# AMENDED 2013
# STORMWATER COMPREHENSIVE PLAN

Prepared for

CITY OF LACEY

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

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# STORMWATER COMPREHENSIVE PLAN

Prepared for

CITY OF LACEY

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# Acronyms and Abbreviations

| | |
|---|---|
| 1991 Manual | Drainage Design and Erosion Control Manual for Thurston Region, Washington |
| 1994 Manual | 1994 Drainage Design and Erosion Control Manual for Lacey |
| 2010 Manual | City of Lacey 2010 Stormwater Design Manual |
| ACEC | American Council of Engineering Companies |
| APWA | American Public Works Association |
| BMP | Best Management Practice |
| CFC | Capital Facilities Charge |
| CIP | Capital Improvement Program |
| City | City of Lacey |
| Ecology | Washington Department of Ecology |
| ESA | Endangered Species Act |
| FTE | Full Time Equivalent |
| GIS | Geographic Information Systems |
| GREEN | Global Rivers Environmental Education Network |
| GMA | Growth Management Act |
| G.O. | General Obligation |
| HOA | Homeowners Association |
| IDDE | Illicit Discharge Detection and Elimination |
| LID | Low Impact Development |
| LLMD | Long Lake Management District |
| LMC | Lacey Municipal Code |
| MUGA | Municipal Urban Growth Area |
| NPDES | National Pollutant Discharge Elimination System |
| O&M | Operations and Maintenance |
| OSI | Open Space Institutional |
| PCHB | Pollution Control Hearings Board (of the state of Washington) |
| Phase II Permit | Western Washington Phase II Municipal Stormwater Permit |

| | |
|---|---|
| PSP | Puget Sound Partnership |
| PWTF | Public Works Trust Fund |
| QAPP | Quality Assurance Project Plan |
| RSMP | Regional Stormwater Monitoring Program |
| SCP | Stormwater Comprehensive Plan |
| SEPA | State Environmental Policy Act |
| SOP | Standard Operating Procedure |
| SR | State Route |
| STORM | Stormwater Outreach for Regional Municipalities |
| SWMP | Stormwater Management Program |
| SWPPP | Stormwater Pollution Prevention Plan |
| TMDL | Total Maximum Daily Load |
| UGA | Urban Growth Area |
| UIC | Underground Injection Control |
| WQIP | Water Quality Implementation Plan |

# ES EXECUTIVE SUMMARY

## ES.1 Introduction

This report presents a plan to guide the City of Lacey's Stormwater Utility programs and projects for years to come. It represents the first Stormwater Comprehensive Plan (SCP) developed by the City and includes stormwater program activities and projects for the 6-year planning horizon. Section 1 of this report describes the challenges the City faces in managing stormwater runoff and protecting receiving waterbodies along with detail on the purpose of this document, goals, how this plan was developed, a summary of accomplishments, and the public involvement process that was followed as this plan came together.

### *ES.1.1 Purpose of this Plan*

The purpose of this plan is to guide the City's Stormwater Utility programs in a manner consistent with applicable local, state, and federal regulations while charging consumers an equitable stormwater utility rate, and supporting the goals and policies expressed in The City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area. The plan includes:

- Identification of and proposed solutions to flooding and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements, especially the Western Washington Phase II Municipal Stormwater Permit (Phase II Permit)
- A financial plan to address the first two items

Since the majority of the City is built-out, most of the identified issues are a result of:

- Uncontrolled runoff from development construction prior to the implementation of the Stormwater Utility Fund in 1985
- Aging infrastructure
- Regulatory mandates

### *ES.1.2 Goals and Policies*

The goals and policies developed in this plan are consistent with the goals of The City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area (Lacey Comprehensive Plan). They support actions that will reduce flooding impacts, ensure stormwater is managed efficiently, protect the quality and quantity of water resources, and protect groundwater, the City's drinking water source. This Stormwater Comprehensive Plan will guide the City's Stormwater Management Program (SWMP) as the City works towards furthering the goals of the Growth Management Act (GMA), to reduce urban growth and reduce sprawl. Future increases in development density, which result from the GMA, will

lead to higher percentages of impervious surface, stress the City's stormwater infrastructure, and require more intensive runoff treatment and flow control to mitigate stormwater impacts to human health and the environment. In support of GMA and the Lacey Comprehensive Plan, the City's SWMP is focused on meeting the following three goals:

1. Protect and enhance surface and groundwater resources to support beneficial use by humans, aquatic life, and wildlife
2. Manage the storm drainage system to protect public safety and minimize property damage caused by flooding and erosion
3. Provide adequate funding for the SWMP through an equitable stormwater utility rate structure

To accomplish these goals, the City developed guiding policies for general stormwater management, water quality, flow control, and funding.

### ES.1.3 Stormwater Comprehensive Plan Development

City staff and consultants conducted detailed analyses to support the conclusions and recommendations in this plan. These analyses included interviews with City staff, field reconnaissance, a staffing needs evaluation, development of capital improvement program (CIP) projects, and calculation of funding needs to implement the plan.

Past studies and plans were reviewed for information on drainage and water quality issues, and to evaluate the existing SWMP. To supplement existing drainage and water quality information and recent documentation of the status of the City's stormwater management program, Herrera Environmental Consultants (Herrera) conducted a workshop and an advisory group meeting with City staff.

### ES.1.4 Stormwater Management Program Accomplishments

- **1960s and 1970s:** Historically, the City's water resource obligations consisted almost exclusively of drainage facility design and flood control. These obligations were the responsibility of the City's Engineering Department.
- **Early 1980s:** The cities of Lacey, Tumwater, and Olympia, in cooperation with Thurston County, funded a study to identify methods to improve surface water quantity and quality conditions in north Thurston County. This work culminated with the North Thurston County/Lacey/Olympia/Tumwater Surface Water Management Utility Development Plan (Thurston County et al. 1986).
- **1985 to 1987:** Based largely on the results of the regional water resources study, the City created the Stormwater Utility Fund on January 24, 1985, which added Chapter 3.52 to the Lacey Municipal Code (LMC). On November 20, 1986, the City added Section 13.08.015 to the LMC making it unlawful to discharge pollutants into the storm drainage system. On December 4, 1986, Chapter 13.70 – Storm and Surface Water Utility Charges was added to the LMC that established interim storm and surface water utility charges. These initial rates became effective on January 1, 1987, and remained in effect for 3 years as studies were conducted to determine a more permanent rate structure.

- **1988 to 1990:**
  - In 1988, Ecology identified Woodland Creek as an impaired water body in the Nonpoint Source Pollution Assessment Report. In response to the growing concern for water quality issues in the Puget Sound area, the City's Public Works Department created a new Water Quality Management section. On March 23, 1989, the City Council authorized the role of a Water Quality Manager to serve as the administrator for the Water Quality Management Program. With this position, a new Water Quality Division was created within Public Works, responsible for managing the City's surface water runoff, groundwater and drinking water issues and concerns.
  - Between 1989 and 1990, a new Water Resources Division was created in response to the growing concern regarding water resources management, and included three full time staff positions. Responsibilities of this division included managing the City's Stormwater Utility, outreach and education programs, basin planning, wellhead protection and water conservation plans.
- **1990 to 1999:**
  - On April 26, 1990, Chapter 13.70 of the LMC was amended to establish a rate structure with a flat rate for single-family and two-family residential parcels and a seven-step sliding rate for commercial parcels. The new rate structure became effective on July 1, 1990, and is still in use today.
  - The City worked together with Thurston County, Olympia and Tumwater to develop a regional drainage manual (Drainage Design and Erosion Control Manual for Thurston Region, Washington) which was adopted on July 1, 1991. An updated version of the manual was adopted by the City on February 1, 1994. The 1994 Manual remained in use for 16 years, until it was replaced in 2010.
  - On February 8, 1996, the prohibitions against discharges into the stormwater system contained in LMC Section 13.08.015 were amended.
  - In March 1996, the Water Resources Manager position was eliminated and the two other full time staff were reorganized into the City's Public Works Engineering Division.
  - In October 1997, the Water Resources Division was re-established as a separate division within Public Works under the supervision of a Water Resources Manager.
  - In 1999, Lacey became the first city in Washington to formally adopt a "zero effect drainage discharge" ordinance (Ordinance 1113, Chapter 14.31 LMC) to allow deviations from standards for projects with no increase in effective impervious surfaces. The ordinance opened the door for the use of innovative low-impact development (LID) methods at development sites in Lacey.
- **1999 to 2004**: From 1999 to 2004, Lacey constructed five of its largest regional stormwater facilities: the Ruddell Road Stormwater Treatment Facility (1999), the Shady Lane Stormwater Facility (2000), the 7th Avenue SE Stormwater Facility (2001), the 45th Avenue Regional Stormwater Facility (2003), and the Fones Road Ditch Stormwater Facility (2004, with the City of Olympia). Construction of these facilities

addressed some of the city's highest-priority needs for runoff water quality treatment and flow control.

- **2004 to 2010:**
  - In 2004, the City passed Ordinance No. 1233 to bring the City into compliance with state law regarding stormwater mitigation. This ordinance added a new chapter (Chapter 5A) to the City of Lacey Development Guidelines and Public Works Standards relating to storm drainage system maintenance. The ordinance also included development of a Private Stormwater Facilities Inspection Program to ensure that private and City-owned stormwater facilities were being properly maintained.
  - In 2007, the City constructed The College Regional Stormwater Facility on Saint Martin's University Property.
  - Ordinance 1332, adopted on August 13, 2009, amended Chapter 5A to add specific definitions and wording regarding illicit discharges, as required by the Phase II Permit.
  - The City of Lacey Stormwater Design Manual was adopted in 2010.

### ES.1.5 Public Involvement and Participation Conducted for this Plan

Public involvement is an important component of the SWMP and will be conducted as part of the preparation of this SCP. The City sought input from the general public and City officials in several ways:

- Published the draft SCP on the City's website on July 5, 2012, and invited comments from the public until November 21, 2012
- Provided paper copies of the draft SCP for review at City Hall
- Provided paper copy of the draft SCP for review in the City Council workroom.
- Presented the draft SCP to the Utilities Committee on July 3, 2012
- Solicited input from the general public on the draft SCP at the Lacey Community Market on July 14, 2012
- Presented the draft SCP to the Planning Commission on October 23, 2012
- Provided a "Preview" copy of the final SCP for review on the City website in May 2013
- Provided paper copies of the final SCP for review at City Hall
- Made paper copy of the final SCP for review in the City Council workroom
- Presented the final SCP to the Planning Commission on May 21, 2013
- Sent utility billing inserts to all Lacey stormwater customers on May 24, 2013, regarding SCP availability and requesting review and comments
- Presented the final SCP to the Utilities Committee on June 7, 2013
- Presented the final SCP for a public hearing before the Planning Commission in Summer/Fall 2013

- The May 2013 Stormwater Comprehensive Plan (without Chapter 6) was adopted by the City Council on July 25, 2013.
- Made the final SCP available on the City's website following approval by Council

### ES.1.6 Plan Organization

This report is organized into six sections:

1. An introduction to the stormwater program, the purpose of the plan, and the methods employed to develop the plan
2. A discussion of the background material that is relevant to the stormwater program;
3. A description of citywide and site-specific stormwater problems and proposed solutions
4. A description of the stormwater management program and activities required to comply with the Phase II Permit and defined program goals
5. Instructions for implementation of the stormwater management program activities and projects
6. A financial plan describing the stormwater utility rate adjustments that are required to implement this plan

The plan appendices provide more detailed background information, calculations and data related to the plans recommendations.

## ES.2 Background

Section 2 of this report discusses the physical environment in the City that affects stormwater management; waterbodies within the City limits and the Urban Growth Area (UGA) that receive surface water or stormwater from within the City limits; climate change considerations; applicable regulations; and a brief history of the stormwater utility fund.

### ES.2.1 Study Area Characteristics

The City is located at the southern tip of Puget Sound and is bordered to the west by the City of Olympia. Thurston County borders the City to the north, east, and south. The City encompasses approximately 16.1 square miles (10,304 acres) in area, including 1.8 lineal miles (9,504 feet) of marine shoreline. The current population is 42,830 in the City and 33,170 in the UGA (Lacey 2012a; 2010 census).

The City's land uses reflect a small town heritage modified by a recent influx of large residential and commercial development. The Hawks Prairie Business District is the latest area of commercial development with large retail and light-industrial parks. Residential developments and a large corporate campus dominate the southern portion of the City. The City maintains a large Open Space Institutional (OSI) land use inventory that includes churches, schools, parks, and protected critical areas. Within the City's UGA boundary (approximately 10,000 acres), almost 17 percent of the land is designated OSI and includes

large tracts of protected critical areas. The City also owns a large portion of the wetland and buffer areas around Woodland Creek. Figure 2-1 summarizes existing land uses in the City.

