop's Close

This 13 acre property located at 11800 SW Military Lane, formerly the Peter Kerr estate, was given to the Episcopal Diocese of Oregon in 1959. It includes 6 acres of formal English garden, designed by Olmsted and Sons, and steep rocky bluff facing Elk Rock Island just north of the Peter Kerr property. The bluff contains native Oregon white oak, Douglas fir and Pacific madrone communities. The trees along the bluff serve as perch

and roost trees for peregrine falcons and bald eagles. The property has been identified as a TEES habitat management opportunity area.

Peter Kerr Property/Elk Rock

Peter Kerr property is a 3.1 acre natural area managed by PP&R (see photo). The property, commonly referred to as Elk Rock, is located to the south of Bishop's Close on a bluff overlooking the Willamette River, directly west of Elk Rock Island. Dominant tree species are Oregon white oak and bigleaf maple. The trees along the bluff serve as perch and roost trees for peregrine falcons and bald eagles.

Elk Rock Island

Elk Rock Island Park is a 15 acre island in the Willamette River owned and managed by PP&R. The island is within unincorporated Clackamas County, abutting the City of Milwaukie and is accessible by foot at low water. The island contains a richness of diverse plant and animal species. The exposed rock, emergent wetlands, and riparian and upland forest provide food, cover, roosting and breeding habitat for a wide range of birds, mammals, reptiles, amphibians and invertebrates. Rare and/or unusual plants that have been found on the island include: Pacific yew *(Taxus brevifolia)*, tiger lily (*Lilium columbianum*), hyacinth cluster lily (*Tritelia hyacintha)*, harvest cluster lily *(Brodiaea coronaria*), western rattlesnake orchid *(Goodyera oblongifolia*), and gum-weed *(Grindelia integrifolia*). Dominant tree species are black cottonwood, bigleaf maple, and Douglas fir, with lesser amounts of Oregon white oak. The TEES report identifies Elk Rock Island as an opportune location to enhance, protect, and restore habitat for several special status species and special status habitats. It is also identified as an anchor habitat[1].

[1] Anchor habitats are sites that are relatively large (e.g., generally over 30 acres) and currently provide conditions and functions favorable to biological communities.

SW Fielding Wetlands

A series of inventoried wetlands exist along SW Fielding Road in unincorporated Clackamas County (see photo). The wetlands, totaling approximately two acres, are located primarily on private properties. One wetland area is located within the public rail line right of way. Off site assessments conducted by BES Willamette Watershed staff for this report suggest that the wetlands have been altered from their historic extent.

Lewis and Clark College

Over half of the 137 acre Lewis and Clark College campus lies within the Palatine subwatershed, all within Portland city limits. The eastern portion of the campus is comprised of forested ravines and ridges that contain the headwaters of two small tributary streams. The northernmost part of the campus is identified as a TEES habitat anchor and a habitat management opportunity area in large part due to its proximity to River View Cemetery.

River View Cemetery

A small portion (approximately 10 acres) of River View Cemetery is located in the Palatine subwatershed. The cemetery consists of 222 acres; 185 acres have almost continuous forest cover. The area provides a critical upland habitat connection between the natural areas of Forest Park, Washington Park, and Marquam Nature Park to the north and Tryon Creek State Natural Area to the south. It is identified by TEES as a habitat anchor and a habitat management opportunity area.

Tryon Cove

Tryon Cove Park is located at the confluence of Tryon Creek and the Willamette River. The 6.5 acre natural area is comprised of parcels owned by the City of Portland, the City of Lake Oswego and Metro. Most of the area is outside of the Palatine subwatershed and in the City of Lake Oswego. The City of Portland and Oregon Department of Transportation (ODOT) recently completed a fish passage project at the Highway 43 culvert located here. The City is currently designing a stream enhancement project at the

Willamette confluence that will improve in-stream and stream bank habitat quality and complexity, improve floodplain connectivity, and improve riparian and upland habitat by recontouring bank slopes, placing large wood for salmonids, removing invasive plants, and establishing native plant communities. Construction is slated for summer 2010.

Powers Marine Park

Powers Marine Park is a 13.07 acre linear park along the west bank of the Willamette River (see photo). Most of the park is located within the Riverview subwatershed, although the southernmost extent is located within the Palatine subwatershed. The City's TEES has identified the park as a habitat management opportunity area.

Westside Wildlife Corridor

The Westside Wildlife Corridor is the forested spine of the west hills. It helps protect remnants of natural habitat by connecting them to its continuous cover from Forest Park south to Tryon Creek State Natural Area (PP&R 2007). The map of natural area acquisition target areas (PP&R 2008) shows most of the Palatine subwatershed as part of the corridor, though no areas within the subwatershed are targeted for acquisition.

Dunthorpe Oaks Special Habitat Area

This special habitat designation[2] in the Dunthorpe neighborhood acknowledges the presence of Oregon white oak habitat in a 21 acre area southwest of Portland. This special status habitat is also recognized by Oregon Department of Fish and Wildlife (ODFW) as a habitat of concern (ODFW 2006).

Palatine Subwatershed Significant Problem Conditions

For the purpose of this report, "problems" are defined as issues that will need to be resolved to a measured extent in order to achieve watershed health objectives defined in the 2005 PWMP. The problems were identified through a review and analysis of Geographic Information Systems (GIS) data, planning documents, scientific research, stewardship activities, inventories, field assessments, and input from City staff, external stakeholders, and residents. The problems described below are specific to the Palatine subwatershed, and are organized by their relationship to the citywide watershed health goals and objectives defined in the PWMP.

PWMP Objective: Terrestrial Habitat

Palatine Subwatershed Problem Condition: The watershed function and habitat value of the terrestrial areas throughout the subwatershed are currently degraded.

Source of Problem Condition: The quantity, connectivity, and distribution of terrestrial habitat have been impacted, and continue to be threatened by residential development. Loss and fragmentation of forest canopy, native vegetation, and the prevalence of invasive plant species have reduced the amount and degraded the quality and connectivity of terrestrial wildlife habitat.

Invasive plants are usually introduced into an environment (i.e., are not native) and spread at such a rate that they cause harm to human health, the environment, and/or the economy. They grow and reproduce quickly, out-compete native species, and

[2] All habitat types in Portland were identified, and those considered as having importance (because they are State Strategy Habitats or are of particular importance in Portland and the Metro area) were identified as Special Status Habitats.

reduce habitat diversity for biological communities. Many invasive plant species have shallow root systems that do little to hold the soil and control erosion, especially on stream banks.

The relatively plentiful forested canopy in the Palatine subwatershed is fragmented by large-lot residential development. The plant communities have been further impacted by the proliferation of invasive plant species. Multnomah County surveys have found that English ivy has overrun most county sites in the Palatine subwatershed. Western clematis and Himalayan blackberry are also prevalent (City of Portland 2001).

PWMP Objective: Aquatic Habitat

Problem conditions associated with this PWMP objective relate to both the Willamette River mainstem and to its tributary streams within the Palatine subwatershed.

Willamette River Problem Condition: The quality and quantity of aquatic habitats have been reduced. Historic off-channel and shallow water habitats, limited in this reach of the river due to rocky and steep terrain, have been reduced or eliminated.

Source of Problem Condition: Development in the floodplain, vegetation removal and the proliferation of invasive plant species have reduced and degraded channel habitat extent and value in the Palatine subwatershed.

Palatine Subwatershed Streams Problem Condition: Stream reaches in the Palatine subwatershed are likely degraded. Culverts beneath Highway 43 and other streets throughout the Palatine subwatershed pose accessibility barriers to aquatic organisms.

Source of Problem Condition: Development and the subsequent hydrologic alterations, water quality impacts, and vegetation removal have reduced stream channel habitat extent and value. Invasive plant species have likely further impacted aquatic habitats. The subwatershed tributary streams do not support any known local fish communities. The culverts beneath Highway 43 impede passage for Willamette River fish communities. Data are not available for other aquatic organisms.

Data gaps: The four stream reaches that originate in the upper Palatine subwatershed run through private residential properties; the conditions of which are largely unknown. Additional study is needed to determine the conditions, extent, and type of aquatic habitat in the Palatine subwatershed streams including: historic extent of fish habitat and the current use and extent of aquatic habitat for other aquatic organisms.

PWMP Objective: Channel and Floodplain Function

Problem conditions associated with this PWMP objective relate to both the Willamette River mainstem and to its tributary streams within the Palatine subwatershed.

Willamette River Problem Condition: Floodplain function has been reduced in the Palatine subwatershed.

Source of Problem Condition: Floodplain is limited in some areas due to natural conditions such as the steep, near-vertical cliffs from Riverside Drive to the river. In other areas, development has reduced the connection between the Willamette River and its floodplain. Riparian areas that historically were interconnected with the river's main channel and side channels have been reduced and tributaries flow through culverts beneath SW Riverside Drive (Highway 43) before reaching the Willamette River.

The reduced level of interaction between the river and the floodplain results in impaired attenuation and flood storage functions. The removal and degradation of native vegetation further reduces these functions. Although some riparian canopy has remained intact in the riparian areas, much of the native understory vegetation has been removed or degraded by invasive species such as English ivy. Structural complexity from large wood accumulations has been eliminated and the banks have been degraded.

Palatine Subwatershed Streams Problem Condition: Upper subwatershed stream floodplains are naturally limited due to steep channels and limited adjacent level ground along these waterways. Where the floodplain historically existed in the lower elevations of the subwatershed, development such as culverts beneath transportation corridors, has reduced floodplain function these streams.

Source of Problem Condition: Culverts beneath roadways, and the fill material that the roads are located on, has impacted the channel and floodplain function of streams and the Willamette River in the Palatine subwatershed.

PWMP Objective: Terrestrial Wildlife and Vegetation

Palatine Subwatershed Problem Condition: Native plant and wildlife communities in the subwatershed have been impacted by residential development. The proliferation of invasive species has further impacted these native communities.

Source of Problem Condition: Development has resulted in a loss of forest canopy and native understory vegetation. Though the subwatershed has an extensive tree canopy, especially when compared to other Willamette subwatersheds, the forest vegetation has been fragmented by residential development and relatively few contiguous forest areas exist.

In the undeveloped areas, the predominance of English ivy and other invasive plant species has simplified the forest understory and degraded the habitat quality for native species. PP&R's 2003-2008 Natural Area Parkland Vegetation Inventory rates Powers Marine Park as severely degraded due to the prevalence of invasives species, with small

areas within the park to be in fair or poor condition. Peter Kerr Natural Area was rated poor and Elk Rock Island was rated fair due to the prevalence of invasive species.

A Multnomah County natural resources inventory found English ivy to be more prevalent in the Palatine area than any other unincorporated Multnomah County area and hypothesized that it could be the area most "overrun by English ivy" in the County (City of Portland 2001).

Safe terrestrial wildlife passage from the subwatershed to the river is interrupted by SW Riverside Drive (Highway 43), which runs the entirety of the eastern edge of the subwatershed. SW Terwilliger Boulevard impairs passage on the west to the Tryon Creek State Natural Area.

PWMP Objective: Fish and Other Aquatic Organisms

Problem conditions associated with this PWMP objective relate to both the Willamette River mainstem and to its tributary streams within the Palatine subwatershed.

Willamette River Problem Condition: Native fish and other aquatic biological communities in the Willamette River have been greatly altered due to impacts upon habitat and food web dynamics. Native fish species are in decline, and several invasive non-native species such as Western mosquitofish, smallmouth bass and white crappie are established. Several salmonid species, including Chinook salmon and steelhead trout, are listed under the state and federal ESA as threatened or endangered.

Source of Problem Condition: The hydrology, habitat, and water quality problems listed in this section have contributed to adverse impacts on fish and other biological populations. Degraded aquatic habitat conditions such as hardened banks reduce the quantity and quality of habitat. Off-channel sites (alcoves, lagoons, backwaters, secondary channels) have been eliminated by historic dredging and filling.

Palatine Subwatershed Streams Problem Condition: The streams in the upper subwatershed do not support any known fish communities.

Source of Problem Condition: Four stream reaches originate in the upper Palatine subwatershed. The reaches travel through private residential properties before their confluence with the Willamette River. Each stream is fragmented to varying degrees by culverts in its lower reaches. It is not known whether the streams support aquatic organisms.

Data gaps: Additional study is needed to determine the conditions, extent, and type of aquatic organisms in the Palatine subwatershed, including the historic extent of fish habitat and the current extent of other aquatic organisms. In-stream habitat in the tributaries should be evaluated to determine the current and potential habitat quality.

PWMP Objective: Stream Flow and Hydrologic Complexity

Palatine Subwatershed Problem Condition: Stream flow regimes in tributary streams have been altered. Stormwater runoff volume impairs water quality, causes flooding and erosion, and degrades habitat quality.

Source of Problem Condition: The underlying source of the altered stream hydrograph is stormwater contributions from the developed portions of the subwatershed. This is exacerbated in some areas by natural conditions such as steep slopes and poorly-draining and erodible soils.

The Palatine subwatershed is a low-density residential area with a relatively low percentage of impervious surfaces (15 percent of the subwatershed). Rooftops comprise the largest portion of impervious area (8 percent of the total subwatershed). Streets comprise 6 percent of impervious area and are distributed throughout the subwatershed. Major streets include Riverside Drive, SW Military Drive, SW Breyman Ave., and SW Palatine Hill Road. Impervious area from parking lots/driveways comprises less than 1 percent of the subwatershed.

Development in the subwatershed has resulted in a loss of native understory and canopy vegetation and an increase in impervious surfaces. This reduces the volume of water that would naturally infiltrate into vegetated soils, which results in increased runoff. Excess runoff contributes to increased flow velocity and volume in stream channels. The proliferation of invasive species may further reduce natural infiltration. Monocultures do not have the multistory layers that can enhance rainfall interception and evapotranspiration. Many invasives form monocultures in comparison to more native multistory habitats and therefore are presumed to provide less hydrologic control. The increased flow and volume causes stream incision, channel erosion, and additional pollutant and nutrient loading to the ecosystem.

Data gap: Stream flow data for the creeks in the Palatine subwatershed are not available.