The soils in the City are typical for the south Puget Sound Region, consisting of well-drained glacial outwash, intermixed with zones of glacial till, and wetland peat bogs. The majority of the City is dominated by outwash soils that generally have high infiltration capacities.

### ES.2.2 Waterbodies

The City has an abundance of natural water resources that includes a chain of connected lakes that flow from one to another through wetlands, culminating in Woodland Creek, which drains to Henderson Inlet on Puget Sound. This chain begins with Hicks Lake, which flows into Pattison Lake, which in turn flows into Long Lake. The outflow from Long Lake forms Woodland Creek which then flows through Lake Lois and enters the southern end of Henderson Inlet. Stormwater runoff in the City and the UGA drains to the following three watersheds: Henderson Inlet, Deschutes, and Nisqually.

Numerous waterbodies located within the City limits, the UGA, or that receive surface water or stormwater from within the City limits are currently listed on the Washington Department of Ecology (Ecology) 303(d) list (Category 5) for water quality impairments:

- **Budd Inlet** – dissolved oxygen, various toxics (tissue)
- **Deschutes River** – temperature, fecal coliform bacteria, dissolved oxygen, fine sediment
- **Henderson Inlet** – dissolved oxygen
- **Long Lake and Pattison Lake (south arm)** – total phosphorus
- **Long Lake** – PCB (tissue), 2,3,7,8 TCDD (tissue)
- **Woodard Creek** – dissolved oxygen
- **Woodland Creek** – temperature

The following waterbodies located within the City limits, the UGA, or that receive surface water or stormwater from within the City limits currently have a total maximum daily load (TMDL) established by Ecology to address impairment from fecal coliform bacteria:

- Eagle Creek
- Fox Creek
- Jorgenson Creek
- McAllister Creek
- Woodland Creek

### ES.2.3 Climate Change

The potential hydrologic changes associated with climate change increase the importance of stormwater management practices that control flows, promote infiltration, and preserve and enhance water quality. Because the City's water resources are precipitation driven and the

City's water supply is from groundwater, ensuring infiltration of stormwater and groundwater recharge will become increasingly important as population grows, groundwater demands increase (due to higher temperatures and greater population), and water resources become more scarce (due to altered precipitation patterns).

Changes in the City's hydrologic patterns will have consequent effects on water quality. As average water temperature increases, it will likely exacerbate existing water quality problems of low dissolved oxygen and frequent algal blooms in the City's lakes and downstream waters. Current inflows of excessive nutrient loads will produce even more frequent algal blooms leading to higher incidences and longer periods of low dissolved oxygen events. Such effects can also adversely alter stream and lake ecosystems, affecting the viability of many native aquatic plant and animal species, especially cold-water fish such as cutthroat trout. The City could reduce its vulnerability to increasingly poor water quality by retrofitting existing stormwater facilities for better treatment performance, or constructing new stormwater infrastructure such as constructed wetlands, or LID facilities that more effectively treat water quality.

### ES.2.4 Applicable Regulations

The City's SWMP supports efforts to comply with the following local, state, and federal regulations and other requirements:

- Ecology's Phase II Permit, originally issued in February 2007 and modified in June 2009 requires cities and counties that manage small municipal separate storm sewer systems to develop a SWMP focused on reducing discharge of pollutants to the maximum extent practicable and on protecting water quality. A revised version of the Phase II Permit was finalized in 2012 and will become effective on August 1, 2013.
- TMDL cleanup action is required for waterbodies on Ecology's Clean Water Act Section 303(d) list due to significant water quality degradation.
- The Puget Sound Partnership (PSP) is the regional organization that the governor has charged with restoring the health of Puget Sound by 2020 (PSP 2009, 2011). The City's SWMP will need to focus on the major stormwater-related issues that PSP highlights for action to assist in this critically important regional effort.
- The federal Endangered Species Act (ESA) prohibits the take of all listed species, including a take that could result from the City's stormwater facility operations or private development stormwater management activities that are permitted by the City.
- The Washington State Growth Management Act (GMA) requires the City to inventory and protect environmentally critical areas (such as steep slopes, wetlands, and streams) (Chapter 36.70A of the Revised Code of Washington). The GMA also requires the City to develop comprehensive plans in order to ensure environmentally responsible and economically sustainable development, including planning for stormwater-related capital facilities.

### ES.2.5 Low Impact Development Stormwater Management

Stormwater management in the context of LID seeks to mimic natural hydrologic processes to manage stormwater onsite. This negates increases in runoff volumes and peak flow rates, reduces pollutant loadings in runoff to surface waters, and recharges groundwater. Examples of these distributed stormwater management practices include permeable pavements, green roofs, bioretention areas (also referred to as rain gardens), compost or topsoil amendment in lawn areas, and cisterns for water reuse. Because LID BMPs blend well with native plant landscaping, they can also be used amidst landscaped areas for a wide range of land uses and can often be designed and constructed alongside roadways and in residential settings. Incorporation of LID into residential areas can also increase property values and add amenity value that traditional stormwater management cannot achieve (LMI 2005; Bryce et al. 2008). The 2013-2018 Phase II Permit, in combination with the 2012 Stormwater Management Manual for Western Washington, make LID stormwater management BMPs mandatory where feasible for onsite stormwater management beginning in 2017. The 2013-2018 Phase II Permit also requires the City review and revise its development-related codes, rules, standards, and other enforceable documents to incorporate and require LID principles and LID BMPs by December 31, 2016.

### ES.2.6 Stormwater Utility Fund

The City created the Stormwater Utility Fund on January 24, 1985, to implement a storm and surface water utility charge. This charge is necessary to fund SWMP activities and projects that are required to provide services to residents, support development and meet regulatory requirements. In December 1987, interim stormwater utility fees were established. These were flat fees assessed to property owners on a per-parcel basis. Residential homeowners paid $1.45 per month per parcel while commercial and business owners paid $14.50 per month per parcel. This ordinance also established a dedicated Stormwater Enterprise Fund, similar to the City's sewer and water enterprise funds, which means the utility is self-supporting. Between 1982 and 1989, stormwater fees generated approximately $130,000 to $170,000 per year in revenue. These funds were largely used for basin planning to determine the needs of the City's stormwater program.

On April 26, 1990, Chapter 13.70 of the LMC was amended to establish a rate structure with a flat rate for single-family and two-family residential parcels and a seven-step sliding rate for commercial parcels. The new rate structure became effective on July 1, 1990, and is still in use today.

Funds received by the stormwater utility are used in the management and control of stormwater or to construct stormwater facilities. The primary accomplishments of the stormwater utility are summarized in Section 1 of this plan. Over the years, stormwater utility fees collected by the City have been used for an increasing number of purposes as stormwater problems and regulatory requirements have grown.

## ES.3 Known Problems and Recommended Solutions

Section 3 of this report summarizes the stormwater and surface water system within the City as well as citywide flooding and water quality problems and recommendations to address

these problems. The section concludes with a discussion of site-specific flooding and water quality problems along with project solutions developed based upon interviews with City staff and field reconnaissance.

### ES.3.1 Citywide Problems and Recommendations

Citywide problems result from local or regional trends in development and behavior. The primary citywide drainage problem is flooding, which is largely caused by uncontrolled runoff from hard surfaces. The primary citywide water quality problems are nonpoint source pollution from older development, including residential and commercial development, from vehicle use in the City-owned rights-of-way, and potentially illicit discharges and illicit connections to the storm drainage system.

The City should consider the following activities to address the Citywide flooding and erosion problems:

- Develop and maintain a list of known drainage problem neighborhoods, assign staff responsible for maintaining the list, and encourage field staff to contribute to the list on a quarterly basis, especially after storm events when they may have noted problems in the field
- Consider flow control retrofits through modification of existing facilities or LID development practices as part of projects programmed through other departments (e.g., consider stormwater retrofits as part of transportation projects)
- Add flow control retrofit CIP projects or neighborhood drainage improvement CIP projects to the site-specific problems list on an annual basis
- Continue to implement requirements of the Stormwater Design Manual for private and public development projects to the maximum extent possible as allowed by state and Federal case law
- Implement the Illicit Discharge Detection and Elimination (IDDE) recommendations in Section 4 of this plan
- Consider implementation of a source control program as resources permit

The City may also consider contributing to implementation of projects identified by Basin Plans for receiving waterbodies such as Woodland Creek that are downstream of the City, particularly when these projects could have a lower cost for an equivalent or greater benefit to water resources than projects implemented within the City of Lacey. These recommended solutions should be further evaluated for their potential to improve City-wide issues of flooding, water quality, and illicit discharges.

### ES.3.2 Site-Specific Problems and Recommendations

Several site-specific problems were evaluated to develop planning level solutions and cost estimates for use in establishing the City's stormwater CIP plan for 2014-2023. Problems were identified by conducting interviews with City staff and performing field reconnaissance. The solutions below were developed to address the site-specific problems. As with Citywide problems discussed above, the City should develop a list of known problems, assign a staff

member to maintain the list and collect information on each problem. The list should be updated on a regular basis with new problem areas and additional information on previously identified problem areas. This list of problem areas will be used to prioritize future CIP project solutions.

### ES.3.3 CIP Project List

Solutions were developed based on field reconnaissance and input from City staff, and were prioritized and ranked based on evaluation of five prioritization factors: problem risk, project efficiency, funding potential, public sentiment, and data quality. Table ES-1 provides an implementation schedule for all 21 stormwater CIP projects with a total value of approximately $11.4 million in 2013 dollars. The schedule reflects the project priorities in that higher priority projects are generally scheduled earlier than lower priority projects.

### ES.3.4 Non-CIP Projects

Additional projects outside the scope of the CIP plan are stormwater facility rehabilitation projects (operations and maintenance projects). Table ES-2 provides an implementation schedule for the 11 operations and maintenance projects (OM1 through OM11).

## ES.4 Stormwater Management Program Evaluation and Recommendations

Section 4 of this report summarizes the key SWMP accomplishments and recommendations for current Phase II Permit requirements and the 2013-2018 Phase II Permit requirements. The recommendations were developed based on a gap analysis (comparison of the City's present SWMP to the 2007-2013 Phase II Permit requirements) and needs assessment conducted in 2011 and 2012 to evaluate specific components of the City's SWMP with respect to Phase II Permit requirements (Lacey 2012b).

Section 4 is organized by the five major SWMP components:

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and elimination (IDDE)
4. Controlling runoff from new development, redevelopment, and construction sites
5. Municipal Operations and Maintenance

In addition to the five SWMP components, Section 4 also includes a summary of the accomplishments and recommendations for the following Phase II Permit requirements:

- Compliance with TMDLs
- Monitoring and Assessment
- Reporting

Underground injection control (UIC) is also discussed in Section 4. Management of UICs are not a Phase II Permit requirement, but are generally considered to be part of the storm drainage system in the City, and were therefore included in the gap analysis and needs assessment evaluation of the City's SWMP.

A summary of the recommendations for the City's SWMP include the following:

- **Public education and outreach:** Continue existing programs and develop new educational materials to reach new target audiences and subject areas.
- **Public involvement and participation:** Continue to promote public participation through the City's website as well as through printed media.
- **IDDE:** Expand business education program and staff training, improve procedures and tracking for calls to the spill response hotline, and improve interdepartmental coordination.
- **Control runoff from new development, redevelopment, and construction sites:** Improve plan review and enforcement coordination, documentation, and tracking; assign additional staff time and resources to the pre-construction and private facility inspection and enforcement programs; expand staff training; and update codes, rules, standards, and other enforceable documents to incorporate new site thresholds, LID principles, and LID Best Management Practices (BMPs).
- **Pollution prevention and operation and maintenance for municipal operations:** Establish an ongoing retrofit program for aging City stormwater facilities; maintain and update a CIP project list to address flooding and water quality problems; continue to provide education and technical assistance to private stormwater facility owners; develop a line inspection program; develop a ditch and culvert inspection program; improve tracking of stormwater-related problems.
- **Compliance with TMDLs:** Comply with TMDL implementation plans developed by Ecology for TMDLs that affect waterbodies or watersheds within the City limits.
- **Monitoring and Assessment:** Coordinate with St. Martin's Abbey to perform flow monitoring at the College Regional Stormwater Facility; make a decision regarding participation in the Regional Stormwater Monitoring Program (RSMP).
- **Reporting:** Submit annual report and SWMP updates to Ecology by March 31 each year; keep all records related to the Phase II Permit for at least 5 years.
- **Underground Injection Control (UIC):** Complete well vulnerability assessments as soon as possible.

More detailed recommendations can be found in Section 4.

## ES.5 Plan Implementation

Section 5 of this report presents detailed information on implementation of the entire contents of this plan. The major components of plan implementation include staffing needs, additional resource needs, completion of CIP projects that address existing flooding and water quality issues, interdepartmental collaboration, and interagency collaboration.

## ES.5.1 Staffing Needs

Under the current level of staffing, City stormwater management personnel are able to address stormwater problems that arise on a daily basis and troubleshoot specific issues that arise with development project reviews, but are not fully able to perform activities that would enable continual improvement of the City's stormwater system. Current staffing levels will not be adequate to meet the requirements of the 2013-2018 Phase II Permit and defined program goals during future years.

### ES.5.1.1 Stormwater Program Management

Based on an analysis of the hours allotted to Stormwater Program Management, 3 full time equivalent (FTE) personnel are needed to fulfill the 2013-2018 Phase II Permit requirements and defined program goals and only 2.45 FTE are currently available to work on these tasks. Therefore, an additional 0.5 FTE are recommended to continue the programmatic activities as well as implement the activities required by the 2013-2018 Phase II permit. The additional staff time will enable compliance with IDDE element of the NPDES permit, an adequate level of support for review development plan submittals, and implementation of the proposed CIP program. 0.5 FTE were assumed for the financial analysis associated with this SCP.

The additional staff are necessary to ensure that resources are available to address 49 new Stormwater Program Management activities and gaps in current stormwater program coverage. The following 12 program areas require the greatest amount of staff time to meet the 2013-2018 Phase II Permit requirements and defined program goals:

1. Develop and distribute new educational materials and measure the understanding and adoption of the targeted behaviors
2. Implement an IDDE compliance strategy that includes informal compliance actions such as public education and technical assistance as well as enforcement
3. Select and implement a field screening methodology appropriate to the City's storm drainage system
4. Complete field screening for 40 percent of the storm drainage system by December 31, 2017, and on average 12 percent each year thereafter
5. Additional effort to conduct, coordinate, and track development site inspections and conduct any triggered enforcement
6. Inspect stormwater treatment and flow control facilities annually and conduct any triggered enforcement
7. Review stormwater plans for new and proposed development projects
8. Update the Lacey 2010 Stormwater Design Manual and stormwater codes to be equivalent to the 2012 Stormwater Management Manual for Western Washington
9. Review, revise and adopt local development codes, rules, standards and other enforceable documents to incorporate and require LID principles and practices
10. Implement an ongoing program to inspect, maintain, repair, and rehabilitate aging City stormwater facilities

11. Maintain and update a CIP project list for stormwater infrastructure and implement CIP projects
12. Develop and implement a programs to inspect and maintain ditches, culverts, and the storm drain system, as well as tracking of problem locations

#### ES.5.1.2 Operations and Maintenance Management

Based on an analysis of the hours allotted to the Stormwater Operations and Maintenance (O&M) Crew (within the Public Works Operations Division), 8.3 FTE personnel are needed to fulfill the Phase II Permit requirements and defined program goals and 5 FTE are currently available to work on these tasks. Based on an analysis of City O&M staffing, the City will need to increase O&M staffing by approximately 3 FTE personnel to fully address the current requirements of the 2013-2018 Phase II Permit and overall City goals. This estimate takes into account the seasonal hiring for the summer months; however, at least 2 additional staff members are necessary to support stormwater O&M activities year-round. 2.5 FTE were assumed for the financial analysis associated with this SCP.

The additional staff are necessary to ensure that resources are available to address 12 new Stormwater Program Management activities and gaps in current stormwater program coverage. The following three program areas require the greatest amount of staff time to meet the 2013-2018 Phase II Permit requirements and defined program goals:

1. Complete field screening for 40 percent of the City's storm drainage system by December 31, 2017, and on average 12 percent each year thereafter
2. Inspect stormwater treatment and flow control facilities annually
3. Inspect and maintain ditches, culverts, and the storm drain system, as well as tracking of problem locations

### ES.5.2 Capital Improvement Program

In addition to implementation of the projects listed in Table ES-1 and funding described in other sections of this plan, the City should take the following steps to ensure an effective stormwater CIP:

1. Annually meet with all Public Works Operations staff to evaluate the risk of known problems and identify new problems
2. Annually review the data contained in CIP and Non-CIP related tables contained in this SCP and add any new information that is collected regarding each problem and solution
3. Annually add new potential projects to the CIP and Non-CIP project lists
4. Maintain a stormwater problem and CIP project file with all information that will be useful for updating the CIP
5. Review the CIP Section when the SCP is updated every 6 years

### ES.5.3 Interdepartmental Collaboration

The City is committed to meeting compliance requirements and deadlines of the Phase II Permit, and providing its citizens with exemplary stormwater management services. The stormwater management program is led by the City's Stormwater Engineer in the Public Works Department, Water Resources Division. The Water Resources Engineer works closely with other City departments and divisions, including the Public Works Operations Division, Parks and Recreation, and Community Development, to implement activities in the program areas of flood protection and water quality.

### ES.5.4 Interagency Collaboration

The policies in the City of Lacey and Thurston County Land Use Plan for the Lacey UGA (Lacey and Thurston County 2008) discuss regional coordination through City involvement in regional planning and implementation of regional plans. The 2007-2026 Capital Facilities Plan (Lacey 2007) also states that the City should continue to work cooperatively with other local governments through joint basin planning in shared drainage basins to provide regionally coordinated planning, construction and maintenance for regional stormwater facilities. To address ongoing regional coordination needs, the City will continue to work with regional stakeholder groups and other local governments in shared drainage basins to protect groundwater and surface water quality and to manage and treat stormwater effectively.

## ES.6 Financial Plan

The City stormwater utility has had conservative financial management in past years. The utility has generated positive cash flow from operations, funded its capital needs on a pay-as-you-go basis, and did not have any outstanding debt in January 2013.

However, as a result of rapid development over the previous decade, the amount of stormwater infrastructure has increased. During the 4 years from 2004 through 2008, stormwater capital assets net of depreciation grew from $15.3 million to $47.4 million, a 210% increase. Development has slowed since 2008, but as a result of the earlier growth, there is a growing need for increased O&M and capital reinvestment in the stormwater system.

The capital improvement program (CIP) outlined in the SCP calls for $11.4 million in constant 2013 dollars ($14.1 million in inflated dollars) over the next 10 years, through 2023. The stormwater CIP can be funded from a variety of sources. In general, these sources can be summarized as: 1) governmental grant and loan programs; 2) publicly issued debt; and 3) cash resources and revenues. An ideal funding strategy would include the use of grants and low-cost government loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes. It is recommended that the City pursue these funding avenues but assume for planning purposes that revenue bonds will be the source of borrowing to meet needs above the utility's available cash resources.

In order to fund the stormwater CIP, bond issues will be required totaling $7,584,000 over the coming 10 years, of which $2,684,000 will be needed in the coming 6 years. This level of debt assumes that the City formalizes and increases its commitment to rate-funded system

reinvestment by transferring to the capital fund about $425,000 per year, which represents a target of 25 percent of depreciation expense.

In order to pay for debt service on the new debt, O&M expenses, and rate-funded capital, stormwater rates will need to increase by 9 percent per year from 2014-2016 and 6 percent per year thereafter. With these projected rate increases, the single family rate will need to increase by $4.00 per month over a 6-year period, from $7.36 per month in 2013 to $11.36 per month in 2017.

After implementing the planned rate increases, the operating reserve is projected to stay within 60-90 days of O&M expenses over the coming 10 years. The target capital contingency reserve is 1 percent of fixed asset original cost, which would correspond to a year-end capital fund balance of approximately $600,000. In order to provide funding from current rates and fund balances for the Hicks Lake to Pattison Lake Conveyance Replacement project, the actual capital fund balance is projected to drop below the target level in 2015 (or whenever the project is built). However, the capital fund balance would begin to be replenished in 2016, and it is projected to be back to the target capital contingency level by 2017, 2 years after fund balances are used for the Hicks Lake project.

Debt service coverage must remain above 1.25 in order to meet bond requirements. For 2014, projected coverage is 2.39. However, due to planned staffing increases, projected coverage drops to 1.43 in 2015, which is adequate but does not constitute a wide margin of error. After 2015, the cumulative effect of planned rate increases is sufficient for debt service coverage to remain above 1.95 through the year 2023. Through 2023, the level of outstanding debt never exceeds 10 percent of capital asset cost net of depreciation, which is well within the suggested limit of 60 percent.

With the rate increases and bond issues shown in this financial plan, the City should be able to address its infrastructure needs over the next 10 years, while continuing to have a financially healthy stormwater utility at a reasonable cost to customers.

**Table ES-1. CIP Project Implementation Schedule with Inflation.**

| Proj. No. | Project Name | Priority | Total Cost (2013 Dollars) | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Ulery Drainage System Improvements [a] | High | $58,000 | $58,000 | | | | | | | | | | |
| 1 | Vactor Decant Facility Project | High | $456,000 | $46,000 | $426,400 | | | | | | | | | |
| 5 | Chambers Lake Stormwater Facility Project [a] | High/Moderate | $2,414,000 | $169,000 | $2,109,120 | $234,707 | | | | | | | | |
| 21 | Hicks Lake to Pattison Lake Conveyance Replacement [b] | High | $630,000 | | $117,000 | $559,728 | | | | | | | | |
| 4 | Brentwood Stormwater Installation | High/Moderate | $446,000 | | $94,640 | $383,968 | | | | | | | | |
| 19 | Stormwater Design Manual Update | Mandatory | $200,000 | | $41,600 | $86,528 | $89,989 | | | | | | | |
| 18 | Code Revisions for LID | Mandatory | $90,000 | | | $43,264 | $56,243 | | | | | | | |
| 17 | Shady Lane Treatment Facility Improvements | Moderate | $134,000 | | | $150,732 | | | | | | | | |
| 3 | Lacey Boulevard Pipe Replacement | High | $53,000 | | | | | $26,907 | $36,500 | | | | | |
| 6 | 22nd Avenue SE System Rehabilitation | Moderate | $133,000 | | | | | $39,775 | $120,449 | | | | | |
| 7 | Diamond Stormwater Alternative | Moderate | $306,000 | | | | | $115,816 | $251,847 | | | | | |
| 20 | Stormwater Comprehensive Plan Update | Routine | $150,000 | | | | | $11,699 | $85,166 | $88,572 | | | | |
| 8 | 25th Loop Storm Improvements | Moderate | $324,000 | | | | | | $103,415 | $302,411 | | | | |
| 9 | Clearbrook Drainage System Improvements | Moderate | $378,000 | | | | | | $88,816 | $385,922 | | | | |
| 10 | Homann Area System Rehabilitation | Moderate | $406,000 | | | | | | $189,798 | $316,330 | | | | |
| 11 | 1010 Midway Storm Improvements | Moderate | $38,000 | | | | | | $17,033 | $30,368 | | | | |
| 12 | Belair / Impala Stormwater Installation | Moderate | $489,000 | | | | | | | $124,001 | $514,529 | | | |
| 13 | College Regional Stormwater Facility Expansion / Modification | Moderate | $4,131,000 | | | | | | | | $744,817 | $2,439,474 | $2,537,053 | |
| 14 | Alder and Gemini Drainage System Improvements | Low | $430,000 | | | | | | | | | | $123,828 | $507,724 |
| 15 | White Fir Stormwater Installation | Low | $151,000 | | | | | | | | | | | $223,517 |
| 16 | 5th Court SE and 5th Way Easement Storm Improvements | Low | $24,000 | | | | | | | | | | | $35,526 |
| **Total Annual Expenditures (Inflation 4% / Year)** | | | **$11,441,000** | **$273,000** | **$2,788,760** | **$1,308,195** | **$296,964** | **$194,197** | **$893,023** | **$1,247,605** | **$1,259,347** | **$2,439,474** | **$2,660,881** | **$766,767** |

Notes.

[a] Project is partially funded by a grant from the Department of Ecology. This table presents total costs.

[b] Hicks Lake to Pattison Lake Conveyance Replacement Project would be funded at the 50 percent level with the other 50 percent coming from Thurston County. Reaching an agreement with Thurston County for 50 percent participation is a condition for beginning design on the project. This table presents cost to the City of Lacey only.