PWMP Objective: Urban Pollutants and Human Pathogens

Palatine Subwatershed Problem Condition: The Willamette River currently violates federal CWA standards and has been placed on Oregon's 303(d) list for manganese, iron, dichlorodiphenyltrichloroethane/dichlorodiphenyldichloroethylene (DDT/DDE), polychlorinated biphenyls (PCBs), aldrin and polycyclic aromatic hydrocarbons (PAHs). When water quality standards are not met, the CWA requires DEQ to set total maximum daily loads (TMDLs) for the pollutant of concern. A TMDL is the calculated amount of pollutant a water body can receive and still meet Oregon water quality standards. The Willamette River has established TMDLs for temperature, bacteria, and mercury[3].

[3] The mercury TMDL is a phased TMDL for which no load allocations for non-point sources or wasteload allocations for point sources were set; however, a reduction target was set in 2006 (City of Portland 2008b).

Source of Problem Condition: Urban stormwater non-point source pollution is a likely cause of the water quality problems in this subwatershed. Although the Palatine subwatershed is a low-density residential area with a relatively small percentage of impervious surfaces (15 percent), pollutants from impervious surfaces such as roadways, driveways and roofs, as well as pollutants carried in pervious surface runoff such as lawn chemicals, are discharged into Palatine streams and to the Willamette River.

Stormwater from transportation corridors can contribute pollutants such as phosphates, copper, lead, zinc, and chromium to levels that impair water quality. The stormwater runoff from Highway 43 (i.e., heavy metals, petroleum products) currently does not receive any treatment before reaching the Willamette River.

Data gap: Water quality data in the subwatershed tributaries have not been fully studied. Potential subwatershed water quality problems presented here are based on GIS pollutant load modeling of land use.

PWMP Objective: Stormwater Conveyance

Palatine Subwatershed Problem Condition/Data Gaps: Stormwater conveyance has not been fully studied in the Palatine subwatershed. Stormwater is conveyed through streams and other surface conveyance (ditches) to the Willamette River. The stream reaches are located on private properties and the conditions are largely unknown.

PWMP Objective: Stream Temperature

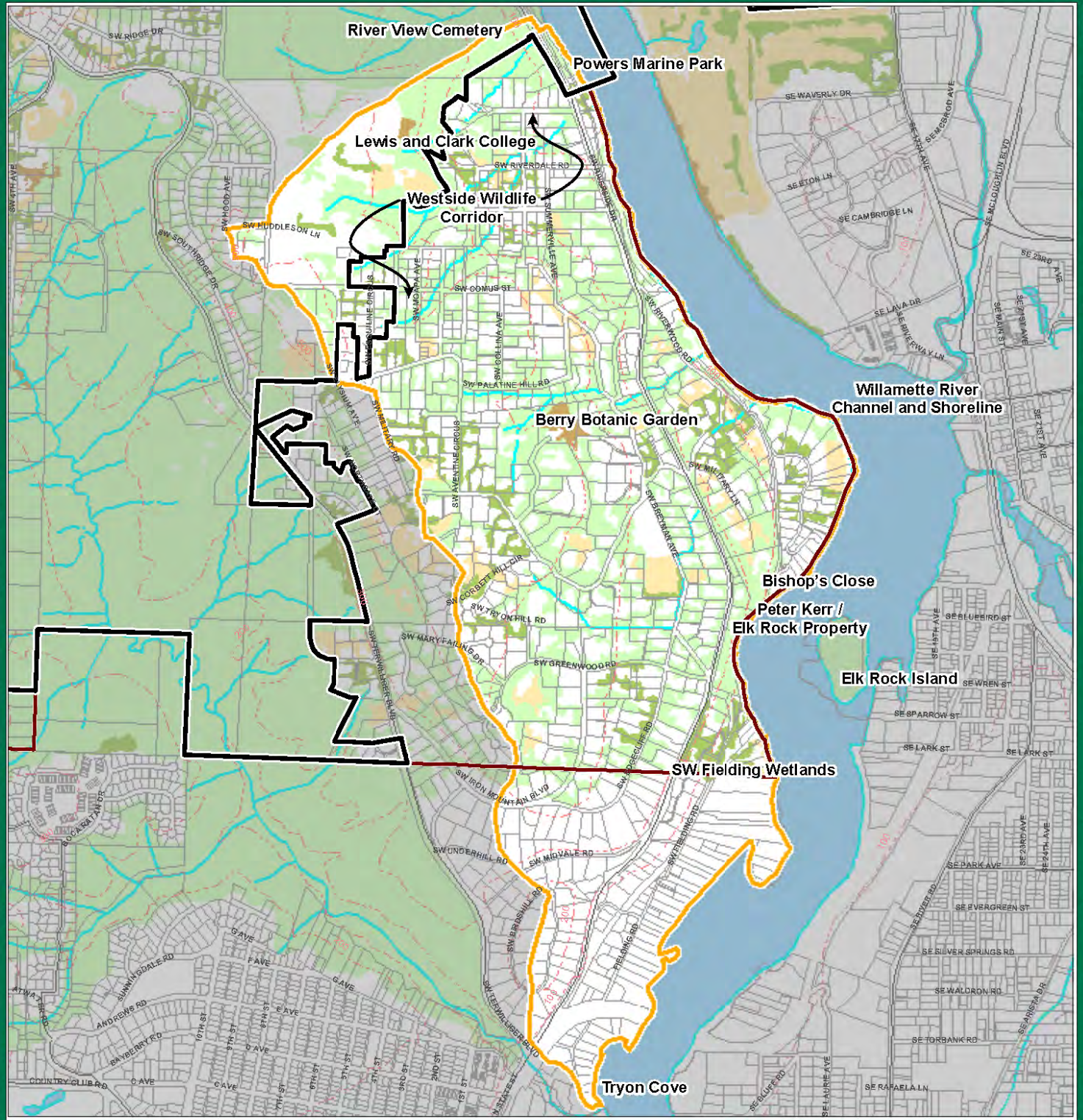
Problem conditions associated with this PWMP objective relate to both the Willamette River mainstem and to its tributary streams within the Palatine subwatershed.

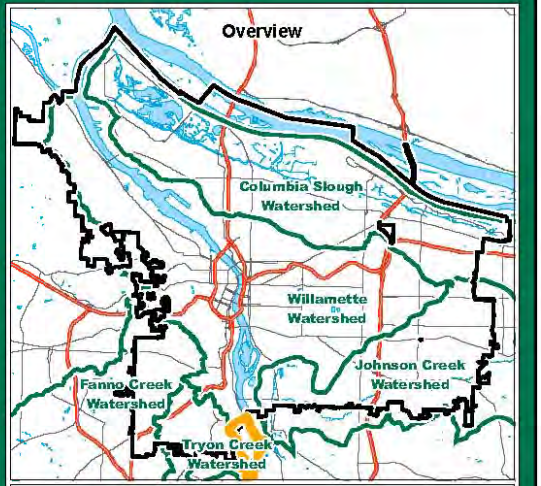
Willamette River Problem Condition: The lower Willamette River currently violates federal CWA temperature standards, which places it on Oregon's 303(d) list of water quality limited waters. Consequently, the River has an established TMDL for temperature (as well as for bacteria and mercury).

Source of Problem Condition: The Willamette River channel and banks have been extensively filled, cleared and armored, impairing channel and riparian conditions, channel structure, complexity and sources of large woody debris. These activities and

upstream hydrologic alterations have likely caused increased stream temperatures as well as other water quality impacts.

Palatine Subwatershed Streams Problem Condition/Data Gaps: Information on temperature in the upper subwatershed has not been fully studied.





Legend

- City of Portland
- Urban Services Boundary
- Subwatershed Boundary
- Existing Taxlots
- Freeways
- Open Channel Streams
- 100 ft Contours

Vegetation

- Forest
- Herbaceous
- Shrubland
- Woodland

1 inch equals 1,500 feet

0 1,500 3,000 Feet

CITY OF PORTLAND
ENVIRONMENTAL SERVICES
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-4
Palatine
Asset Areas

Project No.	Date Printed:
8800	01/29/10

Produced by Systems Analysis - Map Request 5199 (KDR) January, 29th, 2010 \\Cassiopia\GIS\3Projects_ArcMap\Many_BS\Subwatershed_Improvement_Strategies\Phase_6\Fig_4_Pal.mxd

SECTION 4: OPPORTUNITY SELECTION AND RANKING

The Willamette Watershed objectives were developed in coordination with the other BES watershed teams, and are documented in the PWMP. The objectives serve as a guide for identifying potential subwatershed actions for improvement strategies. A measure was developed for each objective in order to quantify the degree to which potential actions would provide benefit towards achieving the watershed objective.

Helpful Definitions

Strategy: Broad categories of approaches to meet subwatershed objectives. There are six strategies in the PWMP. See Section 5 for more detail.

Action: Finer scale than strategy. Actions are projects or programs that are implemented to meet the strategies and are not site-specific.

Opportunity: Project or program that is site-specific. Opportunities are based on needs identified during the field assessments.

For the south subwatersheds, the PWMP objectives were reviewed and then ranked in order of importance relative to improving the current conditions in the project area. Results are shown in Table 4. The weights in Table 4 were calculated by applying a formula based upon the objectives' assigned ranks, to refine the analysis for determining their benefits towards improving subwatershed conditions [i.e., improving stream flow (which is ranked number 1) is not necessarily twice as beneficial as improving aquatic habitat (which is ranked number 2)] in the subwatershed.

The ranked objectives, their weights, and their associated measures were then used to prioritize specific subwatershed improvement opportunities, using a multi-attribute utility analysis (MUA) approach. Detailed information on how the PWMP objectives were ranked to produce the south subwatersheds objectives and on how the MUA was applied to the improvement opportunities can be found in the TM included in Appendix A.

The results of the MUA assigned scores to each subwatershed improvement opportunity. The opportunities with the highest scores for the highest-ranking objectives were identified as priorities. More information about how the opportunities were identified for evaluation is described in detail in Section 5.

Table 4: Results of Ranking Process for South Subwatershed Objectives and Measures

Objective	Measure	Rank	Weight
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.	Terrestrial habitat protected/improved/restored/ enhanced (acres)	1	0.193

Objective	Measure	Rank	Weight
Aquatic Habitat: Protect and improve aquatic, riparian, and floodplain habitat extent, quality, and connectivity that supports the persistence of native fish and wildlife communities.	Aquatic habitat restored/enhanced/protected (linear feet)	2	0.153
Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainageways, wetlands, riparian areas, and floodplains to improve bank stability and natural hydrologic functions and reduce risk to development and human safety.	Channel/Floodplain Restored, protected, or enhanced (acres)	3	0.136
Terrestrial Wildlife and Vegetation: Implement watershed actions to restore populations of terrestrial organisms to healthy, self-sustaining levels, protect and restore the composition and structure of native vegetation communities, and reduce populations of non-native plants and organisms to levels that do not compete with native species.	Native/Invasive ratio improved (Y/N)	4	0.134
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.	Biotic measures improved (Y/N)	5	0.102
Education, Involvement and Stewardship: Implement and support watershed actions in a manner that utilizes community partnerships and provides education to the public about important watershed issues.	Opportunities for education, involvement, and stewardship (Y/N)	6	0.085
Stream Flow and Hydrologic Complexity: Protect and increase rainfall interception areas, create infiltration and detention areas to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.	Effective Impervious Area (EIA) reduced (acres)	7	0.060
Human Pathogens: Maintain and manage sewer infrastructure and stormwater inputs and runoff to limit sewage overflow and the delivery of pathogens to waterways and achieve applicable water quality and sewer design manual standards.	Fecal inputs reduced (Y/N)	8	0.046

Objective	Measure	Rank	Weight
Urban Pollutants: Manage the sources and transport of urban stormwater and industrial pollutants and nutrients to limit surfacewater, groundwater, soil, and sediment contamination to levels that protect ecological and human health and achieve applicable water quality standards.	Urban pollutants reduced in soil or water (Y/N)	9	0.046
Stream Temperature: Protect and improve stream temperatures, dissolved oxygen, and pH levels that protect ecological health and achieve applicable water quality standards.	Stream temperature maintained/reduced (Y/N)	10	0.034
Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity.	Stormwater infrastructure improved/protected/maintained (Y/N)	11	0.011

SECTION 5: STRATEGIES AND ACTIONS

The watershed health objectives outlined in Section 4 describe the desired changes in watershed conditions and functions. The PWMP outlines six strategies to bring about those changes. Strategies are broad approaches that are used to help reach the City's watershed goals and objectives. The six strategies are: Stormwater Management, Revegetation, Aquatic and Terrestrial Enhancement, Protection and Policy, Operations and Maintenance, and Education, Involvement, and Stewardship.

Actions are general projects or programs implemented to achieve the strategies. Table 5 summarizes the watershed strategies and actions as outlined in the PWMP. Additional actions, specific to the Palatine subwatershed, were identified by a city-staffed technical advisory team (Appendix A) and external stakeholder input. This information is summarized in this section.

Table 5: PWMP Strategies and Actions

STRATEGIES	ACTIONS
Stormwater Management	Modify the storm drainage system to increase infiltration and maximize evapotranspiration
	Modify the storm drainage system to increase reuse or detain stormwater
	Modify the storm drainage system to treat stormwater pollutants
	Modify the storm drainage system to separate the flow from combined storm/sanitary sewer
Revegetation	Increase the extent of canopy and other vegetative cover
	Improve the quality and composition of vegetative cover
Aquatic and Terrestrial Enhancement	Restore channel and floodplain function and stability
	Restore or create river, stream, wetland, and terrestrial habitat structure and function
	Restore habitat connectivity and access
	Manage for appropriate native species
Protection and Policy	Implement management of erosion, sediment, and pollutant discharge from construction sites
	Implement management of stormwater for all new and redevelopment projects
	Implement management of pollutant discharges for industrial and commercial sites
	Protect sites and features with high watershed values and functions
Operations and Maintenance	Operate and maintain the storm sewer system, public rights-of-way, greenspaces and other city facilities and infrastructure to remove and prevent pollutant discharges
	Reduce illicit and non-stormwater discharges

STRATEGIES	ACTIONS
	Maintain and repair sewer systems to ensure conveyance for current demand and future growth
Education, Involvement and Stewardship	Promote watershed awareness with city staff, schools, the business community, organizations, and general public
	Provide pollutant prevention education to city staff, the business community, organizations, and general public
	Provide technical assistance and incentives to city staff, schools, the business community, organizations, and general public

Once the actions were identified, they were evaluated for the Palatine subwatershed by conducting field assessments to develop opportunities, or site-specific projects and programs. The field assessments verified current subwatershed conditions (i.e., asset areas and problem conditions) and identified opportunities to address the problems or to protect assets. The field assessments involved an overview of all streams, resource areas, and developed and undeveloped upland areas within the subwatershed, and resulted in detailed documentation of all potential action sites (See Appendix A for more information).

The summary is not intended to be exhaustive of opportunities to improve watershed health in the Palatine subwatershed, but rather to serve as an illustration of how the project team arrived at the specific action opportunities outlined in Section 6.

Some potential actions address many watershed issues and could be included under more than one strategy but to avoid duplication are listed under only one strategy.

Stormwater Management

Stormwater management is an essential component of watershed health improvements. Development, and the consequent increase in impervious surfaces, increases the volume and velocity of stormwater runoff which can lead to flooding and erosion, habitat degradation, and impaired water quality. Managing stormwater runoff through site design or retrofits of existing development can reduce these effects. Directing runoff to natural systems like landscaped planters, swales, and rain gardens, or installing an ecoroof reduces and filters stormwater runoff. Consideration should be given to site constraints arising from geotechnical (e.g., soils/infiltration) and environmental issues (e.g., contamination).

The following is a summary of potential stormwater management actions for the Palatine subwatershed:

- Evaluate stormwater retrofit opportunities on the Lewis and Clark campus
- Evaluate “ditch to swale” opportunities on some of the larger residential streets like SW Palatine Hill and Military Roads

- Examine topography and soil types in the project area and evaluate downspout disconnect opportunities

Revegetation

Removing non-native, invasive species and planting native vegetation is a key strategy to meet watershed health goals. Increasing the amount of canopy cover and native vegetation improves the physical-biological elements of the urban environment such as water quality, stream integrity, and fish and wildlife habitat. Vegetation intercepts, stores, and absorbs rainfall, as well as filters pollutants and nutrients from stormwater runoff. Revegetation efforts can also produce aesthetic, economic, and other community benefits.

The following is a summary of potential revegetation actions for the Palatine subwatershed:

- Revegetate Elk Rock Island
- Protect tree canopy by promoting invasive removal throughout the subwatershed
- Revegetate the riparian areas in the undeveloped portion of Lewis and Clark

Aquatic and Terrestrial Enhancement

Aquatic and terrestrial enhancements improve hydrology, physical habitat, water quality, and biological communities. Restoring channel complexity and increasing riparian vegetation helps normalize stream flows, provide flood storage, and recharge groundwater. Natural area enhancements can improve habitat and protect biodiversity.

The following is a summary of potential aquatic and terrestrial enhancement actions for the Palatine subwatershed:

- Explore off-channel habitat opportunities in Palatine subwatershed
- Protect and restore the SW Fielding Road wetlands

Protection and Policy

Protecting important watershed functions and applying policies that integrate sustainable practices into citywide plans and projects are important to watershed health. Conservation and protection of existing vegetation, stream channels, and wetlands are critical strategies to achieve watershed health.

The following is a summary of potential protection and policy actions for the Palatine subwatershed:

- Support the PP&R Oregon white oak release/enhancement project at Elk Rock Island
- Consider conservation easements/acquisition of the wetlands that are currently on private property adjacent to SW Fielding in Clackamas County
- Consider acquisition of private property between Peter Kerr and Bishop's Close to protect the madrone habitat
- Look for property acquisition opportunities where frequent Federal Emergency Management Act (FEMA) flood claims have been filed (FEMA grant opportunities)
- Create a *viewshed*[4] vegetation management policy, Elk Rock looking east and west
- Partner with North Clackamas Parks District to protect the backwater area (Spring Park) behind Elk Rock Island

Operations and Maintenance

Effective operation and maintenance practices of infrastructure, such as storm, sanitary, and wastewater treatment plants are essential to watershed health.

The following is a summary of potential operations and maintenance actions for the Palatine subwatershed:

- Increase funding for drainage maintenance outside the City of Portland in unincorporated Multnomah County per the Portland/Multnomah County Intergovernmental Agreement
- When culverts fail, consider fish-friendly alternatives

Education, Involvement, and Stewardship

The Education, Involvement, and Stewardship strategy is integrated into all other strategies. Public involvement and stewardship encourages citizens to get involved in the

[4] A viewshed is an area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point. In urban planning, for example, viewsheds tend to be areas of particular scenic or historic value that are deemed worthy of preservation against development or other change.

work of protecting our natural resources. Raising awareness of watershed issues and fostering stewardship of city-owned natural areas promotes healthy watersheds.

The following is a summary of potential education, involvement, and stewardship actions for the Palatine subwatershed:

- Encourage Lewis and Clark college students to conduct environmental research in the Palatine subwatershed
- Promote green building on the Lewis and Clark College campus
- Partner with Berry Botanic Garden to conduct watershed health education and outreach
- Remove invasive plants along the Willamette River and throughout the subwatershed
- Encourage naturescaping to decrease use of pesticide/fertilizers
- Conduct water quality educational outreach to landscape contractors in the Dunthorpe neighborhood, with emphasis on landscaping work conducted adjacent to the Willamette River and associated drainages
- Work with PP&R to install interpretive signage about the unique habitat features of Elk Rock Island and Peter Kerr Natural Area

SECTION 6: PROJECT OPPORTUNITIES

This section describes specific opportunities that exist throughout the Palatine subwatershed to improve subwatershed health. They are geographically specific applications of the potential actions outlined in Section 5. Opportunities to improve watershed health were identified through a comprehensive process that included data analysis, review of available information of current and historical subwatershed conditions, field assessments, stakeholder involvement, and City staff input, and then scored and ranked according to the process described in Section 4. They are organized by the six PWMP strategies presented in Section 5 (Figure 5 at the end of this section).

A single list of ranked projects was developed across all strategies; however, for descriptive purposes, the projects are organized in the tables below by PWMP strategy. Therefore, the ranking is not sequential within each set of strategies. Watershed-wide programmatic opportunities were not included in the subwatershed objective ranking process and did not receive a ranking; however, they are included in the tables in this section.

Stormwater Management Opportunities

The specific stormwater projects and programs presented in Table 6 are designed to improve natural stormwater function, and are the foundation for all other watershed protection and improvement efforts. These projects help minimize the effects of development on watershed processes and natural conditions, providing water quality treatment, flow attenuation, interception and infiltration, reduced channel erosion, improved aquatic habitat conditions, and protection of downstream restoration projects. Projects include structural retrofits and other stormwater management measures that reduce effective impervious area (EIA) by promoting interception, infiltration, retention, and detention, as well as by collecting and limiting contaminant transport. Some potential project sites may be constrained by geotechnical concerns (soils/infiltration) and other environmental issues (contamination). Environmental site assessments will be conducted at a later planning stage. Education and outreach is a critical element of improving watershed health and will be incorporated into all stormwater management projects.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of City partners and programs. Critical partners, programs, and associated regulatory requirements include: Portland Bureau of Transportation (PBOT), PBOT Maintenance Operations, Multnomah County, West Multnomah Soil and Water Conservation District (WMSWCD), Clackamas County, NPDES MS4 permit program, TMDLs, BES Clean River Rewards (stormwater discount) Program, BES Clean Rivers Education Program, BES Sustainable Stormwater Program, BES Community Watershed Stewardship Program, and the City's 2008 Stormwater Management Manual (SWMM).

The process of identifying stormwater management opportunities through watershed field assessments included many internal and external stakeholders. The BES Sustainable Stormwater group was a key player in this process. Staff took part in a mapping

workshop and provided feedback that was used to guide the IS field assessments and the subsequent development of potential projects.

Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on property owned or managed by PP&R will follow the process established through a Memorandum of Understanding (MOU) between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

Table 6: Palatine Subwatershed Stormwater Opportunities

Rank	Project/Program	Location	Project/Program Description
20	Berry Botanic Garden Rain Garden	11505 SW Summerville Avenue	Install a demonstration rain garden on Berry Botanic lawn area east of main building. Currently water sheet flows across the lawn area during the wet season. Create terraced garden to slow flow. Install interpretive signage; good opportunity for stormwater outreach. Work with BES or the WMSWCD to design a facility that will address the pollutants and slopes present at Bishop's Close.
28	Lewis and Clark NW Campus Stormwater Facility	Lewis and Clark College	Install stormwater facilities at the NW corner of the campus to reduce stormwater impacts to the north stream reach. Pre-treat and detain flow before it reaches the tributary.
37	Bishop's Close Green Stormwater Project	Bishop's Close - Upstream of "Cascades"	Design and build a rain garden above the "cascades" to trap sediments in stormwater runoff from parking lots. Work with BES or the WMSWCD to design a facility that will address the pollutants and slopes present at Bishop's Close.
39	Lewis and Clark Facilities, Parking Lot B Swale	Lewis and Clark College	Install a vegetated swale to collect and treat stormwater runoff from parking lot (B). Stormwater runoff currently flows directly into an inlet. Option A: Remove two parking spaces (one is handicapped parking) to create swale, or Option B: Level the raised garden area at the east end of the lot and make it into a swale.
40	Lewis and Clark Facilities, Parking Lot A Retrofit	Lewis and Clark College	Build vegetated infiltration basin to collect and treat stormwater runoff from lower parking lot (A). The majority of the stormwater in the upper facilities parking lot flows into an oil/water separator, and then into the stream, but the lower lot flows directly into a stormwater inlet.
42	Riverwood Stormwater Swale	SW Riverwood	Install a vegetated swale on the west side of SW Riverwood to treat roadway runoff before it enters the Willamette River. Partner with Multnomah County; the County maintains this stretch of roadway.
43	Lewis and Clark Templeton Rain Gardens	Lewis and Clark College	Create rain gardens in existing grassed areas to intercept road/parking area runoff before it enters the stormwater inlet. Currently there are large, grassed lawn areas adjacent to a road/ parking area with adjacent inlets for stormwater drainage. Stormwater flow could be directed to three separate grassed areas (created rain gardens) to control and treat the stormwater runoff.
44	Lewis and Clark Fir Acres Parking Lot B Vegetated Infiltration Basin	Lewis and Clark College	Convert the existing parking island into a vegetated infiltration basin to collect and treat stormwater runoff from the parking lot.
47	Lewis and Clark SW Residence Hall Drive Rain Garden	Lewis and Clark College	Create curb cuts along SW Residence Hall Drive to allow infiltration into the existing garden area.

Rank	Project/Program	Location	Project/Program Description
53	Bishop's Close Stormwater Filters	Bishop's Close parking lot	Install filter units in the Bishop's Close parking lot inlet(s) to provide treatment to stormwater runoff before it discharges directly to the Willamette River.
54	Military Road Stormwater Swale	SW Military Road	Install a vegetated swale on the east side of SW Military Road to capture roadway runoff. The City of Portland maintains this portion of roadway. Install interpretive signage to educate the community about stormwater issues.
62	Iron Mountain Swale	SW Iron Mountain Blvd.	Install a vegetated swale on the west side of Iron Mountain Blvd. Current conditions indicate erosion and high sediment transportation in roadway ditches in this area. Partner with Multnomah County; the County maintains this stretch of roadway.

Revegetation Opportunities

Efforts to preserve native vegetation and prevent the establishment of invasive plants will increase the City's ability to achieve and maintain healthy watersheds. Increasing canopy cover and native vegetation improves the physical-biological elements of the urban environment, such as water quality, stream integrity, and fish and wildlife habitat. Revegetation projects can also result in cost savings on infrastructure expenditures, as well as produce aesthetic, economic, and other community benefits.

Removing invasive plant species is a critical element of the citywide revegetation strategy. Invasive plants impact watershed health by degrading water quality, increasing erosion, reducing biodiversity, altering habitat quality, reducing tree cover, and changing soil characteristics. The City of Portland has a number of plans and programs that support invasive plant removal including the PWMP, the City's Invasive Plant Strategy, the BES EDRR Program, and PP&R's Protect the Best Program. Selection, design, and implementation of revegetation opportunities will be coordinated with these plans and programs.

The Willamette team worked closely with the BES Watershed Revegetation team, PP&R's City Nature and others to identify potential projects. Education and outreach is a critical element of improving watershed health and will be incorporated into all revegetation projects.

Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on property owned or managed by PP&R will follow the process established through a MOU between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

Table 7: Palatine Subwatershed Revegetation Opportunities

Rank	Project/Program	Location	Project/Program Description
5	Fielding Corridor Revegetation and Education, Involvement and Stewardship	SW Fielding Road	Remove invasive plants along the SW Fielding Corridor; plant native plants. Release Oregon white oak on private property at the SW end of Fielding Road. Work with the BES Watershed Revegetation Program, the City of Lake Oswego and SWCD to conduct outreach.
16	Lewis and Clark Revegetation	Lewis and Clark College Campus Natural Areas	Remove invasives from natural areas on the Lewis and Clark campus. Revegetate with native plant species. Partner with the Lewis and Clark campus and BES Watershed Revegetation Program.
24	Elk Rock Island Upland Coniferous Forest Restoration and Enhancement	Elk Rock Island - conifer forest areas	Create/encourage more plant/tree diversity by removing species that dominate (e.g. Douglas fir). Plant natives as appropriate to improve wildlife habitat.
30	Elk Rock Island Low Elevation Deciduous Forest Vegetation Enhancement	Elk Rock Island - riparian forest	Promote native low elevation deciduous forest vegetation on Elk Rock Island via the removal of competing invasive plants. Encourage more plant/shrub/tree diversity by removing/controlling other more dominant plant species (e.g. Douglas fir).
34	Elk Rock Island West Bay Riparian Vegetation Enhancement	Elk Rock Island - West Bay	Promote native riparian vegetation (e.g., pacific willow) on Elk Rock Island through the removal of competing invasive plants to protect the special status species associated with the unique habitats on the island.
48	Bishop's Close "Parterres" Vegetation Enhancement	Bishop's Close - "Parterres"	Protect native and rare plants such as delphinium, Pacific madrone, and Oregon white oak. Remove invasive plants such as ivy, blackberry, wild pea and garlic mustard.
50	Bishop's Close "The Point" Vegetation Enhancement	Bishop's Close - "The Point"	Protect native and rare plants such as delphinium, Oregon white oak, Pacific madrone, and Western hemlock by removing invasive plants such as ivy, blackberry, wild pea and garlic mustard.
52	Bishop's Close "Spring Walk" Vegetation Enhancement	Bishop's Close - "Spring Walk"	Protect native and rare plants by removing competing invasives such as ivy, blackberry, wild pea and garlic mustard.