**Table ES-2. Non-CIP Project Implementation Schedule with Inflation.**

| Project. No. | Project Name | Total Cost (2013 Dollars) | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OM1 | Rehabilitation of Existing Ruddell Road SE Stormwater Facility | $50,000 | $50,000 | | | | | | | | | | |
| OM2 | Rehabilitation of Existing College Street SE at 53rd Avenue SE Ponds | $50,000 | | $52,000 | | | | | | | | | |
| OM3 | Rehabilitation of Existing Lakepointe Park Ponds - Compton Pond and Stockton Pond | $50,000 | | | $54,080 | | | | | | | | |
| OM4 | Rehabilitation of Existing Fones Road Stormwater Facility | $50,000 | | | | $56,243 | | | | | | | |
| OM5 | Rehabilitation of Existing College Regional Stormwater Facility | $50,000 | | | | | $58,493 | | | | | | |
| OM6 | Rehabilitation of Existing Woodland Creek/7th Avenue SE Stormwater Facility | $50,000 | | | | | | $60,833 | | | | | |
| OM7 | Annual Stormwater Pond Rehabilitation -No. 1 | $50,000 | | | | | | | $63,266 | | | | |
| OM8 | Annual Stormwater Pond Rehabilitation -No. 2 | $50,000 | | | | | | | | $65,797 | | | |
| OM9 | Annual Stormwater Pond Rehabilitation -No. 3 | $50,000 | | | | | | | | | $68,428 | | |
| OM10 | Annual Stormwater Pond Rehabilitation -No. 4 | $50,000 | | | | | | | | | | $71,166 | |
| OM11 | Annual Stormwater Pond Rehabilitation -No. 5 | $50,000 | | | | | | | | | | | $74,012 |
| **Total Annual Expenditures (Inflation 4% / Year)** | | $550,000 | **$50,000** | **$52,000** | **$54,080** | **$56,243** | **$58,493** | **$60,833** | **$63,266** | **$65,797** | **$68,428** | **$71,166** | **$74,012** |

# 1.0 INTRODUCTION

The City of Lacey (City) is located on the southern tip of Puget Sound in the northeastern corner of Thurston County. The City has a land area of approximately 17 square miles and a population of approximately 42,830 (Lacey 2012a). The City has five freshwater lakes and several streams, the largest of which is Woodland Creek. The City was first settled by westerners in the 1800s and by the mid-1960s the community had grown to over 8,000 residents. The City was incorporated in 1966. Now much of the developable land in Lacey has been built on (with the exception of large areas north of I-5) and the City's area is comprised of the following land use categories: low density residential (76.2 percent), commercial (7.8 percent), light industrial (7.4 percent), moderate density residential(3.5 percent), high density residential (2.5 percent), surface water and lakes (1.5 percent), and other (open space, cemetery; 1.1 percent).

## 1.1 Purpose of this Plan

The purpose of this plan is to guide the City's Stormwater Utility (Utility) programs in a manner consistent with applicable local, state, and federal regulations while charging consumers an equitable stormwater utility rate. The plan includes:

- Identification of and proposed solutions to flooding and water quality issues
- Actions necessary to ensure compliance with applicable federal, state, and local requirements, especially the Western Washington Phase II Municipal Stormwater Permit (Phase II Permit)
- A financial plan to address the first two items

Since the majority of the City built-out, most of the identified issues are a result of:

- Uncontrolled runoff from development construction prior to implementation of the 1994 Drainage Design and Erosion Control Manual
- Aging infrastructure
- Regulatory mandates

This plan is the first stormwater comprehensive plan (SCP) for the City and is intended to address the following issues:

1. Establish stormwater specific goals and policies for the City's stormwater program
2. Create a long-term plan for the City's stormwater program that ensures compliance with regulatory requirements and meets the needs of the community
3. Maintain existing stormwater infrastructure at a level that keeps pace with system deterioration

4. Ensure that owners of private stormwater facilities maintain their systems in functional condition
5. Control erosion and manage the quantity and quality of stormwater runoff from public and private activities
6. Protect stream channels, aquatic habitat, wetlands, fish, shellfish, and other aquatic resources
7. Protect private and public property and City streets and right-of-ways from flooding or erosion
8. Reduce pollutant discharges and their harm to the environment
9. Preserve and enhance the suitability of all bodies of water for contact recreation, fishing, and a wide diversity of wildlife habitat
10. Identify and implement projects that achieve the City's stormwater goals and policies through a capital improvement program (CIP)
11. Achieve purposes 1 through 10 in a manner that makes efficient use of limited resources to address the most critical problems first

Recent state and federal stormwater regulations have made it technically and financially challenging to address these issues while balancing utility ratepayer costs. Because of the many stormwater challenges facing the City, it must implement and continually improve upon the SCP. This plan addresses current and anticipated regulatory requirements, existing flooding problems, and the resources needed for the City to fully implement the plan.

### 1.1.1 Regulatory Drivers

The Phase II Permit has and will continue to have a significant impact on the workload and operational budget of the both the Water Resources and the Public Works Operations departments. Section 4 of this plan details the specific permit requirements and their impact on the City's Stormwater Management Program (SWMP).

### 1.1.2 Impacts and Importance of Managing Stormwater Runoff

The urban development that has occurred in Lacey over the past century has adversely affected the quantity and quality of stormwater runoff. This runoff has increased peak flow rates causing erosion of streams, contributed to minor flooding of properties and streets, and increased pollutant loading to streams, wetlands, lakes, and Puget Sound. The City is faced with the challenge of conveying stormwater runoff safely and cost-effectively while preventing or minimizing adverse high flow impacts (erosion, flooding, and sediment deposition), water quality degradation in lakes and streams receiving runoff, and degradation of aquatic habitat caused by high flows and degrading water quality. In addition, the City's drinking water is derived from groundwater; therefore, the City must maintain groundwater recharge processes while protecting groundwater quality through runoff treatment prior to infiltration.

## 1.2 Goals and Policies

Goals and policies have been developed to guide the City's SWMP and are consistent with the goals of The City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area (Lacey Comprehensive Plan). They support actions that will reduce flooding impacts, ensure stormwater is managed efficiently, protect the quality and quantity of water resources, and protect groundwater, the City's drinking water source. This Stormwater Comprehensive Plan will guide the City's stormwater program as the City works towards furthering the goals of the Growth Management Act (GMA), to reduce urban growth and reduce sprawl. Future increases in development density, which results from the GMA, will lead to higher percentages of impervious surface, stress the City's stormwater infrastructure, and require more intensive runoff treatment and flow control to mitigate stormwater impacts to human health and the environment.

This section summarizes existing City goals and policies as well as recommended goals and policies to enable the City's SWMP to better support the goals of the GMA and Lacey Comprehensive Plan, the City's Stormwater Management Program.

### *1.2.1 Existing City Goals and Policies*

The City of Lacey and Thurston County are Phase II Permit municipalities and are therefore subject to the same requirements for construction within the UGA. The City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area (UGA) (Lacey and Thurston County 2008) includes goals and policies for utilities and capital facilities as well as water resources that are related to the City's SWMP.

Similarly, the City's 2007-2026 Capital Facilities Plan (Lacey 2007) also includes goals and policies related to stormwater drainage. Each plan's goals and policies relevant to the SWMP are summarized in Appendix A.

### *1.2.2 Recommended Goals and Policies*

After reviewing the City's existing goals and policies, it was determined that an independent and comprehensive set of stormwater goals and policies should be developed as part of the SCP to effectively guide the City's SWMP. The independent set of stormwater goals and policies was developed to clarify and more specifically document the City's priorities directly related to stormwater and surface water management. The existing goals and policies were taken into account when developing the stormwater-specific goals and policies.

The objective of the City's SWMP is to meet the following three goals:

1. Protect and enhance the quality and quantity of surface and groundwater resources to support beneficial use by humans, aquatic life, and wildlife
2. Manage the storm drainage system to protect public safety and minimize property damage caused by flooding and erosion
3. Provide adequate funding for the Stormwater Management Program through an equitable stormwater utility rate structure

Policies to support these three goals can be divided into the following four categories:

1. General (G) stormwater management program policies
2. Water quality (WQ) policies
3. Flow control (FC) policies
4. Funding (M) policies

Detailed policies were developed for each of these categories based on existing City policies, feedback from City staff regarding priorities of the stormwater program, and a review of policies used by other local jurisdictions. These recommended policies are summarized in separate subsections below.

#### *1.2.2.1 General Stormwater Management Program Policies*

G1. Continue to develop and implement a comprehensive stormwater management program consistent with requirements of the federal Clean Water Act, the Phase II Permit issued by the Washington State Department of Ecology, the state Growth Management Act, and the Puget Sound Action Agenda

G2. Improve public knowledge of stormwater runoff issues, encourage public involvement in stewardship activities, and encourage public support for the City's stormwater management program

G3. Ensure that new development, redevelopment, and City projects are in conformance with the City's adopted stormwater requirements

G4. Analyze proposed new development and redevelopment for potential impacts on the downstream storm drainage system and water quality as part of the stormwater plan review process

G5. Coordinate with other departments throughout the stormwater plan review, permitting, and project approval process to ensure that the process results in a functional stormwater system

G6. Construct new or improved stormwater facilities in accordance with the current CIP plan

G7. Review the CIP list annually to identify new projects, remove completed projects, refine planned projects, and reevaluate project prioritization

G8. Participate in the development and implementation of regional water quality management plans, groundwater management plans, stormwater management plans, lake management plans, drainage basin plans, watershed action plans, and wellhead protection plans to ensure that Lacey's water resources are protected

G9. Continue to work cooperatively with other local governments through joint basin planning in shared drainage basins to provide regionally coordinated planning, construction, and maintenance for regional stormwater facilities.

G10. Oversee construction and maintenance of privately owned stormwater facilities to ensure that they function as designed to protect private property, public property, and the environment

G11. Proactively maintain, repair, rehabilitate, and replace aging City stormwater facilities and minimize the need for costly and disruptive emergency repairs

G12. Revise this Stormwater Comprehensive Plan every 6 years, or sooner if needed, to ensure that it provides for effective long-term stormwater project planning, system maintenance, response to mandates, and program funding

#### *1.2.2.2 Water Quality Policies*

WQ1. Comply with all applicable requirements from federal, state, and local governments related to water quality

WQ2. Develop new stormwater treatment projects for the CIP plan when these problems cannot be addressed through source control or maintenance of the existing infrastructure

WQ3. When practicable, add or improve water quality treatment whenever constructing new stormwater facilities or conducting maintenance, repair, rehabilitation, or replacement of aging City stormwater facilities

WQ4. Protect surface water quality by addressing potential nutrient loading from stormwater

WQ5. Protect groundwater resources by regulating land use activities, such as requiring a higher level of stormwater treatment within wellhead protection areas, and encouraging practices that minimize impacts to groundwater, such as preserving native vegetation or planting low-input vegetation

#### *1.2.2.3 Flow Control Policies*

FC1. Comply with all applicable requirements from federal, state, Thurston County, and City of Lacey related to flood protection

FC2. Develop new drainage projects for the CIP plan to address flooding problems when these problems cannot be addressed through maintenance of the existing infrastructure

FC3. Continue to encourage and allow the use of LID stormwater Best Management Practices for flow control for new development and redevelopment in accordance with current regulations

FC4. Provide adequate stormwater conveyance in the public storm drain system as follows:

- Accommodate the 10-year 24-hour event from existing development within the public storm drain system, except as noted in the three bullets below

- Accommodate the 25-year 24-hour event from existing development for storm drains and culverts that pass under public roads
- Accommodate the 25-year 24-hour event from existing development within the long term UGA boundary public right-of-way without having water over more than 50 percent of the driving lane
- Accommodate the 100-year 24-hour event from existing development for culverts and bridges that convey natural channels

#### *1.2.2.4 Funding Policies*

M1. Prioritize the most beneficial and cost-effective projects and programs to ensure that available resources are used efficiently

M2. Implement an equitable and logical stormwater utility rate structure

M3. Review the rate structure and projected future rates and expenses on a regular basis to ensure that utility rates will adequately fund implementation of this plan

M4. Actively seek outside funding to leverage or complement utility funds in order to implement this plan

## 1.3 Stormwater Comprehensive Plan Development

Significant research was conducted to develop the SCP. Past studies were reviewed for information on drainage and water quality problems, and to evaluate the existing SWMP. To supplement existing drainage and water quality problem information, and recent documentation of the status of the City's stormwater program, Herrera Environmental Consultants (Herrera) conducted a workshop and an advisory group meeting. Several follow-up meetings, telephone conversations, and field reconnaissance trips were held with City staff following the workshop and the advisory group meeting. The following subsections describe the workshop, the advisory group meeting, document review, and the gap analysis and needs assessment.

### *1.3.1 Workshop*

To examine the components of the City's SWMP in more detail and to identify previously undocumented issues, City staff members representing all aspects of the City's stormwater program attended a workshop on March 4, 2011, at Lacey City Hall. A Stormwater Comprehensive Plan Questionnaire was distributed to participants in advance of the workshop to help gather staff input and perspectives on a consistent set of questions. The completed questionnaire was used to facilitate the workshop discussion of Phase II Permit requirements, other regulatory requirements (e.g., requirements related to TMDLs, UIC, and ESA compliance), staffing needs, funding needs, and other issues of concern to stormwater managers and staff (e.g., stormwater problem locations, potential CIP projects, critical areas, and groundwater and wellhead protection). A list of the workshop attendees is included in Table 1-1.

| Table 1-1. City of Lacey Stormwater Comprehensive Plan Workshop Attendees. | | |
|---|---|---|
| **Attendee** | **Department/Division** | **Title** |
| Doug Christenson | Public Works/Water Resources | Stormwater Engineer |
| Jack Froschauer | Public Works/Operations | Stormwater Inspection Compliance Specialist |
| Julie Rector | Public Works/Water Resources | Water Quality Analyst |
| Peter Brooks | Public Works/Water Resources | Water Resources Manager |
| Rick McBroom | Public Works/Water Resources | Engineering Technician III |
| Samra Seymour | Community Development | Associate Planner |
| Steve Larson | Public Works/Operations | Senior Maintenance Technician |
| Tim McGuire [a] | Finance | Financial Services Manager |
| Tom Stiles | Public Works | Development Review Engineer |

[a] No longer works for the City of Lacey.