Aquatic and Terrestrial Enhancement Opportunities

The specific stream enhancement projects presented in Table 8 are designed to improve the amount and quality of important habitat in the Willamette River channel and its tributaries. The lower Willamette River functions as a critical salmonid migration corridor and rearing ground, and the ecological effects of local conditions impact Chinook, coho, and steelhead populations throughout the entire Willamette subbasin. These projects will increase habitat extent and diversity by daylighting stream channels, improving streambank conditions, creating shallow water and off-channel habitat, increasing tributary stream

accessibility, adding channel complexity, and increasing channel stability.

Examples of specific aquatic and terrestrial enhancements to protect, restore, and enhance aquatic and terrestrial habitat conditions (as appropriate to the site) include:

- Snag creations
- Seasonal ponds for amphibian breeding
- Artificial bat or bird habitat structures
- Oak replacement

Oregon white oak woodland habitat was once dominant in the Portland area, and is still important both locally and regionally. Many different wildlife species, such as neo-tropical birds and Western gray squirrels, utilize this valuable habitat type for nesting and foraging.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City and other agency programs. Critical programs, partners, and regulatory requirements include: the BES Science Fish and Wildlife Program, TEES, the ESA, Water Resource Development Act (WRDA), The Office of Healthy Working Rivers, BPS and Metro's riparian corridor and wildlife habitat inventories, PP&R, ODFW Restoration and Enhancement Program, and Oregon Watershed Enhancement Board (OWEB).

Education and outreach is a critical element of improving watershed health and will be incorporated into all aquatic and terrestrial enhancement projects. Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on property owned or managed by PP&R will follow the process established through a MOU between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

Table 8: Palatine Aquatic and Terrestrial Enhancement Opportunities

Rank	Project/Program	Location	Project/Program Description
4	Tryon Creek Culvert Removal/Bridge Install	Highway 43/Tryon Cove	Enhance and eventually replace the Highway 43 Tryon Creek culvert. The highway impedes both fish and wildlife passage. Place deer crossing sign on highway and reduce traffic speeds to help with wildlife passage in the interim. ODOT modified the culvert in 2008 to make it more accessible to fish, but additional modifications are needed.
11	Elk Rock Island East Bay Aquatic Habitat Enhancement	Elk Rock Island, East Bay	Enhance off-channel habitat for salmonids at Elk Rock Island by adding large wood and planting riparian vegetation. The east bay section of the island has unique habitat features that benefit salmonid rearing habitat.
14	Berry Botanic Garden Riparian Enhancement	11505 SW Summerville Ave.	Enhance streamside vegetation at Berry Botanic Garden. Remove ivy and garlic mustard and plant natives. Partner with Berry Botanic Garden and with garden volunteers.
15	Tryon Creek Confluence (C)--Upper Reach	Tryon Cove	Lay back banks of Tryon Creek to create floodplain in the upper Tryon Cove area. The historic floodplain area has been filled. This project would reconnect the creek with its floodplain and slow the water flow.

Rank	Project/Program	Location	Project/Program Description
17	Bishop's Close--Special Habitat Protection and Enhancements	Bishop's Close, oak and madrone habitats	Enhance Oregon white oak/Pacific madrone/Pacific yew habitat by developing and implementing a forest management plan focused on the unique plant community. Provide information about this unique habitat at a visitors' kiosk.
19	Tryon Creek Confluence (B)--Middle Reach	Tryon Cove	Restore and enhance Tryon Creek confluence streambank in the middle Tryon Cove reach by removing rock riprap and laying back banks to reduce bank slope. The historical floodplain has been filled. Restore floodplain bench as current conditions allow. This project is part of the City of Portland's Tryon Creek Confluence Habitat Enhancement Project, Construction is estimated for Summer 2010.
22	Tryon Creek Confluence (A)--Lower Reach	Tryon Cove	Add large wood, extend the beach and lay back creek banks at the Tryon Creek confluence with the Willamette River. Habitat is currently degraded from placement of riprap and from invasive plants; remove invasives and plant natives. This project is part of the City of Portland's Tryon Creek Confluence Habitat Enhancement Project. Construction is estimated for Summer 2010.
23	Lewis and Clark North Tributary Stream Enhancement	Lewis and Clark College, north reach	Restore streambanks; remove invasives and revegetate along the north reach of the Lewis and Clark tributary. Stream appears to be impacted by upstream stormwater flows. Consider use of brush dams to capture sediment. Partner with the Lewis and Clark community and BES Revegetation Program.
25	Lewis and Clark South Tributary Stream Enhancement	Lewis and Clark College, south reach	Restore streambanks; remove invasives and revegetate along the south reach of the Lewis and Clark tributary. Partner with the Lewis and Clark community and BES Revegetation Program.
26	Elk Rock/Peter Kerr Native Vegetation Protection and Enhancement	Elk Rock/Peter Kerr natural area	Protect rare plant communities at Elk Rock/ Peter Kerr natural areas. Protect and restore the composition and structure of the native plant communities, and reduce populations of non-native plants to levels where they do not compete with the native plant species.
29	Elk Rock Island Rock Outcrop Vegetation Protection and Enhancement	Elk Rock Island, rock outcrops	Remove invasive plants and plant native plants on the rock outcrop areas at Elk Rock Island. This area contains some rare, native plants. Also provide educational outreach to visitors on the unique habitat features and how to best protect them.
31	Elk Rock Island Oak Woodlands (North) Protection and Enhancement	Elk Rock Island, oak woodlands (north)	Enhance/protect oak forest habitat and other native vegetation at Elk Rock Island. There are high value older Oregon white oak trees and their associated plant communities present onsite. Encourage more herbaceous plant/shrub/tree diversity by removing some of the Douglas fir and big leaf maple. Controls weed trees and shrubs including ivy, false brome, and vinca.
32	Elk Rock Island Grassland Habitat Protection and Enhancement	Elk Rock Island, grassland	Enhance native grasses and forbs on Elk Rock Island, which are a unique habitat feature of the island, with some rare native plants (e.g. Festuca rameria). Remove competing invasive plants to encourage plant diversity and to allow for the release of native plants.
33	Elk Rock Island Oak Woodlands (South) Protection and Enhancement	Elk Rock Island, oak woods south	Enhance oak forest habitat and other native vegetation on Elk Rock Island. There are high value older Oregon white oak trees and associated plant communities present. Encourage more plant/shrub/tree diversity by removing some of the other tree species (e.g. Douglas fir, chinese chestnut). Oaks are a SHA and host special status species. Plant natives as appropriate to improve wildlife habitat.

Rank	Project/Program	Location	Project/Program Description
49	Tryon Cove Terrestrial Habitat Protection and Enhancement	Tryon Cove	Enhance upland terrestrial habitat in Tryon Cove. Protect mature canopy, add snags and investigate feasibility of ponds for amphibians. The area, historically a residential yard where the structure has been removed, has a mature tree canopy.
51	Tryon Cove Grassland Habitat Enhancement	Tryon Cove	Protect and enhance the Tryon Cove grassland area. This area will likely be the disposal location for fill material from the Tryon Creek stream restoration project. Plant native grasses on fill. Remove invasives such as blackberry and plant with native grasses.
55	Tryon Cove Shrub Island Habitat	Tryon Cove	Enhance shrub island habitat in Tryon Cove. The shrub island is located in the grassland area. Remove invasives; plant natives. Investigate feasibility of creating seasonal ponds and/or bat habitat.
56	Tryon Cove Hedgerow Habitat	Tryon Cove	Protect/enhance upland hedgerow habitat on the edge of the grassland in Tryon Cove, which currently consists of arborvitae and invasive blackberry. Slowly replace these plants with natives. Include shrubs with berries to provide both food and cover.
57	Tryon Cove Beach Habitat Enhancement	Tryon/ Willamette River confluence	Create beachfront habitat at Tryon Cove. Currently the area has a lack of habitat features. Plant willow for beaver forage, create snags for eagle and osprey habitat, and place gourds for purple martins.
58	Fielding Wetland TriMet Aquatic Enhancement	SW Fielding Road	Replace culverts in SW Fielding wetland area to enhance habitat connectivity and restore associated wetland features. Currently, water seeping from rocks on the bluff is routed into two culverts beneath the railroad tracks on TriMet property.
59	Bishop's Close, Aquatic Habitat Enhancements	Bishop's Close, Cascades	Work with this property owner to develop plans for future water feature renovation that would enhance the structures for aquatic organisms.
60	Lewis and Clark Stormwater Outfall and Repair & Maintenance: Palatine	Lewis and Clark campus	Improve conditions of stormwater outfalls to prevent and reduce erosion of Lewis and Clark stream channels. A 2009 geotechnical report submitted to the City as part of the campus Master Plan update identified 6 of 28 stormwater outfalls as in "urgent" or "important" need of repair; 7 outfalls could not be located.

Protection and Policy Opportunities

Projects and programs in this category identify opportunities to protect and improve watershed function, habitat value, and connectivity through acquisition or easements, zoning overlays, resource tracts, development standards review, building code review, and other protection measures and programs. This approach strives to ensure that the highest quality areas are protected, and that development planned in or near resource areas is completed with the most environmentally sensitive design and minimal impact.

Protection of areas with the highest remaining function and value has been identified as a cornerstone for effective watershed management (City of Portland 2004). Areas for which protection and policy actions could be pursued include:

- Remaining forested areas, stream remnants, and associated ravines that serve as key habitat area anchors and connections between larger habitat areas
- Any area where vegetated floodplain is accessible to the river, or where natural, gently sloped streambanks are present

- Wetlands and forested areas, natural streambanks, and tributary confluences that provide high quality habitat and are the most sensitive portions of the watershed
- Development issues related to the amount of hardened streambanks, shallow water habitat, and riparian or floodplain vegetation.

A number of policy and regulatory strategies have been effectively used by the City to protect watershed resources. Selection, design, and implementation of projects in the Palatine subwatershed that are outside the City of Portland will be coordinated with the appropriate jurisdiction. Critical partners and programs include: Multnomah County, Clackamas County, the City of Lake Oswego, BPS Portland Plan and River Plan projects, Regulatory Improvement Program, PBOT Planning, Urban Forestry Program, SWMM, development standards review, building code review, environmental review, Metro natural resources planning, and Portland Development Commission.

Willamette Watershed Property Acquisition Program

Acquisition is a tool under the Protection and Policy strategy of the PWMP. Related projects are listed in Table 9. Properties were chosen on the basis of their ability to protect watershed assets or to allow implementation on public land. Properties identified for potential acquisitions in the Willamette Watershed in Portland will be managed through a "willing seller" approach. Through the program, willing sellers are offered fair market value for their property and are under no obligation to sell. If they choose to sell, the land acquired will be managed to improve fish and wildlife habitat, restore wetlands, improve water quality, and may provide passive recreation activities. Some properties identified as potential acquisition sites may be constrained by contamination and/or other feasibility issues. These issues will be identified and addressed at a later planning stage.

Land conservation easements may also work to achieve some of the PWMP protection and policy goals, and thus the IS goals. A conservation easement is a legally binding agreement made by the property owner not to develop part of a property, but to leave it permanently "natural". The landowner retains title to the property. The easement becomes part of the land deed, meaning that all future property owners will be bound by the terms of the easement.

In November 2007, the City's Grey to Green Initiative was launched to accelerate some principal elements of PWMP implementation. The Grey to Green Land Acquisition Program will build on previous and current efforts to permanently protect important natural resources areas by placing land in public ownership.

Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on properties owned or managed by PP&R will follow the process established through a MOU between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

Some protection and policy projects/programs that have been identified are citywide opportunities and were not included in the subwatershed objective ranking process; however, they are included in the following table.

Table 9: Palatine Subwatershed Protection and Policy Opportunities

Rank	Project/Program	Location	Project/Program Description
1	Fielding Wetlands Conservation Easements	Fielding Wetlands and escarpment	Work with private landowners to develop conservation easements. Conservation of herbaceous and forested wetland habitats and adjacent Oregon white oak woodlands are high priority for this SHA.
9	Elk Rock Island East Bay Buffer and Aquatic Enhancement Property Acquisitions	Elk Rock Island, East Bay	Property acquisition is recommended for the alcove behind Elk Rock Island (on the Milwaukie side). It has some very good aquatic and terrestrial habitat. A bald eagle's nest is currently on a private residence and the alcove has potential for being excellent aquatic habitat for salmonids.
12	Bishop's Close Integrated Pest Management (IPM)	Bishop's Close	Work with Bishop's Close Garden committee to develop an IPM approach on the property.
27	Elk Rock/Peter Kerr Natural Area Peregrine Falcon Eyrie Protection	Elk Rock/Peter Kerr	Reduce/restrict potential adverse impacts to peregrine falcon nesting area/habitat. The cliff wall provides nesting sites for peregrine falcons. Possible creation of a "noise reduction zone" along the Willamette River through Bureau of Development Services that could be implemented during critical nesting periods.
45	Peter Kerr, Adjacent Conservation Easements	Peter Kerr, adjacent properties	Work with property owners adjacent to Peter Kerr natural area to develop conservation easements designed to protect habitat for rare plants believed to be present at this location. Also, encourage IPM practices on landscaped portions of properties.
Not Ranked	ODOT Coordination, Hwy 43	Highway 43	Coordinate with ODOT on water quality issues to facilitate the treatment and detention of stormwater runoff from ODOT transportation corridors.
Not Ranked	EDRR Policy	Watershed-wide	Support the Invasive Plant Strategy's EDRR program to control less-common invasive plant species before they become widespread and difficult to manage. Program needs include resources for expanding citizen search networks, as well as management strategies for neighborhoods.
Not Ranked	Stormwater Management: Reduce/Maintain Impervious Area	Watershed-wide	Currently, the amount of impervious area in the Palatine subwatershed is at the threshold of impairing watershed health by reducing urban stream stability (approximately 15%). Partner with Multnomah and Clackamas counties to support stormwater management programs and policies that result in a no-net-increase in impervious areas in the Palatine subwatershed.

Operations and Maintenance Opportunities

Opportunities in this category are broad undertakings that include watershed-wide sewer maintenance actions related to the protection and improvement of watershed conditions.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing programs. Critical partners and programs include: PBOT Maintenance Operations, the BES Wastewater Maintenance group, Multnomah County, Clackamas County Department of Transportation and Development, and ODOT.

Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on properties owned or managed by PP&R will follow the process established through a MOU between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

Operations and maintenance projects that have been identified are citywide opportunities and were not included in the subwatershed objective ranking process; however, they are included in the following table.

Table 10: Palatine Subwatershed Operations & Maintenance Opportunities

Rank	Project/Program	Location	Project/Program Description
Not ranked	Outfall Assessment and Prioritization	Watershed-wide	Map all outfalls in the subwatershed. Use map as a guide to assess drainages for illicit discharges/connections. Develop a protocol for prioritizing repair/replacement of outfalls impairing watershed health.
Not ranked	Maintenance Staff Best Management Practice (BMP) Program	Watershed-wide	Coordinate adoption of BMPs with the City of Portland, Multnomah and Clackamas County Maintenance departments in the interest of watershed health. Promote maintenance of trash racks and stormwater conveyance infrastructure adjacent to streams to improve stream channel functions and reduce invasive species transport.
38	Riverside Drive Ditch to Swale	SW Riverside Drive between Radcliffe and Riverdale	Convert stormwater conveyance ditch along Riverside Drive to a swale that will filter pollutants before it drains into stream. It is an approximately 5 percent slope. Conduct fieldwork to verify viability.
41	Summerville Avenue Ditch to Swale	SW Summerville Avenue at SW Breyman	Convert stormwater conveyance ditch along SW Summerville Avenue to a swale that will filter pollutants before it drains into the adjacent stream. It has approximately 4 percent slope. Conduct fieldwork to verify viability.
46	Riverwood Road Ditch to Swale	SW Riverwood Road	Convert stormwater conveyance ditch along SW Riverwood Road to a swale that will filter pollutants. The street is maintained by the City of Portland.
61	Breyman Avenue Ditch to Swale	SW Breyman Avenue	Convert stormwater conveyance ditch along SW Breyman Avenue to a swale that will filter pollutants. Road is maintained by the City of Portland.

Education, Involvement, and Stewardship Opportunities

Education and outreach is a critical element of improving watershed health and will be incorporated into all Palatine IS projects. The following projects are solely focused on this strategy. Public and commercial education programs are necessary to reach out to watershed residents and businesses to help improve watershed conditions. Projects in this category relate to a range of issues, such as maintenance practices, commercial pollution control practices, public stormwater education, pet waste clean up, yard design and invasive species education, and dumping prevention outreach.

Selection, design, and implementation of these projects will be coordinated with or rely

directly on the local jurisdictional authority. Since the majority of the Palatine subwatershed is outside of City of Portland boundaries, this will involve leveraging existing resources and encouraging and supporting watershed improvement actions at the community level. Critical existing programs include: WMSWCD, the City of Lake Oswego, Metro, Multnomah County Road Services Water Quality Program, Clackamas County Department of Transportation and Development, and the Clackamas County Soil & Water Conservation District.

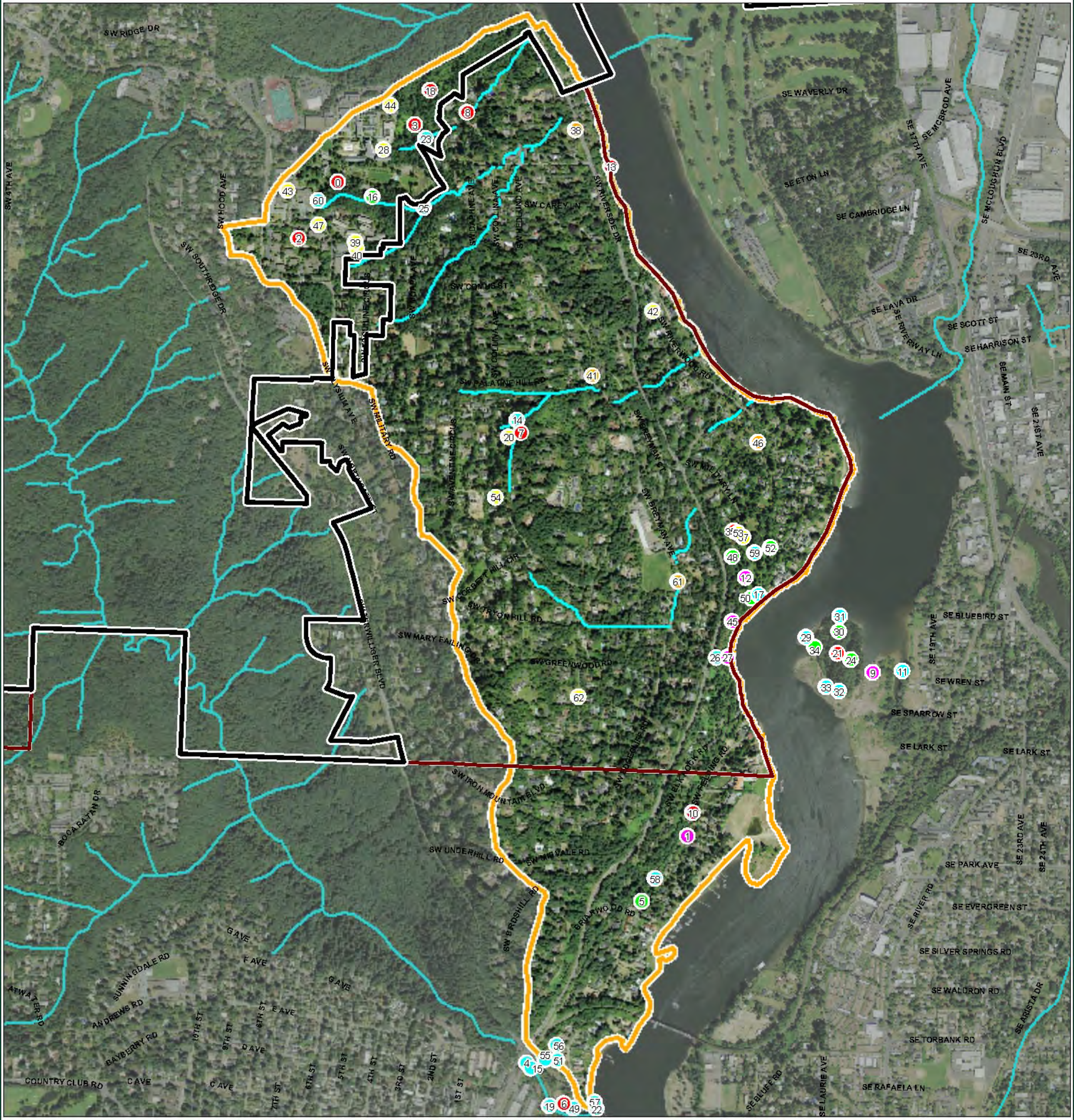
Opportunities that have been identified on private properties will not be pursued without the consent and cooperation of affected property owners. Opportunities identified on properties owned or managed by PP&R will follow the process established through a MOU between PP&R and BES. The MOU process will be used to guide the implementation of any opportunities selected for concept planning or design development.

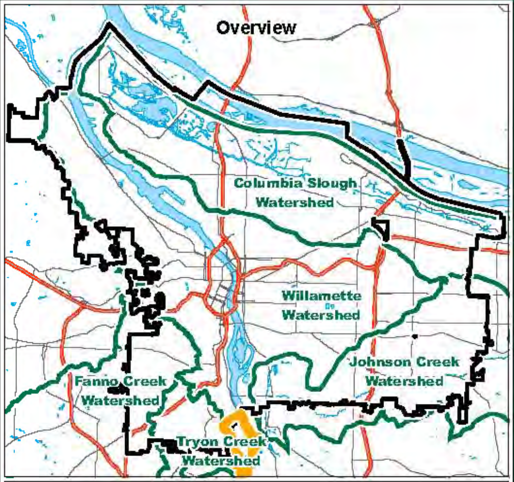
Some of the Education, Involvement, and Stewardship programs/projects that have been identified are watershed-wide opportunities and were not included in the subwatershed objective ranking process; however, they are included in the following table.

Table 11: Palatine Education, Involvement, and Stewardship Opportunities

Rank	Project/Program	Location	Project/Program Description
2	Lewis and Clark Stormwater Outreach	Lewis and Clark campus	Conduct stormwater management outreach to Lewis and Clark College. Partner with college campus to implement actions that reduce stormwater volume and improve water quality. Focus on reducing erosion, improving slope stability, and stream protection.
3	Lewis and Clark Maintenance Practices Outreach	Lewis and Clark campus	Conduct outreach to Lewis and Clark College on land management for healthy watersheds. Provide information on managing invasive species and landscaping practices that minimize chemical use. Actions should work to protect tree canopy, improve slope stability, and enhance riparian areas by managing invasive species on campus and adjacent properties with high value habitat.
6	Tryon Cove Environmental Education Learning Center	Tryon Cove	Convert three-car garage adjacent to the Tryon Creek confluence into an environmental education learning center that promotes watershed health via a healthy Tryon Creek. Provide education about salmonid habitat, floodplain function, native (riparian) vegetation, terrestrial habitat, and general watershed health.
7	Berry Botanic Garden Education, Involvement, and Stewardship	11505 SW Summerville Avenue	Partner with Berry Botanic Garden to conduct watershed health outreach at Garden facility.
8	Palatine Stream Landowners Outreach	Streamside property owners	Conduct stormwater, stream protection and landscaping outreach and education to streamside property owners and landscaping professionals. Partner with WMSWCD and SOLV.
10	Fielding Corridor Restoration Public Outreach	Wetlands parallel to Fielding Road	Conduct education and outreach to improve historic wetland function at SW Fielding Wetland. Wetlands have been excavated to create ponds. Encourage homeowners to improve wetland function/hydrology and promote native plantings. Also include outreach to landscape maintenance companies. Protect large old oak trees and associated habitat.

Rank	Project/Program	Location	Project/Program Description
13	Willamette Riverbank Outreach, Willamette River Property Owners	Willamette Riverbank	Conduct outreach and education to improve riverbank maintenance practices related to stormwater routing, stream protection, and landscaping practices.
18	Westside Wildlife Corridor: Natural Area Coordination	Palatine Natural Areas	Coordinate with Tryon Creek State Park, PP&R (Powers Maine Park), and Lewis and Clark College on Westside Wildlife Corridor strategies. Strategies to coordinate include; invasive plant removal, wildfire prevention, climate change, and wildlife habitat and connectivity enhancement. These natural areas form a wildlife corridor, but each is managed individually.
21	Elk Rock Island Natural Area Education, Outreach and Stewardship	Elk Rock Island	Install discretely located interpretive signage that explains the habitat communities that exist on Elk Rock Island, as well as the importance of protecting and restoring these habitats for the benefit of numerous wildlife species. This project is designed to educate the public on the unique and valuable habitat features that are part of the natural area. This would include obeying the park rules established for natural area.
35	Bishop's Close Neighbor/Landowner Educational Outreach	Bishop's Close	Provide neighbors/private landowners who live adjacent to Bishop's Close garden with information on identifying invasive weeds and options for removing them from their property.
36	Promote Fire Safe Landscaping	Wildfire hazard areas	Support education efforts to property owners in high fire hazard areas of the City. Help residents learn about fire safe methods of landscaping their property.
Not Ranked	Illegal Dumping Outreach	Watershed-wide	Develop trash and yard debris disposal education materials for homeowners adjacent to natural areas. Install signs and fences where appropriate.
Not Ranked	Invasive Species Outreach	Watershed-wide	Support landowner education throughout the Willamette Watershed to control the spread of existing problem species, to prevent introduction of new invasive species, and to provide educational opportunities particularly in public areas and open spaces.
Not Ranked	EDRR Outreach	Watershed-wide	Support landowner education throughout the Willamette Watershed to control targeted less-common invasive species such as garlic mustard before they become widespread and difficult to manage.
Not Ranked	Naturescaping and Yard Tree Outreach	Watershed-wide	Support landowner education throughout the Willamette Watershed to encourage yard trees, naturescaping, and backyard habitat. Provide educational opportunities particularly in public areas and open spaces.
Not Ranked	Residential Non-Point Source Pollution Outreach	Watershed-wide	Conduct outreach and education to reduce impacts of non-point source pollutants, including those associated with washing activities, roof treatments, and pet waste. Install pet waste educational signs, bag stations, and trash bins in natural areas.





Legend

- City of Portland
- Urban Services Boundary
- Palatine Subwatershed Boundary
- Open Channel Streams

Palatine Potential Project Strategies

- Aquatic and Terrestrial Enhancement
- Education Involvement and Stewardship
- Operations and Maintenance
- Protection and Policy
- Revegetation
- Stormwater Management

1 inch equals 1,500 feet

0 — 1,500 — 3,000 Feet

N E S W

City of Portland Environmental Services
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-5
Palatine
Potential Projects

Project No.	Date Printed:
8800	02/05/10

Produced by Systems Analysis: Map Request 5199 (KDR) February, 5th, 2010 \\Cassio\GIS3\Projects_Arc\Misc\Mary_B\Subwatershed_Improvement_Strategies\Phase_6\Fig_5_Pal.mxd

SECTION 7: RECOMMENDATIONS

This report summarizes the Improvement Strategies (IS) process for the Palatine subwatershed and identifies opportunities, in the form of ranked site-specific projects, to protect and improve watershed health. This process is only one step in the larger watershed management process, a long-term adaptive management system that will include implementation, monitoring, evaluation, and improvement of projects and programs.

The projects in this IS report were developed through the use of a rapid assessment process that is based on a well-established science-based method for identifying subwatershed improvements. The method was developed by the Center for Watershed Protection in Ellicott City, Maryland[5]. Selecting the Improvement Strategies involved the collaboration of various stakeholders including all relevant City bureaus, non-profit organizations, and subwatershed residents.

The following recommended actions are the projects identified in Section 6 grouped relative to geographic and/or programmatic clusters. Actions in this section have been grouped and prioritized based on an integrated approach that addresses the watershed goals established in the Integrated Framework for Watershed Health (2005b): hydrology, physical habitat, water and sediment quality, and biological communities.