### 1.3.2 Advisory Group Meeting

A project advisory group was organized to provide interdepartmental input on the SCP throughout the project. The first advisory group meeting was held on April 12, 2011, to introduce the project to the group members, provide an overview of the current status of the SWMP, discuss City goals and policies, and discuss priorities for the SWMP and SCP. A list of the advisory group members is included in Table 1-2.

| Table 1-2. City of Lacey Stormwater Comprehensive Plan Advisory Group. | | |
|---|---|---|
| **Attendee** | **Department** | **Title** |
| Doug Christenson | Public Works/Water Resources | Stormwater Engineer |
| Peter Brooks | Public Works/Water Resources | Water Resources Manager |
| Erin Keith | Public Works/Water Resources | Water Resources Specialist |
| Samra Seymour | Community Development | Associate Planner |
| Scott Spence | City Manager's Office/Public Affairs | City Manager |
| Scott Egger | Public Works | Public Works Director |
| Roger Schoessel | Public Works | City Engineer |
| Dennis Stevens [a] | Public Works/Operations | Transportation Supervisor |
| Troy Woo | Finance | Finance Director |
| Tim McGuire [a] | Finance | Financial Services Manager |

[a] No longer works for the City of Lacey.

### 1.3.3 Document Review

Herrera reviewed all pertinent documents, including drainage basin studies and City planning documents, to provide a foundation for the SCP. The most relevant documents to the SCP development effort are summarized in Table 1-3. In addition to the documents summarized below, information on the existing storm drainage system infrastructure was derived mostly from geographic information system (GIS) data provided by the City.

| Table 1-3. Relevant Documents to Support the Development of the City of Lacey Stormwater Comprehensive Plan. | | |
|---|---|---|
| **Title** | **Author** | **Year(s)** |
| The City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area | City of Lacey | 1994 (updates in 2003 & 2007) |
| McAllister-Eaton Creek Drainage Basin Plan | Thurston County | 1994 |
| 1994 Drainage Design and Erosion Control Manual | Thurston County | 1994 |
| Design Report for Chambers Lake Stormwater Treatment Facilities | ENTRANCO | 1995 |
| Woodland and Woodard Creek Comprehensive Drainage Basin Plan | Thurston County | 1995 |
| Chambers-Ward-Hewitt Comprehensive Drainage Basin Plan | Thurston County | 1995 |
| Lacey Municipal Code | City of Lacey | 2001 (various updates) |
| WRIA 13 Watershed Assessment | Watershed Planning Committee | 2004 |
| Nisqually River Basin Fecal Coliform Bacteria and Dissolved Oxygen TMDL Study | Washington State Department of Ecology | 2005 |
| Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature TMDL Study | Washington State Department of Ecology | 2006 |
| Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, Temperature, and pH TMDL Water Quality Improvement Report Implementation Strategy | Washington State Department of Ecology | 2006 |
| 2007-2026 Capital Facilities Plan - Section 7, Storm Drainage | City of Lacey | 2007 |
| Henderson Inlet Watershed Characterization Report | Thurston County | 2007 |
| Interim Results from the Budd Inlet, Capitol Lake, and Deschutes River Dissolved Oxygen and Nutrient Study | Washington State Department of Ecology | 2007 |
| Nisqually River Basin Fecal Coliform Bacteria and Dissolved Oxygen TMDL Water Quality Implementation Plan | Washington State Department of Ecology | 2007 |
| McAllister Springs Drinking Water Protection Area | City of Olympia | 2008 |
| Lacey 2009 Development Guidelines and Public Works Standards | City of Lacey | 2009 |
| Stormwater Management Program Annual Reports | City of Lacey | 2009, 2010, 2011 |
| City of Lacey 2010 Stormwater Design Manual | City of Lacey | 2010 |
| Thurston County Water Resources Monitoring Report 2007-2009 Water Years | Thurston County | 2010 |
| Lacey Stormwater Pollution Prevention Plan | City of Lacey | 2011 |
| Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment TMDL Water Quality Study Findings | Washington State Department of Ecology | 2012 |

### 1.3.4 Gap Analysis and Needs Assessment

Despite lacking a formal SCP, the City has a fairly well developed SWMP that has achieved compliance with the Phase II Permit, accomplished reductions in flooding and water quality impacts, provided flow control and/or water quality treatment at most major drainage system outfalls, and has a well-informed group of staff members assisting with stormwater management. However, there is still significant room for improvement of the SWMP.
The SWMP is in need of clearly defined and up-to-date policies and goals, a long-term implementation plan for SWMP activities and CIP projects, a clearly justified and equitable rate structure, an improved plan for public facility O&M, a comprehensive and documented strategy for managing maintenance of privately owned stormwater facilities, and development of new CIP projects for current drainage and water quality problem areas.

Following the workshop and advisory group meeting, the City SWMP annual reports and other documents listed in Table 1-3 were compared to the Phase II Permit requirements, other regulatory requirements, and other stormwater-related concerns unique to the City of Lacey. The findings of this process, including SWMP needs, are presented in Section 4 of this plan.

## 1.4 Stormwater Management Program History and Accomplishments

This section details the history and accomplishments of the City's SWMP.

### 1.4.1 Historical Stormwater Management

Historically, the City's water resource obligations consisted almost exclusively of drainage facility design and flood control. These obligations were the responsibility of the City's Engineering Department. Generally, the same engineers that reviewed development plans and designed roads also filled drainage design roles. This level of stormwater priority and staffing was typical of most local governments in the Pacific Northwest throughout the 1960s and 1970s.

Early in the 1980s, the cities of Lacey, Tumwater, and Olympia, in cooperation with Thurston County, funded a study to identify methods to improve surface water quantity and quality conditions in north Thurston County. This work included an examination of financing options in 1983 and culminated with the North Thurston County/Lacey/Olympia/Tumwater Surface Water Management Utility Development Plan (Thurston County et al. 1986), which recommended development of a regional approach to stormwater management and the creation of a regional stormwater utility that encompassed the needs of all four jurisdictions. Although this recommendation was never adopted, it was the basis for the implementation of individual stormwater utilities. The history of the Lacey SWMP is provided below and Table 1-4 provides a complete list of stormwater ordinances passed since 1985.

#### 1.4.1.1. Establishing a Basic SWMP (1985 to 1987)

Based largely on the results of the regional water resources study, the City of Lacey created the Stormwater Utility Fund by passing Ordinance No. 712 on January 24, 1985, which added Chapter 3.52 to the Lacey Municipal Code (LMC). On November 20, 1986, the City passed Ordinance No. 791, which added Section 13.08.015 to the LMC making it unlawful to discharge

| Table 1-4. City of Lacey Ordinances Relating to Stormwater. | | | |
|---|---|---|---|
| **Ordinance Number** | **Date Passed by Council** | **Topic** | **Description** |
| 712 | Jan. 24, 1985 | Utility Financial | Created a Stormwater Utility Fund and added new Chapter 3.52 to the LMC |
| 791 | Nov. 20, 1986 | Illicit Discharge | Unlawful to discharge pollutants into storm system; created Section 13.08.015 LMC |
| 794 | Dec. 4, 1986 | Utility Financial | Established interim utility charges and created Chapter 13.70 LMC |
| 886 | Apr. 26, 1990 | Utility Financial | Adopted new storm and surface water utility charges; revisions to Chapter 13.70 LMC |
| 911 | June 13, 1991 | Drainage Regulations | Adopted the 1991 Drainage Design and Erosion Control Manual for Thurston Region |
| 934 | Mar. 26,1992 | Utility Financial | Increased Storm and Surface Water Utility Charges; amended Section 13.70.030 LMC |
| 983 | Dec. 16, 1993 | Drainage Regulations | Adopted the updated 1994 Drainage Design and Erosion Control Manual into Chapter 5 of the Development Guidelines & PW Standards |
| 1010 | Feb. 9, 1995 | Utility Financial | Increased Storm and Surface Water Utility Charges; amended Section 13.70.030 LMC |
| 1031 | Feb. 8, 1996 | Illicit Discharge | Amended prohibitions against discharges into the storm system, in Section 13.08.015 LMC |
| 1082 | Feb. 26, 1998 | Utility Financial | Increased Storm and Surface Water Utility Charges; amended Section 13.70.030 LMC |
| 1113 | Aug. 26, 1999 | Drainage Regulations | Established provisions for approval of Zero Effective Impervious Surface projects; created new Chapter 14.31 of the LMC, titled “Zero Effect Drainage Discharge” |
| 1233 | Dec. 16, 2004 | Illicit Discharge | Added new Chapter 5A to the Development Guidelines & PW Standards, creating the Stormwater Maintenance Code with maintenance standards |
| 1279 | Dec. 7, 2006 | Utility Financial | Increased Storm and Surface Water Utility Charges; amended Section 13.70.030 LMC |
| 1332 | Aug. 13, 2009 | Illicit Discharge | Amended Chapter 5A of the DG&PWS, the Stormwater Maintenance Code, per the Western WA Phase II Permit |
| 1342 | Jan. 28, 2010 | Drainage Regulations | Adopted the Lacey 2010 Stormwater Design Manual; amended Section 14.24.160 LMC, adding SDM to substantive environmental policies |

pollutants into the storm drainage system. The following month, on December 4, 1986, Ordinance No. 794 added Chapter 13.70 – Storm and Surface Water Utility Charges), which established interim storm and surface water utility charges. The initial interim rates, "in effect only until permanent rates based upon further study are enacted," were $1.45 per month for single-family residential parcels, $2.90 per month for two-family residential parcels, and $14.50 per month for all other parcels. These initial rates became effective on January 1, 1987, and remained in effect for 3 years as studies were conducted to determine a more permanent rate structure. With these three ordinances, Lacey had established a basic stormwater program that included a funding mechanism and an illicit discharge code.

#### *1.4.1.2 Establishing the Water Quality and Water Resources Divisions (1988 to 1990)*

In 1988, Ecology identified Woodland Creek as an impaired body of water in the Nonpoint source Pollution Assessment Report. In response to the growing concern for water quality issues in the Puget Sound area, the City's Public Works Department created a new Water Quality Manager section. On March 23, 1989, the Lacey City Council authorized the role of a Water Quality Manager to serve as the administrator for the Water Quality Management Program. With this position a new Water Quality Division was created within Public Works, responsible for managing the City's surface water runoff, groundwater and drinking water issues and concerns.

Between 1989 and 1990, the Water Resources Division was re-established as a separate division under Public Works under the supervision of a Water Resources Manager. Responsibilities of this division included managing the City's Stormwater Utility, outreach and education programs, basin planning, wellhead protection and water conservation plans.

#### *1.4.1.3 Refined Utility Rate, Development Guidelines, and Improved Illicit Discharge Code (1988 to 1999)*

On April 26, 1990, Ordinance No. 886 was passed by the City Council, amending Chapter 13.70 of the LMC and establishing a rate structure with a flat rate for single-family and two-family residential parcels and a seven-step sliding rate for commercial parcels. With the adoption of this rate structure, Lacey's Stormwater Utility and Stormwater Management Program became solidly established. The new rate structure became effective on July 1, 1990, and is still in use today. Cooperation and coordination between Lacey, Thurston County, Olympia and Tumwater has been significant over the years. The four jurisdictions demonstrated this level of cooperation by collaborating to develop a regional drainage manual. The City of Lacey adopted the Drainage Design and Erosion Control Manual for Thurston Region, Washington (1991 Manual) as its first stormwater manual by Ordinance No. 911, which became effective on July 1, 1991. The 1991 Manual became part of the City's Development Guidelines and Public Works Standards, to regulate runoff from new development, redevelopment, and construction sites. An updated version of the manual was adopted by Ordinance No. 983, and went into effect on February 1, 1994, as the 1994 Drainage Design and Erosion Control Manual for Lacey (1994 Manual). The 1994 Manual remained in use for 16 years, until it was replaced in 2010.

On February 8, 1996, Ordinance No. 1031 was passed, amending the prohibitions against discharges into the stormwater system contained in LMC Section 13.08.015.

In 1996, the Water Resources Manager position was eliminated and the two other full time staff were reorganized into the City's Public Works Engineering Division. Less than 2 years later, in October of 1997, the Water Resources Division was separated from the City's Public Works and reinstituted as a separate division to focus on the City's utility services needs.