The groups of actions are intended to protect areas that 1) have been identified in the IS process as assets, or 2) work toward improving local subwatershed conditions in problematic areas. The projects individually and collectively work toward achieving the goals and objectives identified in the Portland Watershed Management Plan (PWMP). The groupings are not intended to suggest an order of implementation or replace the project ranking process described in previous sections; rather they highlight areas based on the technical team's understanding of the subwatershed and opportunities that exist for funding, partnerships, and/or local support.

Bishop's Close

Background
The Peter Kerr estate was renamed Elk Rock Gardens of the Bishop's Close when it was given to the Episcopal Diocese of Oregon in 1959. The property is owned and maintained by the Diocese; the house is now the Bishop's offices. The gardens are open to the public from 8:00 am to 5:00 pm, seven day a week. They are closed on some holidays.

[5] http://www.cwp.org/ - CWP provides training and technical resources to municipalities around the country to assist with assessing watershed conditions. The resources include evaluating local environmental ordinances and programs, field assessments and crafting restoration and protection strategies for small watersheds.

Site Description
Located in the Dunthorpe area about two miles north of Lake Oswego, the estate consists of thirteen acres on a high bluff on the western bank of the Willamette River. The property includes approximately six acres of cultivated English-style gardens that were designed by the New York firm of Olmstead and Son. They are widely known for their many varieties of magnolias as well as for outstanding examples of many other native and exotic plants.

The public gardens at Bishop's Close coincide with a City of Portland identified Special Habitat Area (SHA). Dunthorpe Oaks, within the SHA, contains sensitive or rare native plant populations associated with the oak woodland habitats that are present on the perimeter of the property[6].

The BES Watershed Team conducted two site visits to evaluate potential Improvement Strategies at this location. The projects listed below are suggested to improve and protect the valuable oak and rare species habitat present in this part of the Willamette Watershed.

Benefits
Because the site has a SHA designation, enhancement of plant and wildlife features on this property are a high priority for this subwatershed. The improvements are likely to benefit birds such those that are special status TEES species: band-tailed pigeon, western wood-peewee, Hutton's Vireo, white-breasted nuthatch, black-throated gray warbler, chipping sparrow, and Bullock's oriole; as well as mammals such as the red tree vole, and western gray squirrel; and plant species like the pale larkspur.

In addition to the wildlife and habitat values, oak enhancement at Bishop's Close can play an important role in soil development and in sustaining air and water quality. This special habitat resource is also noted for its natural beauty.

Constraints
The property is privately owned. The Improvement Strategies could be implemented through regular maintenance and enhancements over time. Project implementation costs were not considered when identifying the list of potential improvements and may be considerable. It is recommended that the landowner seek funding opportunities through some of the programs that are available through BES, West Multnomah Soils and Water Conservation District (WMSWCD), and Metro.

Partnerships
BES, Bishop's Close Diocese, WMSWCD, Metro

Potential Funding Sources
BES Community Watershed Stewardship Program (CWSP), Metro Nature in Neighborhoods (NIN), WMSWCD Financial Incentives for Sustainable Habitats (FISH)

[6] A TEES site evaluation was conducted for the Bishop's Close property. The report is available through the BES Watershed Team.

Improvement Strategy Tools

Opportunities for Potential Projects and Programs
Opportunities for improvements at Bishop's Close are organized by the following PWMP strategies: stormwater management; aquatic and terrestrial enhancements; revegetation; policy and protection; and education, involvement and stewardship.

The location and current conditions of the property suggest it is a high priority site for continued investment in the protection, enhancement and restoration of aquatic and terrestrial habitats.

The following potential projects and programs were identified for the Bishop's Close through onsite assessment conducted by BES staff in the Willamette Watershed and the Science Fish and Wildlife team. The projects and programs are conceptual; no design or project development was conducted during the assessment and development of this IS report. Potential projects and programs for Bishop's Close include:

Stormwater Retrofits

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bishop's Close Stormwater Filters (50)
- Bishop's Close Green Stormwater Project (32)

Aquatic and Terrestrial Enhancement Projects

All aquatic and terrestrial enhancement projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bishop's Close--Aquatic Habitat Enhancements (56)
- Bishop's Close--Special Habitat Protection and Enhancements (11)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bishop's Close "The Point" Vegetation Enhancement (47)
- Bishop's Close "Parterres" Vegetation Enhancement (45)
- Bishop's Close "Spring Walk" Vegetation Enhancement (49)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Peter Kerr--Adjacent Conservation Easements (41)
- Bishop's Close Integrated Pest Management (7)

Education, Involvement and Stewardship Projects

Education, Involvement, and Stewardship will be conducted through community partnerships. Potential projects and their rankings are as follows:

- Bishop's Close Neighbor/Landowner Educational Outreach (31)

Lewis and Clark Campus

Background

The Lewis and Clark campus is located on Palatine Hill (137 acres). The campus lies in both the Willamette (94 acres) and the Tryon (43 acres) watersheds. In the Willamette Watershed, 70 acres of the campus lie within the Palatine subwatershed. The campus is in the Collins View neighborhood within the Portland City limits and is contiguous with Tryon Creek State Natural Area. Campus redevelopment projects include an award-winning environmentally sustainable [Leadership in Energy and Environmental Design (LEED) certified] academic building.

Site Description

The eastern portion of the campus is comprised of forested ravines and ridges that contain the headwaters of small tributary streams. The northernmost part of the campus is identified in the City of Portland TEES as a Habitat Anchor and a Habitat Management Opportunity in large part due to its proximity to the undeveloped portion of the River View Cemetery.

The forested portion of the campus is characterized as mid-seral second growth deciduous and coniferous woodland with invasive species problems (blackberry, English ivy and clematis) in the understory and canopy.

There are two streams with headwaters on the Lewis and Clark campus that are direct tributaries to the Willamette River. These streams comprise 5,732 linear feet of tributary flow to the river, terminating at its floodplain, which serves as an important ecological link between the upland and aquatic habitats in the river corridor. The river itself is designated as critical habitat for federally listed salmon and steelhead Evolutionarily Significant Units (National Marine Fisheries Service 2005, 2006).

Need

Due to the location of the campus at the top of the subwatershed, stormwater improvements and restoration of the forested areas of the campus would provide significant benefit to overall subwatershed health.

Benefits

The projects grouped below address aquatic and terrestrial enhancements, water quality and hydrology issues. The influence of the campus on watershed function is key due to the location of the headwater streams and upland forests on the property. Improvements and enhancements on this property will have a substantial impact on the condition of the subwatershed and on the critical salmonid habitat in the adjacent Willamette River.

Constraints
The property is privately owned.

Partnerships
Opportunities should be developed to partner with the Lewis and Clark campus, community groups and individual property owners to conserve and enhance natural areas. Lewis and Clark College faculty and students may be a valuable resource for research in the subwatershed.

Potential Funding Sources
CWSP, NIN, and FISH are all likely local grants opportunities.

Opportunities for Potential Projects and Programs
Opportunities for improvements at the Lewis and Clark campus are organized by the following PWMP strategies: stormwater management; aquatic and terrestrial enhancements; revegetation; policy and protection; and education, involvement and stewardship.

The following potential projects and programs were identified for the Lewis and Clark campus through onsite assessment conducted by BES staff from the Willamette Watershed, Watershed Revegetation Program, and Sustainable Stormwater teams. The projects and programs are conceptual; no design or project development was conducted during the assessment and development of this IS report. Potential projects and programs for Lewis and Clark Campus include:

Stormwater Retrofits

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Lewis and Clark Facilities Parking Lot A Retrofit (36)
- Lewis and Clark Facilities Parking Lot B Swale (35)
- Lewis and Clark Fir Acres Parking Lot B Vegetated Infiltration Basin (26)
- Lewis and Clark SW Residence Hall Drive Rain Garden (44)
- Lewis and Clark Templeton Rain Gardens (39)
- Lewis and Clark NW Campus Stormwater Facility (24)

Aquatic and Terrestrial Enhancement Projects

All aquatic and terrestrial enhancement projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Lewis and Clark Stormwater Outfall and Repair and Maintenance: Palatine (57)
- Lewis and Clark North Tributary Stream Enhancement (20)
- Lewis and Clark South Tributary Stream Enhancement (23)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Lewis and Clark Revegetation (9)

Education, Involvement and Stewardship Projects

Education, Involvement, and Stewardship projects are as follows:

- Lewis and Clark Maintenance Practices (not ranked)

Peter Kerr Natural Area/Elk Rock and Elk Rock Island Habitat Enhancements

Background

Both Elk Rock (west side of the Willamette River) and Elk Rock Island (east side of the Willamette River) are owned by the City of Portland, and managed by Portland Parks and Recreation (PP&R). Peter Kerr purchased these sites in 1910. In 1940, he donated the lands to the City of Portland with the requirement that they be managed in a natural state.

Elk Rock is also known as the Peter Kerr Property. The 3 acre (1.3 ha) property was donated for a public park. It is perched on a cliff, through which runs a 1,200-foot (370 m) railroad tunnel. The Willamette Shore Trolley uses the tunnel for passenger excursions between Portland and Lake Oswego.

Elk Rock Island (13.2 acres) represents part of an ancient volcano that erupted about 40 million years ago and may be the oldest exposed rock in the Portland area. The island contains seven distinct habitats, including wetlands, forests and grasslands. A number of birds, including bald eagles, peregrine falcons and osprey, have been spotted in the area.

Elk Rock Island is accessible from Spring Park in Milwaukie on the east side of the river during periods of low water levels on the Willamette River. It is a popular location for fishing, birding, hiking, botanizing, parties, dog walking, and other recreational uses.

Site Description
Both Elk Rock and Elk Rock Island are south of Portland at approximately river mile 19. Elk Rock is located within an unincorporated area of Multnomah County. It is zoned as R20 (i.e., 1 residential unit per 20,000 square feet of land), but is included within both the conservation (c) and a protection (p) environmental zone overlays. Elk Rock Island is located in Clackamas County, adjacent to the City of Milwaukie, and is not zoned.

Elk Rock is mostly comprised of a sheer inaccessible rock cliff, which provides a barrier to impacts from recreationists and development. It is the location of the only known peregrine eyrie on a natural structure in Portland. The cliff is also believed to be the location of many rare and unusual plants. The cliff has been the location of botanic surveys, with documentation of the unusual plants reaching back to the 1850's (Christy, Kimpo, Marttala, Gaddis and Christy 2009).

Elk Rock Island is a peninsula that is cut off from the mainland during high flow conditions in the Willamette River. It is comprised of oak woodlands, mixed deciduous and conifer forest, rock outcrops, and grassland meadows. Wood features on the island provide structures that are potentially useful to wildlife. These included snags, downed wood, and large stumps. Active uses of these structures were observed during site assessments in spring 2009, including woodpecker cavities in several large snags and a bald eagle nest. The island has been the location of botanic surveys, with documentation of the unusual plants reaching back to the 1850's (Christy, Kimpo, Marttala, Gaddis and Christy 2009).

The shoreline around the peninsula provides diverse habitat types for unique plant communities, fish and wildlife. The beach/mudflat, rocky areas and floodplains surrounding the island are seasonally inundated to various levels. These seasonally inundated features are the locations of large wood pieces and sinuous shorelines. Several sites on the island are comprised of unique habitats that may contain rare plants and animals. The river channel and off-channel area to the east of the island/peninsula are designated as critical habitat for Endangered Species Act (ESA) listed salmonids.

All sites on the island are impacted by their proximity to urban development. Evidence of this includes invasive plants and animals, and damage from recreation overuse. The site is currently managed by PP&R through the "Protect the Best" program.

Benefits
The IS projects recommended for Elk Rock and Elk Rock Island will protect, restore, and enhance both terrestrial and aquatic habitats. This will benefit fish and wildlife and will also provide high value recreation opportunities to visitors.

Restoration and enhancements would provide increased watershed functions that would benefit wildlife, human health and safety, and improve aquatic habitats in the adjacent "critical habitat" for ESA listed species in the Willamette River.

Restoration and enhancement would also increase the wildlife habitat values of the upland forest areas. These forests provide diverse food and habitat factors to species associated with oak woodlands, which are a special status habitat in the Portland area. Enhancement actions recommended in this report would protect the functions that these communities provide to wildlife as well as enhance water quality.

Constraints
Work at these locations would be planned and conducted under the PP&R and BES Memorandum of Understanding (MOU) to partner on restoration work.

The unique habitats, wildlife and plants of both the island and Elk Rock may be especially sensitive to disturbances.

- A bird monitoring plan should be put in place, and restoration activities should be completed outside of the spring and summer nesting seasons.
- Habitats at both sites may contain remnants of rare or special status plant species; restoration activities should be preceded by a thorough plant survey, and a protection plan completed if rare species are located.

Restoration of the island and surrounding forested habitats related to off-channel fish habitat may be constrained by the willingness of the adjacent landowners. Where landowner cooperation agreements are feasible, restoration may be constrained by costs. Conservation easements will be constrained by landowner willingness and costs.

Partnerships
PP&R, Friends of Elk Rock, Metro, Willamette Riverkeeper, Portland Audubon, Clackamas Parks and Recreation, City of Milwaukie

Potential Funding Sources
Oregon Watershed Enhancement Board (OWEB), PP&R, Metro, Oregon Department of Fish and Wildlife (ODFW), BES

Improvement Strategy Tools

Opportunities for Potential Projects and Programs
Opportunities for improvements at Elk Rock and Elk Rock Island are organized by the following PWMP strategies: stormwater management; aquatic and terrestrial enhancements; revegetation; policy and protection; and education, involvement and stewardship.

The location and current conditions of property suggest it is a high priority site for continued investment in the protection, enhancement and restoration of aquatic and terrestrial habitats.