In 1999, Lacey became the first city in Washington to formally adopt a "zero effect drainage discharge" ordinance (Ordinance No. 1113, Chapter 14.31 LMC) to allow deviations from standards for projects with no increase in effective impervious surfaces. The ordinance opened the door for the use of innovative LID methods at development sites in Lacey.

#### 1.4.1.3 Construction of Regional Stormwater Management Facilities (1999 to 2004)

From 1999 to 2004, Lacey constructed five of its largest regional stormwater facilities: the Ruddell Road Stormwater Treatment Facility (1999), the Shady Lane Stormwater Facility (2000), the 7th Avenue SE Stormwater Facility (2001), the 45th Avenue Regional Stormwater Facility (2003), and the Fones Road Ditch Stormwater Facility (2004). Construction of these facilities addressed some of the city's highest-priority needs for runoff water quality treatment and flow control.

#### 1.4.1.4 Improved Operations and Maintenance (2004 to 2007)

In 2004, the City of Lacey passed Ordinance No. 1233 to bring the City into compliance with State law regarding stormwater mitigation. This ordinance added a new chapter (Chapter 5A) to the City of Lacey Development Guidelines and Public Works Standards relating to storm drainage system maintenance. The ordinance also included development of a Private Stormwater Facilities Inspection Program to ensure that private and City-owned stormwater facilities were being properly maintained.

### 1.4.2 Current Stormwater Management Program

The Phase II Permit was issued by Ecology in January 2007, with an effective date of February 16, 2007 (see Appendix B). Since the Phase II Permit became effective, the City has been complying with the requirements of the permit including development and implementation of a SWMP with five primary components: public education and outreach; public involvement and participation; illicit discharge detection and elimination; controlling runoff from new development, redevelopment, and construction sites; and municipal operations and maintenance. The City's current SWMP includes regulations addressing inspections and maintenance of stormwater facilities, prohibition of illicit discharges, and stormwater management on construction sites and development projects.**Ordinance No. 1332** was adopted by the Lacey City Council in 2009, updating Chapter 5 of the City of Lacey Development Guidelines and Public Works Standards. Chapter 5A includes specific definitions and wording regarding illicit discharges. Chapter 5C, the Stormwater Maintenance Code, outlines minimum maintenance requirements, waste disposal, inspection procedures/authority, prohibited substances and enforcement policies as required by the Phase II Permit. Ordinance No. 1332 amended the provisions of Ordinance No. 791 and Ordinance No. 1233 to reflect the Phase II Permit's new requirements prohibiting the discharge of pollutants to the City's storm drainage system.

- **LMC Chapter 13.08 Use of Sewers – Private Sewage Disposal** prohibits discharges of waste to natural outlets. Under Chapter 13.08.015, discharging pollutants into the storm drainage system is unlawful and subject to a fine of up to $5,000.

- **City of Lacey 2010 Stormwater Design Manual (2010 Manual),** adopted by Ordinance No. 1342 on January 28, 2010, regulates stormwater management at new development, redevelopment, and construction sites. The City implements this manual to specify drainage requirements and design criteria to reduce pollutants in stormwater runoff, reduce flooding and erosion, protect groundwater and surface waters, and comply with the Phase II Permit. The 2010 Manual is technically equivalent to Ecology's 2005 Stormwater Management Manual for Western Washington, and replaced the City's 1994 Manual with updated guidance including LID techniques.

Decals on storm drains help educate the public about stormwater impacts.

## 1.4.3 Accomplishments

Although this is the first SCP for the City, the City has developed a comprehensive stormwater program that includes extensive programmatic accomplishments and stormwater system related accomplishments.

### 1.4.3.1 Stormwater Management Program Accomplishments

The following list highlights some of the SWMP's recent accomplishments:

#### Public Education and Outreach

- Hosted annual Storm Pond Maintenance Workshops for Homeowners Associations (HOAs) and property managers since 2008, including providing site-specific information to assist attendees with maintenance of their particular drainage features.

- Provided stormwater education in local schools, including field education for all Komachin Middle School students during the 2011-2012 school year.

- Created Lacey's first stormwater utility newsletter, *The Wet Street Journal*, and distributed it to 13,500 residential stormwater customers in Lacey in November 2011. The newsletter included specific information about the Henderson Inlet Watershed, local water quality issues, Best Management Practices, coupons for incentives to encourage reducing pollution sources, and a kids' page.

- Designed and printed 25 individualized stormwater facility educational signs, to install at select public stormwater facilities across the City. The signs include the facility name, general information about stormwater, a simple graphic to illustrate how each particular facility functions, and a list of residential Best Management Practices. The signs were installed beginning in 2012.

- Lacey provides more than 20 different brochures and informational handouts, covering all aspects of stormwater, from rain gardens to vegetation management.
- In an effort to reduce the amount of fecal coliform bacteria polluting surface waters, 1,500 portable pet waste bag dispensers were distributed to Lacey residents in 2011. In addition, 12 new neighborhood pet waste stations were installed in 2011, bringing the total to more than 100 citywide.

### Public Involvement

- Continued involvement with regional efforts including StreamTeam, the STORM group, Project Green, and other collaborative efforts.
- In September 2011, took 40 local residents on the annual Henderson Watershed Tour via chartered bus, to visit a stormwater treatment facility, an oyster farm, and other points of interest within Lacey's primary watershed draining to Puget Sound.
- In 2011, 549 volunteers completed more than 760 hours of work on action projects, such as planting trees and monitoring stream health along Woodland Creek.

Students get involved with tree planting.

Volunteers perform invasive plant removal in April 2012.

### Stormwater System Mapping and Illicit Discharge Detection and Elimination

- Developed an electronic stormwater infrastructure map
- Trained City staff to identify illicit discharges and illegal connections to the stormwater system, and provided staff training on updated stormwater regulations.

### Stormwater Management Requirements for New Developments

- In 1999, Lacey became the first city in the state of Washington to formally adopt a "zero effect" drainage discharge ordinance (Ordinance No. 1113, Chapter 14.31 LMC) to encourage an innovative LID approach at development sites, to maintain forest-like hydrologic processes (e.g., evapotranspiration and infiltration). LID methods have been installed or proposed at more than 20 commercial project sites in Lacey.

- Created and adopted the City's 2010 Stormwater Design Manual, to replace the outdated 1994 drainage manual with Lacey-specific guidance that meets current state standards. The 2010 SDM is technically equivalent to Ecology's current (2005) Stormwater Management Manual for Western Washington, and includes technical design criteria for LID features such as bioretention cells and permeable pavements.

A detailed list of all of the SWMP accomplishments related to the Phase II Permit is provided in Section 4.

#### *1.4.3.2 Stormwater System Related Accomplishments*

The City has constructed nine regional stormwater facilities since 1991 to address water quality treatment and/or flow control of stormwater runoff (see Table 1-5).

**Table 1-5. Regional Stormwater Facilities Constructed Since 1991.**

| Name | Location | Downstream Receiving Water | Construction Date |
|---|---|---|---|
| College Regional Stormwater Facility | St. Martin's University, north of Abbey Way SE | College Creek (tributary to Woodland Creek) | 2008 |
| Fones Road Ditch Stormwater Facility[a] | Fones Road south of Pacific Avenue | Taylor Wetlands (headwaters of Woodard Creek) | 2004 |
| 45th Avenue Regional Stormwater Facility | Rainier Vista Park | Groundwater | 2003 |
| 7th Avenue SE Stormwater Facility | 7th Avenue west of Carpenter Road | Woodland Creek | 2001 |
| Shady Lane Stormwater Facility | Shady Lane at Sierra Drive | Hicks Lake | 2000 |
| Ruddell Road Stormwater Treatment Facility | Ruddell Road at 32nd Avenue SE | Hicks Lake | 1999 |
| Ruddell Road SE Stormwater Treatment Facility | SE corner of Rainier Vista Park | Groundwater/Southwick Lake | 1993 |
| Yelm Highway Stormwater Facility | William A. Bush Park, west of Rainier Loop | Groundwater | 1992 |
| Woodland Creek Stormwater Treatment Facility | North of 7th Avenue SE at Lacey Street SE | Groundwater/Woodland Creek | 1991 |

[a] Originally Fones Road Ditch Stormwater Facility was jointly-developed with the City of Olympia, with an upper facility in Lacey that flows to lower facility in Olympia. The two facilities are now owned separately.

The College Regional Stormwater Facility was honored with the following two awards:

- In 2009, the College Regional Stormwater Facility received a bronze award for "Future Value to the Profession" from the Washington State Chapter of the American Council of Engineering Companies (ACEC).
- In 2010, the College Regional Stormwater Facility received a Project of the Year award in the Environment category, projects under $5 million, by the Washington State Chapter of the American Public Works Association (APWA).

College Regional Stormwater Facility was constructed in 2008.

In addition to constructing regional stormwater facilities, the City has also been maintaining its current stormwater system, and expanding public education and outreach and illicit discharge investigation activities. Table 1-6 summarizes some of the City's accomplishments in these areas based on Public Works records and annual reports submitted to Ecology as part of the Phase II Permit reporting requirement.

**Table 1-6. City of Lacey Stormwater Management Program by the Numbers.**

| Stormwater Management Program Component | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Volunteer Participants on Action Projects | 137 | 70 | 271 | 269 | 549 |
| Volunteer Hours on Action Projects | 611 | 106 | 201 | 510 | 762 |
| Number of Spill Responses | 56 | 57 | 54 | 109 | 137 |
| Acres of Storm Ponds Maintained | 680 | 1,037 | 1,027 | 1,235 | 1,768 |
| Total Number of Catch Basins (public) | 3,580 | 3,741 | 4,010 | 4,419 | 4,716 |
| Catch Basins Cleaned (%) | 42% | 100% | 100% | 100% [a] | 59% |
| Miles of Street [b] | 132 | 148 | 345 | 350 | 352 |
| Miles of Streets Swept (lane miles) | 4,000 | 3,900 | 4,223 | 5,411 | 5,271 |

Source: Lacey (2010a, 2011, 2012a)

[a] Some catch basins were inspected and cleaned more than once.

[b] 2007-2008 are listed as centerline miles, 2009-2011 are lane miles.

## 1.5 Public Involvement and Participation Conducted for this Plan

Public involvement is an important component of the SWMP and will be conducted as part of the preparation of this SCP. During the development of this SCP, the City sought input from the general public and City officials in several ways:

- Presented the June 2012 initial draft SCP to the Utilities Committee on July 3, 2012
- Published the June 2012 initial draft SCP on the City's website on July 5, 2012, and invited comments from the public until November 21, 2012
- Provided paper copies of the June 2012 initial draft SCP for review at City Hall
- Provided paper copy of the June 2012 initial draft SCP for review in the City Council workroom.
- Solicited input from the general public on the June 2012 initial draft SCP at the Lacey Community Market on July 14, 2012
- Presented the June 2012 initial draft SCP to the Planning Commission on October 23, 2012
- Provided a "Preview" copy of the May 2013 final draft SCP for review on the City website in May 2013
- Provided paper copies of the May 2013 final draft SCP for review at City Hall
- Made paper copy of the May 2013 final draft SCP for review in the City Council workroom
- Presented the May 2013 final draft SCP to the Planning Commission on May 21, 2013
- Sent utility billing inserts to all Lacey stormwater customers on May 24, 2013, regarding SCP availability and requesting review and comments
- Presented the May 2013 final draft SCP to the Utilities Committee on June 7, 2013
- Presented the May 2013 final draft SCP for a public hearing before the Planning Commission in on June 18, 2013
- The May 2013 Stormwater Comprehensive Plan (minus Chapter 6) was adopted by the City Council on July 25, 2013
- Hosted an open house for the general public on October 22, 2013, to provide information on proposed changes to the stormwater utility rates
- Provided information on proposed stormwater utility rates to the Olympia Master Builders and Lacey Chamber of Commerce in Fall 2013.
- Made the final SCP available on the City's website following approval by Council

## 1.6 Plan Organization

This report is organized into six sections:

1. An introduction to the stormwater program, the purpose of the plan, and the methods employed to develop the plan
2. A discussion of the background material that is relevant to the stormwater program

3. A description of citywide and site-specific stormwater problems and proposed solutions
4. A description of the stormwater management program and activities required to comply with the Phase II Permit and defined program goals
5. Instructions for implementation of the stormwater management program activities and projects
6. A financial plan describing the stormwater utility rate adjustments that are required to implement this plan

The plan appendices provide more detailed background information, calculations, and data related to the plans recommendations:

- **Appendix A** lists the current City goals and policies related to stormwater.
- **Appendix B** summarizes regulations that guide the stormwater program.
- **Appendix C** provides summary sheets for all Capital Improvement Program (CIP) projects and non-CIP projects included in this plan.
- **Appendix D** provides cost estimates for all CIP and non-CIP projects.
- **Appendix E** provides an estimate of the staffing level of effort that is necessary to meet the requirements of the Phase II Permit and the defined program goals.
- **Appendix F** provides supporting documentation for the financial plan.
- **Appendix G** contains a stormwater system atlas displaying the storm drain system, impervious land cover data set, and drainage basins.
- **Appendix H** contains a table of the primary Stormwater Treatment Facilities in the City.