The following potential projects and programs were identified for Elk Rock and Elk Rock Island through onsite assessment conducted by BES staff in the Willamette Watershed, PP&R, and the Science Fish and Wildlife team. Additionally, due to the special habitat associations at both sites, staff consulted with Portland Audubon for concepts to protect and enhance special status wildlife in the area. The projects and programs are conceptual; no design or project development was conducted during the assessment and development of this IS report. Potential projects and programs for Elk Rock and Elk Rock Island include:

Stormwater Retrofits

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- (No projects were identified)

Aquatic and Terrestrial Enhancement Projects

All aquatic and terrestrial enhancement projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Elk Rock Island East Bay Aquatic Habitat Enhancement (15)
- Elk Rock Island Grassland Habitat Protection and Enhancement (28)
- Elk Rock Island Oak Woodlands (North) Protection and Enhancement (27)
- Elk Rock Island Oak Woodlands (South) Protection and Enhancement (29)
- Elk Rock Island Rock Outcrop Vegetation Protection and Enhancement (25)
- Elk Rock/Peter Kerr Native Vegetation Protection and Enhancement (21)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Elk Rock Island Low Elevation Deciduous Forest Vegetation Enhancement (26)
- Elk Rock Island Upland Coniferous Forest Restoration and Enhancement (19)
- Elk Rock Island West Bay Riparian Vegetation Enhancement (30)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Elk Rock Island East Bay Buffer and Aquatic Enhancement Property Acquisitions (5)
- Elk Rock/Peter Kerr Natural Area Peregrine Falcon Eyrie Protection (22)
- Peter Kerr--Adjacent Conservation Easements (41)

Education, Involvement and Stewardship Projects

Education, Involvement, and Stewardship will be conducted through community partnerships. Potential projects and their rankings are as follows:

- Elk Rock Island Natural Area Education, Outreach and Stewardship (14)

Fielding Wetlands Corridor

Background

BES Willamette Watershed staff learned of the mapped/delineated wetlands along SW Fielding Corridor through a review of geographic information system (GIS) mapping for the area. The City of Portland wetlands GIS layer provides polygons for the wetlands parallel to and west of Fielding Road. The recorded source of the wetland delineations is the City of Lake Oswego. Additional GIS information was reviewed for the area including soil types, historic and current vegetation types, and elevations.

With this information, Willamette Watershed staff assessed the wetland area from the public right of way on Fielding Road. Findings from the off-site assessment were used to provide recommendations for enhancing the wetlands and the surrounding forested area to improve watershed functions. These improvements are grouped in this recommendation to provide an overview of potential habitat and water quality improvements that relate to the function of the wetlands and the adjacent Willamette River.

The location of the wetlands, adjacent to the Willamette River and within the 100-year floodplain, makes them significant resources for restoration of watershed functions.

Site Description

Wetlands

Approximately 1.38 acres of wetlands are mapped within an 8.3 acre area in the vicinity of SW Fielding Road. These wetlands are located in Clackamas County, just north of the confluence of Tryon Creek with the Willamette River, along a depression that runs parallel to the river at 20-30 feet in elevation. The soil type is Wapato Silt Loam. The soils are defined as hydric (based on the criteria that poorly drained soils that are less than 1 foot above the water table during the growing season, or that have a permeability of less than 6 inches per hour).

From the vantage point of the adjacent road, it appears that the wetlands have been altered. Ponds located in the vicinity of the wetlands are deep and steep sided; they appear to have been excavated to enhance their function as permanent water features. Staff was not able to observe shallow water/seasonal wetland type habitat desirable to aquatic and terrestrial wildlife associated with floodplain wetlands. Vegetation surrounding the ponds is primarily ornamental landscaping. Individual Oregon ash and Oregon white oak trees still remain near the ponds.

Adjacent forested area

The upland forests and the tree canopy near the wetlands and along the western slope provide a high level of aerial cover. Tree species observed included Douglas fir, Red alder, Oregon white oak, and big leaf maple. The most prevalent invasive plant, which is extremely abundant and occurs throughout the site, is English ivy (*Hedera helix*). In some instances, ivy was observed completely encircling trunks and extending upwards into the canopy. Other predominant invasive plants were clematis (*Clematis* spp.) and Himalayan blackberry (*Rubus discolor*).

Historic vegetation mapping suggests that the large diameter and large crown Oregon white oak trees on the upland slopes and adjacent to the wetlands may be of significant age. The 1851 GLO survey maps show that approximately 300 acres surrounding the wetlands was previously covered with mesic type forest that had recently burned.

Benefits
Restoration and enhancements made in the Fielding Wetlands Corridor would provide increased watershed functions and benefit wildlife, human health and safety, and improve aquatic habitats in the adjacent "critical habitat" for ESA listed species in the Willamette River.

Wetlands provide food, protection from predators, and other vital habitat factors for many of the nation's fish and wildlife species, including endangered and threatened species. In addition, wetland ecotypes have economic value associated with subsistence use of fish and wildlife resources. They also remove pollutants from overland flows before they reach lakes, rivers and bays. Wetlands intercept storm runoff and prevent flooding by releasing water gradually to downstream systems.

Restoration and enhancement would increase the wildlife habitat values of the upland forest areas in the Fielding Wetlands. The mixed tree species in the area provide diverse food and habitat factors to species associated with oak woodlands, which are a special status habitat in the Portland area. Enhancement actions recommended in this report would protect the functions that these communities provide to wildlife as well as enhance water quality.

Constraints
Restoration work in and near wetlands will require permits from the City of Lake Oswego, Oregon Department of State Lands and the U.S. Army Corps of Engineers (ACOE). Restoration of wetlands and surrounding forested habitats related to the wetlands may be constrained by the willingness of the landowners to participate. Where landowner cooperation agreements are feasible, restoration may be constrained by costs. Conservation easements will be constrained by landowner willingness and costs.

Potential Partnerships
Clackamas County Soil and Water Conservation District, property owners, City of Lake Oswego

Potential Funding Sources
OWEB, ACOE, U.S. Environmental Protection Agency Five Start Wetland Restoration Grant Program, U.S. Fish and Wildlife Service National Coastal Wetlands Conservation Grant Program

Improvement Strategy Tools

Opportunities for Potential Projects and Programs
Opportunities for improvements in the Fielding Wetlands Corridor are organized by the following PWMP strategies: stormwater management; aquatic and terrestrial enhancements; revegetation; policy and protection; and education, involvement and stewardship.

The location and current conditions of the Fielding Wetlands Corridor suggest it is a high priority site for investment in the protection, enhancement and restoration of aquatic and terrestrial habitats.

The following potential projects and programs were identified for the Fielding Wetlands Corridor through offsite assessment conducted by BES staff in the Willamette Watershed. The projects and programs are conceptual; no design or project development was conducted during the assessment and development of this IS report. Potential projects and programs for Fielding Wetlands Corridor include:

Stormwater Retrofits

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- (No projects were identified)

Aquatic and Terrestrial Enhancement Projects

All aquatic and terrestrial enhancement projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Fielding Wetland TriMet Aquatic Enhancement (55)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Fielding Corridor Revegetation and Education, Involvement and Stewardship (3)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Fielding Wetlands Conservation Easements (1)

Education, Involvement and Stewardship Projects

Education, Involvement, and Stewardship will be conducted through community partnerships. Potential projects and their rankings are as follows:

- Fielding Corridor Restoration Public Outreach (18)

South Portland Invasive Species Projects

Background

Invasive plants and animals are species that spread so aggressively that they can harm human health and the environment. These species can become a serious problem that damages local biodiversity and economy. Invasives grow more quickly than native plants, reduce wildlife habitat diversity, impair water resources, increase erosion, degrade

public infrastructure (such as water systems and dams), create fire hazards, and degrade recreational opportunities.

The ecological health of the natural areas of South and Southwest Portland are threatened by several particularly virulent species that have gained a local foothold. Protection, enhancement and restoration of the natural areas are directly linked to treatment of these species.

Project Description

The City of Portland Invasive Plant Strategy calls for a program to provide technical assistance to gardeners, property owners and community groups for the control and removal of the top 15 invasive plant species in Portland. The program works to facilitate partnerships with other agencies and non-profit entities to coordinate the City's efforts. The South Portland Invasive Species Project recommendations are grouped to present concepts related to improvement of water quality, aquatic and terrestrial wildlife, fish, and vegetation communities in the Palatine subwatershed. Three programs are available to assist with implementation of specific projects.

City of Portland Watershed Revegetation Program

Through the Watershed Revegetation Program, BES forms partnerships with public and private landowners to restore degraded streambank and upland areas. This restoration work improves water quality, controls erosion, reduces stormwater pollution, aids in long-term salmon recovery, and enhances wildlife habitat.
Restoring native plants can also beautify and enhance natural areas, gardens and residential landscapes.

Early Detection Rapid Response (EDRR) (City of Portland-BES)

This program is working to control less-common invasive plant species within city limits before they become widespread and difficult to manage. The program provides resources for expanding citizen search networks, as well as management strategies for neighborhoods. Information on the program is available by emailing Mitch Bixby, Invasives Plants Manager for the EDRR, at mitch.bixby@bes.ci.portland.or.us.

EDRR (WMSWCD)

WMSWCD is a non-regulatory agency tasked with advising the public on a range of plant issues. In this subwatershed, they have taken on the EDRR responsibilities of unincorporated Multnomah County, although their jurisdiction technically includes all of Portland west of the Willamette. Information on the program is available by emailing Mary Logalbo, Urban Conservationist, at mary.logalbo@or.nacdnet.net.

Benefits

Invasive plant management is an action that protects and improves aquatic and terrestrial habitat quality. Invasive plant removal and native revegetation within riparian areas improve stream temperature, which improves dissolved oxygen levels and protects ecological health. These actions also facilitate species recovery and sustainability of native fish and aquatic organisms as well as terrestrial wildlife and vegetation.

Constraints
Invasive species projects may be constrained by a number of factors: 1) ability of agencies to reach landowners for participation, 2) landowner willingness to participate, and 3) cost.

Partnerships
4 County Cooperative Weed Management Area, WMSWCD, Berry Botanic Garden, Three Rivers Land Conservancy, and Audubon Backyard Habitat Program

Potential Funding Sources
CWSP, BES operating funds (EDRR program, Willamette Watershed, Fanno-Tryon), Oregon Department of Agriculture weed board grants, WMSWCD, Metro NIN grants

Improvement Strategy Tools

Opportunities for Potential Projects and Programs
Opportunities for improvements from the South Portland Invasive Species Projects are organized by the following PWMP strategies: revegetation; policy and protection; education, involvement and stewardship; and operations and maintenance.

The following potential projects and programs were identified through assessment conducted by BES staff in the Willamette Watershed. The projects and programs are conceptual; no design or project development was conducted during the assessment and development of this IS report. Potential projects and programs include:

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bishop's Close "Parterres" Vegetation Enhancement (45)
- Bishop's Close - "Spring Walk" (49)
- Bishop's Close "The Point" Vegetation Enhancement (47)
- Elk Rock Island Low Elevation Deciduous Forest Vegetation Enhancement (26)
- Elk Rock Island West Bay Riparian Vegetation Enhancement (30)
- Fielding Corridor Revegetation and Education, Involvement and Stewardship (3)
- Lewis and Clark Revegetation (9)
- Berry Botanic Garden Riparian Enhancement (8)
- Elk Rock Island Grassland Habitat Protection and Enhancement (28)
- Elk Rock Island Oak Woodlands (North) Protection and Enhancement (27)
- Elk Rock Island Rock Outcrop Vegetation Protection and Enhancement (25)
- Elk Rock/Peter Kerr Native Vegetation Protection and Enhancement (21)

- Lewis and Clark North Tributary Stream Enhancement (20)
- Lewis and Clark South Tributary Stream Enhancement (23)
- Tryon Creek Confluence (A)--Lower Reach (17)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- EDRR Policy *
- Invasive Species Policy *
- Bishop's Close Integrated Pest Management (7)

Education, Involvement and Stewardship Projects

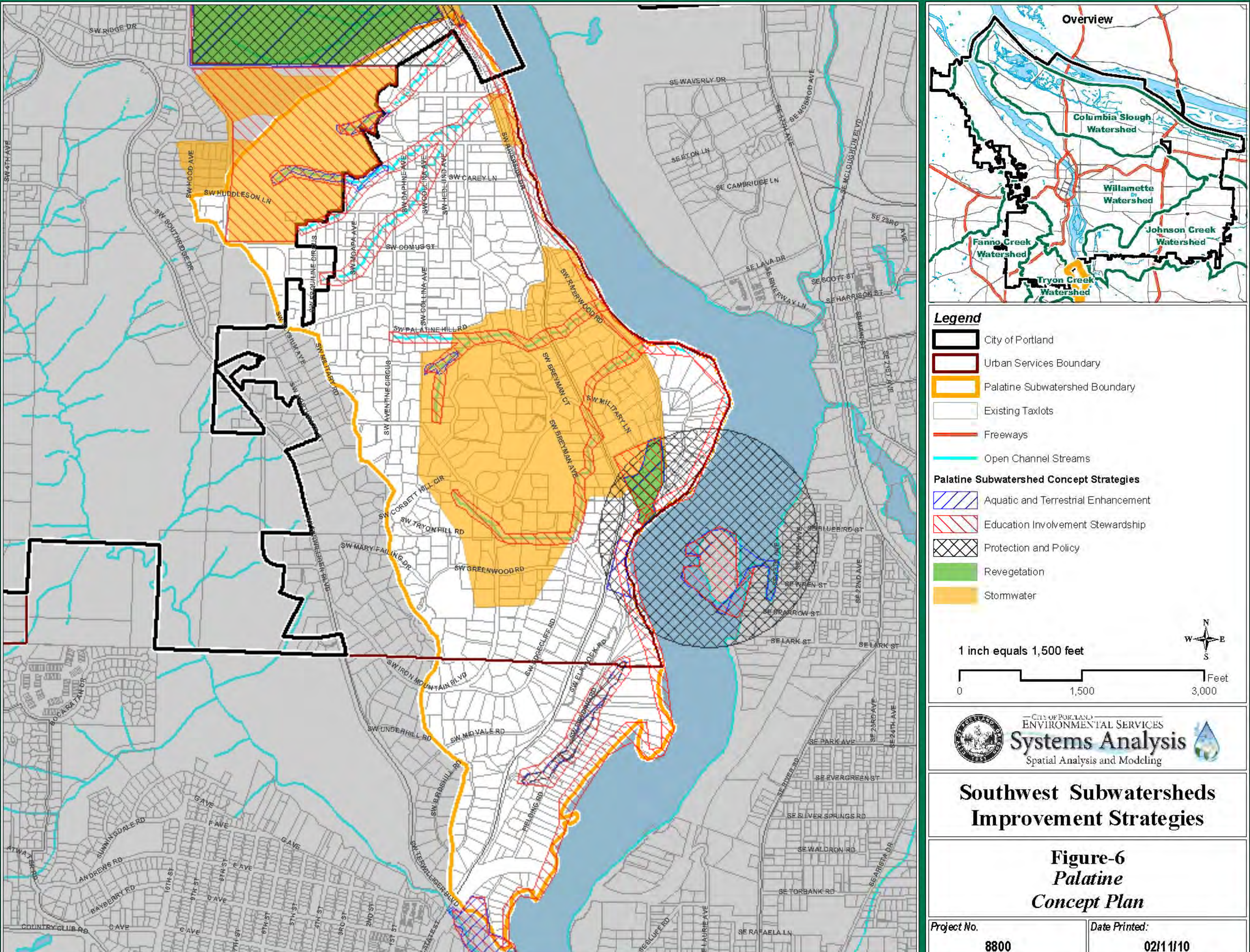
Education, Involvement, and Stewardship projects are as follows:

- Invasive Species Outreach *
- Naturescaping and Yard Tree outreach *
- Bishop's Close Neighbor/Landowner Educational Outreach (31)

Operations and Maintenance

- Maintenance Staff BMP Program *

* Programmatic and watershed-wide projects were not ranked


Overview
Columbia Slough Watershed
Willamette Watershed
Johnson Creek Watershed
Fanno Creek Watershed
Tryon Creek Watershed
Legend
City of Portland
Urban Services Boundary
Palatine Subwatershed Boundary
Existing Taxlots
Freeways
Open Channel Streams
Palatine Subwatershed Concept Strategies
Aquatic and Terrestrial Enhancement
Education Involvement Stewardship
Protection and Policy
Revegetation
Stormwater
1 inch equals 1,500 feet
0
1,500
3,000
Feet
N
S
E
W
SW RIDGE DR
SW 4TH AVE
SW HOOD AVE
SW HUDDLESON LN
SW SOUTHRIDGE DR
SW CAREY LN
SW COMUS ST
SW PALATINE HILL RD
SW RIVERWOOD RD
SW BREYMAN CT
SW BREYMAN AVE
SW MILITARY LN
SW MILITARY RD
SW AVENTINE CIRCUS
SW CORBETT HILL CIR
SW TRYON HILL RD
SW MARY FAILING DR
SW GREENWOOD RD
SW IRON MOUNTAIN BLVD
SW UNDERHILL RD
SW MIDVALE RD
SW BIRDSHILL RD
SW TERWILLIGER BLVD
FIELDING RD
SE WAVERLY DR
SE ETON LN
SE CAMBRIDGE LN
SE MCLOUGHLIN BLVD
SE LAVA DR
SE RIVERWAY LN
SE SCOTT ST
SE HARRISON ST
SE BLUEBIRD ST
SE WREN ST
SE SPARROW ST
SE LARK ST
SE PARK AVE
SE EVERGREEN ST
SE SILVER SPRINGS RD
SE WALDRON RD
SE TORBANK RD
SE RAFAELA LN
SE LAURIE AVE
SE BLUFF RD
COUNTRY CLUB RD
BOCA RATAN DR

Southwest Subwatersheds Improvement Strategies

Figure-6
Palatine
Concept Plan

Project No.	Date Printed:
8800	02/11/10

Produced by Systems Analysis: Map Request 5199 (KDR) February 11th, 2010\CassioGIS3\Projects_Arc\Misc\Mary_B\Subwatershed_Improvement_Strategies\Phase_6\Fig_6_Pal.mxd

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Schueler, Thomas R. and Heather K. Holland, Eds. 2000. *Assessing the Potential for Urban Watershed Restoration,* from The Practice of Watershed Protection. pp. 705 – 711.

The following technical memoranda were prepared for the purposes of developing this final report:

- Palatine Subwatershed Data Analysis and Review Technical Memorandum 2.1
- Palatine Subwatershed Pipe System Data Analysis and Review Technical Memorandum 2.2
- Palatine Subwatershed Characterization Summary Technical Memorandum 2.3
- Palatine Subwatershed Stakeholder Input Technical Memorandum 3.2
- Palatine Subwatershed Improvement Strategies Development Technical Memorandum 4.5
- Palatine Subwatershed Improvement Strategies Evaluation Technical Memorandum 5.5

South Subwatersheds Improvement Strategies

Memo

To: South Subwatershed Project Team
From: Willamette Watershed Planning Team
Task ID: IS Evaluation: Opportunities Ranking Process
Date: 6/19/2009
Subject: **Improvement Strategies Task 5.1**

The subwatershed improvement strategy opportunity ranking process assigns a relative value to each opportunity (i.e., a project or program in a specific location) for improving subwatershed health conditions. The project opportunity rankings are assigned to inform the selection and implementation process and to guide which projects to pursue as opportunities become available.[1]

The following steps were used to complete the ranking of improvement strategy opportunities for the Riverview and Palatine subwatersheds in 2009, and can be replicated for future use:

1. **Develop a list of assets and problem areas** (Task 2 - Characterization) for the subwatershed based on literature review, inventories, and stakeholder input.
2. **Conduct field assessments to evaluate actions** (Task 4 – Development) i.e., potential projects and programs, in areas identified above for watershed improvement strategies. The necessary information for each action is stored in a database maintained by Willamette Watershed staff. Information collected and recorded for each action includes:
   - General information on the site assessed, staff involved, ownership, location, zoning, etc.
   - Description of the type of action proposed - size, location, potential actions etc.
   - Implementation considerations – limitations, coordination factors, etc.

   The field information documented for each site is used in the steps that follow to help quantify the degree to which potential actions will help improve watershed conditions.
3. **Select opportunities** from the identified actions based on the following objectives in the 2005 Portland Watershed Management Plan (PWMP):
   1. Stream Flow and Hydrologic Complexity

[1] The process does not take into consideration any feasibility or implementation factors. The rankings are not intended to represent a set order in which to implement projects or programs.

2. Channel and Floodplain Function
3. Stormwater Conveyance
4. Aquatic Habitat
5. Terrestrial Habitat
6. Stream Temperature
7. Human Pathogens
8. Urban Pollutants
9. Fish and Other Aquatic Organisms
10. Terrestrial Wildlife and Vegetation
11. Education, Stewardship and Involvement

4. **Rank PWMP objectives (Task 5 – Evaluation)** based on their contribution to subwatershed health through a review of results in Steps 1-3, and the Willamette Watershed technical team's best professional judgment. Use the following process to rank the PWMP objectives to show which are most important for improving subwatershed conditions. First, each team member assigns a grade for the current subwatershed condition associated with each PWMP objective. Five grade levels are possible
   - low = 1 point
   - low average = 2 points
   - average = 3 points
   - high average = 4 points
   - high = 5 points

   Second, obtain a consensus grade based on group discussion for the current subwatershed condition associated with each objective. Some of the chief considerations leading to the graded results in the South subwatersheds include:
   - These subwatersheds have a separated sanitary and stormwater infrastructure.
   - The subwatersheds are the 'greenest' subwatersheds in the Willamette Watershed plan area. Riverview has the greatest amount of Open Space (222-acre River View Cemetery) and Palatine has the most intact tree canopy (compared to other Willamette subwatersheds).
   - Assets include madrone habitat in Bishop's Close, rare vegetation and nesting Peregrine Falcons in Peter Kerr Park, rare plant and animal associations and habitats on Elk Rock Island, Bald Eagle nest on private property near Elk Rock Island, willow habitat in Powers Marine Park, and a string of wetlands in Palatine subwatershed.
   - The natural areas are degraded by invasive plant species (Portland Parks and Recreation 2003-2008 Vegetation Survey and Multnomah County 2001 Inventory of Natural, Scenic and Open Space Resources).
   - This section of the Willamette River contains some of the most intact habitat for ESA listed salmonids in the Portland reach of the Willamette.
   - There is significant tree canopy in both subwatersheds due to low density residential development in Palatine and the undeveloped portion of River View Cemetery.

- The streams in Riverview subwatersheds that reach the Willamette River originate in an undeveloped forested area and are presumed to be of high water quality (cold and clear), relative to other streams in the Willamette watershed in Portland.

Based on the conditions of the watershed natural areas, zoning and land use (considerations above) PWMP objectives are ranked. To allow the ranks to reflect the relative importance on a more refined scale (#1 is not necessarily twice as important as #2) weights are assigned based upon each objectives' selected rank. A value based on a scale of 1 – 100 is used to refine the analysis for determining their benefits towards improving subwatershed conditions.

South Subwatersheds Objectives Ranking Results

South Subwatersheds Health Objectives	Final Rank
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.	19.3182
Aquatic Habitat: Protect and improve aquatic, riparian, and floodplain habitat extent, quality, and connectivity that supports the persistence of native fish and wildlife communities.	15.3409
Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainage ways, wetlands, riparian areas and floodplains to improve bank stability and natural hydrologic functions and reduce risk to development and human safety.	13.6364
Terrestrial Wildlife and Vegetation: Implement watershed actions to restore populations of terrestrial organisms to healthy, self-sustaining levels, protect and restore the composition and structure of native vegetation communities, and reduce populations of non-native plants and organisms to levels that do not compete with native species.	13.3523
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.	10.2273
Education, Involvement and Stewardship: Implement and support watershed actions in a manner that utilizes community partnerships and provides education to the public about important watershed issues.	8.5227
Stream Flow and Hydrologic Complexity: Protect and increase rainfall interception areas, create infiltration and detention areas to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.	5.9659
Human Pathogens: Maintain and manage sewer infrastructure and stormwater inputs and runoff to limit sewage overflow and the delivery of pathogens to waterways and achieve applicable water quality and sewer design manual standards.	4.5455
Urban Pollutants: Manage the sources and transport of urban stormwater	4.5455

South Subwatersheds Health Objectives	Final Rank
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.	
Stream Temperature: Protect and improve stream temperatures, dissolved oxygen, and pH levels that protect ecological health and achieve applicable water quality standards.	3.4091
Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity.	1.1364

5. **Assign a metric to each objective**. Each PWMP objective listed in Step 3 is assigned a metric that, when measured, would indicate a positive improvement in subwatershed health. Metrics are chosen based on the assets and problems specific to the subwatershed. Metrics are assigned based on PWMP objectives. In the South subwatersheds the metrics have been assigned as follows:

   Objective: Metric
   1. Terrestrial Habitat: Terrestrial Habitat protected/improved/enhanced (acres)
   2. Aquatic Habitat: Aquatic habitat restored/enhanced/protected (linear feet)
   3. Channel and Floodplain Function: Channel/Floodplain restored/protected/ enhanced (acres)
   4. Terrestrial Wildlife and Vegetation: Native/Invasive ratio improved (Y/N)
   5. Fish and Other Aquatic Organisms: Biotic measures improved (Y/N)
   6. Education, Involvement and Stewardship: Opportunities for education, involvement and stewardship (Y/N)
   7. Stream Flow and Hydrologic Complexity: Effective impervious area (EIA) reduced (acres)
   8. Human Pathogens: Fecal inputs reduced (Y/N)
   9. Urban Pollutants: Urban pollutants reduced in soils or water (Y/N)
   10. Stream Temperature: Stream temperature maintained/reduced (Y/N)
   11. Stormwater Conveyance: Stormwater infrastructure improved/protected /maintained (Y/N)

   Each objective is assigned at least one metric (i.e., there can be more than one) based on the predicted ability of the recommended action(s) to improve subwatershed health. As indicated above, metric can be based on acres, linear feet, or the detectable accomplishment (Y/N) for the recommended actions.

6. **Analyze opportunity projects using a multi-attribute utility analysis tool.** Multi-Attribute Utility Analysis (MUA) is a formal, analytic approach for evaluating and comparing alternatives for decisions with multiple objectives. This decision-making tool allows the decision-maker to incorporate objectives that are measured on different scales, and to generate a prioritized list of alternatives based upon scores.

Scores are calculated using anticipated measurable improvements (i.e., metrics) for each opportunity, and the final ranks and weights assigned to each objective by the Project Team. Each action is first assigned a value for each measure.

For example:

Action: Create a vegetated stormwater infiltration facility that could receive water from a 0.5 acre catchment area
Measure: Reduce Effective Impervious Area (EIA)
Value associated with one measure: 0.5 acres

The following formula is then applied:

$$Score = \sum_{i=1}^{m} k_i U_i$$

where m = the initial value for the measure identified in Step 6 (in the example above, 0.5 acres)
k = the weight assigned to each objective
U = the normalized value for the measure[8]

The final score for each opportunity (i.e., project or program in a specific location) demonstrates a relative value towards improving subwatershed health conditions and does not take into consideration any feasibility, implementation, or cost factors. The scores are not intended to represent a set order in which to implement opportunities. Rather, they will inform the selection and implementation processes to pursue as resources become available.

7. A draft version of the complete scored and prioritized list of opportunities is then developed by Willamette Watershed staff and sent to the Technical Advisory Team for review. The team includes:

- BES Clean River Rewards (Danny Kapsch)
- BES Communications Staff/Office of the Director
- BES Community Stewardship (Jennifer Devlin)
- BES Coordinated Sited Analysis (Clark Henry)
- BES Engineering Systems Analysis (Alicia Lanier/Dave Whitaker/Mike Szwaya)
- BES Grey to Green (Shannah Anderson)
- BES Maintenance (Joe Dvorak/Steve Hazzard)
- BES Regulatory/Policy (Dawn Hottenroth)

[8] Values for the metrics associated with each action were normalized to a 0 to 1 scale using the following formula, where *U* is the action's normalized score for each measure:

$$U = \frac{X}{Best} - \frac{Worst}{Worst}$$

- BES Revegetation (Ryan Durocher, Darian Santner)
- BES Science, Fish, and Wildlife (Claire Puchy)
- BES Source Control (Michael Pronold)
- BES Sustainable Stormwater (Tim Kurtz/Casey Cunningham)
- Bureau of Planning (Mindy Brooks)
- Portland Bureau of Transportation (Micheal Boyle, Tom Caufield, Kelly Shepard, Chad Tippen)
- Portland Parks and Recreation (Mark Wilson, Emily Roth, Marissa Dorais)
- Portland Water Bureau (Cherri Warnke)

The opportunities list is reviewed by city stakeholders and the Willamette Watershed Team, and is then finalized based on consideration of comments received.