# 2.0 BACKGROUND

This section provides background information on:

- The physical environment in the City that affects stormwater management
- Waterbodies within the City limits, in the UGA, and that receive surface water or stormwater from within the City limits
- Climate change considerations
- A list of applicable regulations
- A brief history of the stormwater utility fund

## 2.1 Study Area Characteristics

The City of Lacey is located at the southern tip of Puget Sound and is bordered to the west by the City of Olympia. Thurston County borders the City to the north, east, and south. The City encompasses approximately 16.6 square miles (10,624 acres) in area, including 1.8 lineal miles (9,504 feet) of marine shoreline. The current population is 42,830 in the City and 33,170 in the UGA (Lacey 2012a, 2010 census). The SCP only addresses stormwater issues within the city limits, but the UGA is included in text and figures when the UGA is relevant to stormwater management issues within the city limits.

The City's land uses reflect a small town heritage with a recent influx of large residential and commercial development. The Hawks Prairie Business District is the latest area of commercial development with large retail and light-industrial parks. Residential developments and a large corporate campus dominate the southern portion of the City. The City maintains a large Open Space Institutional (OSI) inventory, which includes churches, schools, parks, and protected critical areas. Within the City's urban growth boundary (approximately 10,000 acres), almost 17 percent of the land is designated OSI and includes large tracts of protected critical areas. The City also owns a large portion of the wetland and buffer areas around Woodland Creek. Figure 2-1 summarizes existing land uses in the City.

The soils in the City are typical for the south Puget Sound Region, consisting of well-drained glacial outwash, intermixed zones of glacial till, and wetland peat bogs. The majority of the City is dominated by Hydrologic Soil Groups A and B, outwash soils that generally have high infiltration capacities (see Figure 2-2). These soils are generally most suitable for stormwater infiltration applications and constitute the following percentage of area in the City:

- **Group A soils** – 31.2 percent
- **Group B soils** – 32.9 percent

Hydrologic Soil Groups C and D are sandy or silty soils characterized by low permeability and relatively high runoff potential, making them less suitable for stormwater infiltration

applications. A portion of the City is also occupied by wetlands and lakes (see Section 2.2). These soil groups constitute the following percentage of area in the City:

- **Group C soils** – 26.0 percent
- **Group D soils** – 3.4 percent
- **Wetlands and lakes** – 6.5 percent

Sensitive ground water areas in the City include Wellhead Protection Areas (WHPAs) and Critical Aquifer Recharge Areas (CARAs). WHPAs consist of a sanitary control area and time-based capture zones that are used to identify the area of influence around each drinking water well, and where land use management can help to reduce the risk of contamination (Lacey 2013). CARAs are defined as "areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge" (WAC 365-190-030). Because WHPAs identify areas where land use is carefully regulated to avoid contamination of drinking water, groundwater in these areas should be protected. Heightened land use and infiltration regulations in these areas are governed through the City's wellhead protection program (Chapter 6 of City of Lacey Water Comprehensive Plan) to prevent contamination of drinking water. Future development in wellhead protection areas through land use and activity regulation is defined and enforced through the Lacey Municipal Code (LMC 14.36). These protected areas constitute the following percentage of the City and are shown in Figure 2-3:

- **Wellhead Protection Areas (WHPAs)** – 28.5 percent
- **Critical Aquifer Recharge Areas (CARAs)** – 96.5 percent

Stormwater infiltration in these areas is regulated in the City of Lacey Stormwater Design Manual (2010).

## 2.2 Waterbodies and Impervious Surfaces

The City has an abundance of natural water resources that includes a chain of connected lakes that flow from one to another through wetlands, culminating in Woodland Creek, which drains to Henderson Inlet on Puget Sound. This chain begins with Hicks Lake, which flows into Pattison Lake, which in turn flows into Long Lake. The outflow from Long Lake forms Woodland Creek which then flows through Lake Lois, turns north, flows out of Lacey and enters the southern end of Henderson Inlet.

During the development of the SCP, all drainage basin boundaries within the City limits and the UGA were delineated using digital elevation data (PSLC 2002) and the City's storm drain system GIS data (City of Lacey 2011a). In addition, the City developed a comprehensive GIS-based dataset of all impervious surfaces inside the City limits that delineates five surface types within the City limits based on aerial photography (Lacey 2009):

- Building footprints
- Roadways

- Parking lots
- Sidewalks
- Driveways

Finally, drainage basins were delineated for 53 stormwater facilities. The regional stormwater pond drainage basins include all area that is immediately tributary to the pond, but exclude upstream areas that are managed by other stormwater facilities.

Figure 2-4 displays the water bodies and major drainage basins within the city limits and the UGA. Figure 2-5 displays the impervious surface distribution within the City limits and Table 2-1 displays the percent of impervious surface within each basin. A stormwater system atlas was developed that displays the storm drain system, the impervious surface data set, and the regional stormwater pond drainage basins (Appendix G).

**Table 2-1. Drainage Basin Impervious Area.**

| Drainage Basin | Total Basin Area (ac) | Basin Area within the City Limits (ac) | Percent Impervious within the City Limits [a] |
|---|---|---|---|
| Chambers Lake | 947 | 601 | 31 |
| College Regional Stormwater Facility | 424 | 424 | 43 |
| Deschutes River | 18,565 | 1,387 | 41 |
| Eagle Creek | 1,919 | 1,348 | 16 |
| Fox Creek | 1,097 | 3 | 7 |
| Long's Pond | 50 | 27 | 10 |
| Henderson Inlet | 15,423 | 989 | 15 |
| Hicks Lake | 1012 | 951 | 39 |
| Indian Creek | 893 | 128 | 65 |
| Lake Lois | 572 | 215 | 39 |
| Little McAllister Creek | 2,169 | 42 | 40 |
| Long Lake | 2,160 | 432 | 24 |
| McAllister Creek | 1,6574 | 627 | 21 |
| Pattison Lake | 2,187 | 393 | 20 |
| Ruddell Road Stormwater Treatment Facility | 114 | 113 | 35 |
| Southwick Lake | 236 | 216 | 29 |
| Woodard Creek Outlet | 4,966 | 20 | 82 |
| Woodland Creek Outlet | 5,878 | 2,321 | 36 |

Notes:

[a] Percent impervious calculations are based on drainage basin areas within the City limits and the UGA only

This remainder of this section is divided into three subsections summarizing background information on the following groups of waterbodies:

- Waterbodies within the City limits
- Waterbodies within the UGA
- Waterbodies outside of the City limits and the UGA that receive drainage from tributaries or stormwater facilities within the City limits

Each section includes a description of the larger watershed (Henderson Inlet, Deschutes, or Nisqually) that the waterbody is located in, the size and land use in the drainage basin, a summary of basic waterbody information, a brief description of the results of prior studies, and water quality issues (as determined by Ecology's water quality assessment).

Ecology groups waterbodies into five categories as part of the state water quality assessment. Category 1 (meets tested standards for clean waters), Category 2 (waters of concern), and Category 3 (insufficient data) are not described in this section since the available data does not demonstrate that there is water quality impairment. Category 4 includes three subcategories: Category 4a (has a TMDL), Category 4b (has a pollution control program), and Category 4c (is impaired by a non-pollutant). These subcategories are highlighted in the waterbody descriptions if applicable since waterbodies in this category either have water quality issues that the City is aware of and taking steps to address (Category 4a and 4b) or the impairment is due to a non-pollutant (Category 4c), such as instream flow, that is not regulated by a TMDL process. Category 5 is also known as the 303(d) list and identifies impaired waterbodies that have exceeded water quality standards for one or more pollutants. The most recent 303(d) list is the 2010 list developed by Ecology in 2010 and approved by the U.S. Environmental Protection Agency in 2012. Ecology is now on a rotating schedule for completing the freshwater and marine water quality assessments and 303(d) lists, with the next draft freshwater quality assessment anticipated to be available in fall 2013.TMDLs or water cleanup plans are established for parameters identified on the 303(d) list. The status of the TMDL implementation plans for each waterbody is also summarized below.

### 2.2.1 Waterbodies within the City Limits

Four lakes and one major stream system are located within the City limits. With one exception, these waterbodies are all part of the Henderson Inlet Watershed; Chambers Lake is part of the Deschutes Watershed. The following waterbodies are summarized below:

**Henderson Inlet Watershed**

- Woodland Creek
- Hicks Lake
- Southwick Lake
- Long's Pond

**Deschutes Watershed**

- Chambers Lake

#### 2.2.1.1 Woodland Creek

Woodland Creek originates in a horseshoe-shaped chain of lakes connected by extensive wetlands in southeast Lacey. Hicks Lake flows into Pattison Lake, which then flows into Long Lake. From the north end of Long Lake, Woodland Creek flows through Woodland Creek Community Park, past Long's Pond to Lake Lois. From Lake Lois, the creek carves a narrow ravine through forest land, crosses Martin Way and Interstate 5, and then flows through rolling hills and wetlands before ultimately discharging to the southern tip of Henderson Inlet. A total of 2.4 miles of the creek lies within the City limits, and a total of 1.9 miles of the creek lies within City-owned parcels (within the UGA). The contributing basin area is 16,560 acres, 79 percent of which is within the Lacey city limits and UGA. The basin consists primarily of urban and rural residential areas as well as commercial areas, and suburban residential development is rapidly increasing in the headwater areas near the mouth of the basin (Ecology 2006). The stream portion between lake Lois and the springs north of Martin Way usually dries up during the summer months, significantly reducing fish habitat and productivity in the upper reach of the stream.

Pollutants from urban stormwater runoff have contributed to declining water quality in Woodland Creek. Pet wastes and failing septic systems are common sources of bacteria in stormwater runoff in residential settings and rural settings. Woodland Creek has consistently failed to meet water quality standards for fecal coliform bacteria and currently has a TMDL (Category 4A) for fecal coliform bacteria along with several tributaries located in the UGA (described in the following section) (Ecology 2012a). Bacterial pollution, largely from Woodland Creek, affects shellfish harvests in Henderson Inlet. Much of the pollution in the rural area was historically caused by failing on-site sewer systems and agricultural practices (Thurston County 2010). In 2001, Thurston County responded by establishing the Henderson Shellfish Protection District (Thurston County 2010). In 2005, the Thurston County Board of Health created the Henderson Watershed Protection Area, which requires inspection of all on site sewage systems in the Henderson Watershed area. Additional measures to reduce pollutant loads in the stream include implementation of agricultural BMPs, new stormwater treatment facilities and improved farm planning and public education. These pollution reduction efforts have shown positive results, and in 2010, commercial shellfish harvest area increased by 240 acres due to improving water quality (Thurston County 2010). In June 2012, the Washington State Department of Health announced that 100 acres of commercial shellfish harvest area have also reopened to harvest (WADOH 2012).

Woodland Creek is included on Ecology's 303(d) list (Category 5) for fecal coliform bacteria and temperature violations (Ecology 2012a). The stream also exhibits high concentrations of total phosphorus and nitrate (Thurston County 2010). The lower reach of Woodland Creek is also listed as Category 4C for instream flow ("intensified peak flows" from stormwater runoff).

#### 2.2.1.2 Hicks Lake

Hicks Lake is the first in a series of four lakes (Hicks, Pattison, and Long lakes, and Lake Lois) that comprise the Woodland Creek subbasin and flow to Henderson Inlet. Hicks Lake is the only one of the four lakes that is located inside the City limits; the other three lakes are located within the UGA. Hicks Lake has a drainage area of 1,010 acres, comprised primarily of

urban and suburban residential areas with a small portion of undeveloped forest. Discharge from Hicks Lake flows to Pattison Lake through an outlet channel located on private property.

The mean depth of Hicks Lake is 18 feet, and the deepest portion of the lake extends to 35 feet (Ecology 1997). Flooding has been observed in the past during extreme storm events (Thurston County 2010).

Hicks Lake was classified as meso-eutrophic by Ecology in 1997, but more recent studies show the lake is approaching a eutrophic state (Thurston County 2010). In 2008, the nutrient (i.e., phosphorus) concentration in the lake was in the eutrophic range and the water clarity was lower than it was in the previous years (Thurston County 2010). This may in part be due to runoff from a high-density urban area that has become increasingly developed. Despite this, the total phosphorus concentration remains below state water quality standards. The lake has been listed by Ecology as Category 4C due to the presence of swollen bladderwort (*Utricularia inflata*), an invasive exotic species (Ecology 2012a).

Hicks Lake is a popular recreational lake, accessed through Wanschers Community Park on the lake's western shore and the adjacent boat launch.

#### 2.2.1.3 Southwick Lake

Southwick Lake is a 36-acre lake, located to the west of Pattison Lake and south of Hicks Lake in the Henderson Inlet Watershed. The lake has no apparent inlets or outlets, and collects runoff from a drainage area of 260 acres. Most of the shoreline is under private ownership. Land use along the lake's shoreline is a combination of low to moderate density urban residential areas and open spaces. Lacustrine wetlands are located along the vegetated northern shoreline of Southwick Lake. Southwick Lake does not have any known water quality issues. Southwick Lake is located within the 100-year floodplain, thus the water level in the lake has the potential to rise significantly during large storm events (ESA Adolfson 2008).

#### 2.2.1.4 Long's Pond

Long's Pond, also referred to as Goose Lake, is a 12-acre lake located in the Henderson Inlet Watershed that receives flow from Long Lake through Woodland Creek and a series of wetlands (ESA Adolfson 2008). Himes Creek flows out of Long's Pond into Woodland Creek. Long's Pond, which has a drainage area of 50 acres, does not have any known water quality issues. Woodland Creek Community Park comprises much of the lake's shoreline. Long's Pond is most popular for its youth fishing program (Lacey 2012c).

#### 2.2.1.5 Chambers Lake

Chambers Lake is part of the Chambers Basin in the Deschutes Watershed. Little and Big Chambers Lake, previously one large lake, were separated into two lakes after the construction of the Chehalis Western Railroad in 1927, and are now connected with a 500-foot long channel (Thurston County 1995a). The boundary that separates the City of Lacey from the City of Olympia lies between the two lakes therefore, Big Chambers Lake is primarily within the City of Olympia while Little Chambers is located in the City of Lacey. The Chambers Basin also includes Chambers Ditch, South Tributary and Chambers Creek.

Lacey and Olympia share jurisdiction of Big Chambers Lake, while the City of Lacey alone has jurisdiction of Little Chambers Lake. The drainage basin contributing to both lakes is 950 acres. Discharge from Big Chambers Lake flows through Little Chambers Lake, which discharges to the Deschutes River via Chambers Ditch and Chambers Creek. The shoreline of both lakes includes a variety of wetland habitats (ESA Adolfson 2008).

Big Chambers and Little Chambers Lakes are similar in size and depth, with areas of 68 and 58 acres and maximum depths of 5 and 7 feet, respectively. Big Chambers Lake has no inlets and is fed only by groundwater and stormwater runoff. The water level tends to fluctuate with the seasons (Thurston County 1995a). The areas to the south and southwest of the lake have experienced flooding related to groundwater and surface water that has deemed it unsuitable for development (ESA Adolfson 2008).

Both Little and Big Chambers Lakes are classified as eutrophic and have dense populations of aquatic plants, despite efforts to reduce plant growth with the introduction of grass carp in 1990 (Thurston County 1995a). Historically, many species of fish inhabit this lake, including cutthroat trout, bass, perch, catfish, crappie and spiny ray; however, over the years, cutthroat trout population has greatly declined (Thurston County 1995a).

### 2.2.2 Waterbodies within the Urban Growth Area

Four streams are located within the UGA; three of these streams are part of the Henderson Inlet Basin and one is part of the Nisqually Basin. The following waterbodies are summarized below:

**Henderson Inlet Watershed**

- Eagle Creek
- Fox Creek
- Jorgenson Creek

**Nisqually Watershed**

- Little McAllister Creek

#### 2.2.2.1 Eagle Creek

Eagle Creek is a 2-mile long tributary to Woodland Creek, entering the stream along its eastern bank near river mile 2.25 (Thurston County 2004a; Ecology 2006). Eagle Creek has a drainage area of 1,920 acres and currently has a TMDL (Category 4A) for fecal coliform bacteria and is on Ecology's 303(d) list (Category 5) for dissolved oxygen (Ecology 2012a).

#### 2.2.2.2 Fox Creek

Fox Creek is a 1.2-mile long tributary to Woodland Creek, and enters the stream along its northern bank near river mile 1.9 (Thurston County 2004a; Ecology 2006). Fox Creek has a drainage area of 1,100 acres and currently has a TMDL (Category 4A) for fecal coliform bacteria and is on Ecology's 303(d) list (Category 5) for dissolved oxygen (Ecology 2012a).

#### 2.2.2.3 Jorgenson Creek

Jorgenson Creek is a 1.0-mile long tributary of Woodland Creek, and flows into the stream along its southwest bank around river mile 1.2 (Thurston County 2004a; Ecology 2006). Jorgenson Creek has a drainage area of 510 acres and currently has a TMDL (Category 4A) for fecal coliform bacteria and is on Ecology's 303(d) list (Category 4A) for dissolved oxygen (Ecology 2012a).

#### 2.2.2.4 Little McAllister Creek

Little McAllister Creek, located within the McAllister/Eaton Creek Basin and the Nisqually Watershed, originates in the spring-fed wetlands. The stream loses a total of 180 feet in elevation over 2 miles as it flows through a steep ravine, and ultimately discharges into agricultural ditches. The stream forks into two branches that flow to the south and to the west (Thurston County 2004b). The Little McAllister sub-basin is 2,170 acres and accounts for seven percent of the total McAllister/Eaton Creek Basin. A TMDL study of dissolved oxygen and bacteria in McAllister Creek and the Nisqually Watershed was conducted in 2005, and determined that a 74 percent reduction in fecal coliform bacteria in Little McAllister Creek was needed to meet water quality standards (Ecology 2005a).

### 2.2.3 Waterbodies Receiving Surface Water or Stormwater from Within the City Limits

The following waterbodies receiving surface water or stormwater discharges from within the City limits are summarized below:

**Henderson Inlet Watershed**

- Henderson Inlet
- Lake Lois
- Long Lake
- Pattison Lake
- Woodard Creek

**Deschutes Watershed**

- Deschutes River

**Nisqually Watershed**

- Puget Sound (Nisqually Reach)

#### 2.2.3.1 Henderson Inlet

Bound on the east and west by the Nisqually Reach of Puget Sound and Budd Inlet, respectively, Henderson Inlet is one of five inlets that contribute to South Puget Sound. The drainage basin area of Henderson Inlet is approximately 1,190 acres within the city limits and UGA. Woodland and Woodard Creek drain 80 percent of the inlet; while Dobbs Creek (East

Creek), Meyer Creek (Snug Creek), and Sleepy Creek (Libby Creek), and several other small streams account for the remaining 20 percent.

High levels of fecal coliform bacteria in the lower portion of Henderson Inlet have prohibited commercial shellfish harvesting since the 1980s. In 2001, the Thurston County Commissioners created the Henderson Inlet shellfish protection district. The district is composed of an appointed local stakeholder group, who develop water quality restoration recommendations. The district stakeholders currently meet every other month to discuss water clean-up plans for the area (Thurston County 2012).

Henderson Inlet is on Ecology's 303(d) list (Category 5) for dissolved oxygen, and has a TMDL (Category 4A) for fecal coliform bacteria. Several of its tributaries, including Dobbs Creek, Sleepy Creek, and Woodard Creek are also on Ecology's 303(d) list (Category A4 or 5) for one or more violations of fecal coliform bacteria, temperature, dissolved oxygen, or pH. Other tributaries to Henderson Inlet also failed to meet water quality standards for these parameters, but are not on Ecology's 303(d) list (Ecology 2006).

#### *2.2.3.2 Lake Lois*

Lake Lois is last in the series of four lakes (Hicks, Pattison, and Long lakes, and Lake Lois) that make up Woodland Creek drainage system, which is part of the Henderson Inlet Watershed. The lake, which has a maximum depth of 10.5 feet, is separated into three lobes and spans a total area of just under 13 acres with a drainage area of 570 acres. The lower two lobes are bisected by the berm of Carpenter Road, but connected to each other through a culvert. Recent construction of Carpenter Road has increased the size of the culverts connecting the lower two lobes. A narrow, shallow channel connects the upper two lobes. The southern lobe of Lake Lois receives flow from Long Lake via Woodland Creek.

Located in the center of Lacey and partially inside the City Limits, Lake Lois is the main attraction of Lake Lois Park and Habitat Reserve, which is comprised of land purchased by the City of Lacey over a period of 30 years (Lacey 2012d). Lake Lois Park and Habitat Reserve (located to the west and east of Carpenter Road, respectively) were included in the Woodland Creek/Lake Lois Enhancement Project conducted by the City of Lacey in 1994 (Skillings-Connolly and FishPro 1995). This project was initiated in 1992 with the goal of improving the water quality over a 3-mile stretch of Woodland Creek, extending from the outlet of Long Lake to Draham Road. A major water quality concern leading to the development of the Enhancement Project was the presence of Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive exotic species that has persisted in both Long Lake and Lake Lois since the late 1980s (Lacey and Ecology 1995) and has resulted in a Category 4A listing for Lake Lois for Eurasian water-milfoil (Ecology 2012a). In 1978, Lake Lois was described as extremely eutrophic. As Lake Lois is very shallow, its water quality is largely influenced by the high nutrient loading from Long Lake.

A number of field surveys conducted between 1970 and 1992 suggest that the majority of fish activity in Lake Lois occurs in December and January, and that the coho salmon population greatly outnumbers the chum salmon population. The Enhancement Project suggested that reducing nutrients and dissolved pollutants in Lake Lois could be achieved by treating stormwater runoff in a stormwater treatment facility and bioswales prior to entering the

southern lobe of the lake. The installation of a control structure at the outlet of Lake Lois was also suggested, which would regulate flow downstream and reduce peak flows during large storm events (Lacey and Ecology 1995).

#### 2.2.3.3 Long Lake

Long Lake, located along the east boundary of Lacey in Thurston County, is comprised of two basins connected by a narrow channel. A small part of the south basin is located within the City Limits.The south basin is fed by Pattison Lake and a small stream, and the north basin flows to the north to the Henderson Inlet via Woodland Creek and Lake Lois. This 320-acre lake has a maximum depth of 21 feet and drainage area of 2,160 acres. It collects runoff from urban and suburban residential areas as well as a small percentage of agricultural and forested areas (Thurston County 2010). Most of the shoreline is surrounded by dense residential development and Long Lake Park, one of the most used parks in the City, lies on the West bank of the Northern basin (Lacey 2012d).

The lake experiences nuisance blue-green algae blooms and emergent aquatic plants that frequently interfere with recreational activities. The lake is on the Ecology's 303(d) list (Category 5) for total phosphorus, PCB (tissue), Dieldrin (tissue), and 2,3,7,8-TCDD (tissue) (Ecology 2012a). In 2008, the south basin was treated with aluminum sulfate (alum) to reduce total phosphorus concentrations and decrease blue-green algae blooms. The south basin continues to show a decrease in total phosphorus concentrations since the alum treatment; however, the north basin contains high concentrations of total phosphorus that exceed state water quality standards (Thurston County 2010). Long Lake is also listed under Category 4C for Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive aquatic species, which has been controlled by the Long Lake Management District (LLMD) since the late 1980s. The LLMD has been actively controlling nuisance invasive and native plants in the lake using approved control methods, including aquatic herbicide treatments, bottom barriers, mechanical harvesting, and diver surveys.

#### 2.2.3.4 Pattison Lake

Pattison Lake, also referred to as Patterson Lake, is part of the Henderson Inlet Watershed. This 271-acre lake, with a maximum depth of 22 feet, was separated decades ago into two basins to the north (81 acres) and south (190 acres) through placement of excavated railroad fill (Thurston County 2010). The edge of the northern basin borders the City Limits to the east. Pattison Lake is the second in the series of four lakes beginning with Hicks Lake that ultimately drain north to Henderson Inlet. Hicks Lake flows directly to Pattison Lake, which in turn flows into the south basin of Long Lake. The lake's drainage area is 2,190 acres and is comprised primarily of suburban residential areas and some undeveloped forested wetland areas (Thurston County 2010).

Both basins of Pattison Lake experience harmful algae blooms that decrease water clarity and have adverse effects on water quality. The south basin in particular experiences severe algae blooms and filamentous algae that cause problems with recreational activities such as boating and fishing. The south basin of Pattison Lake is categorized as a highly productive eutrophic lake, and is on Ecology's 303(d) list (Category 5) for total phosphorus. A series of treatments and water quality improvement efforts were conducted on Pattison Lake from the late 1970s to the early 1990s, including alum treatment and aquatic plant harvesting. The water level in

the lake has slowly risen due to unintentional blockage of the outlet channel to Long Lake (Thurston County 2010).

Fishing, swimming and boating are popular recreational activities on Pattison Lake.

#### 2.2.3.5 Woodard Creek

Woodard Creek, part of the Henderson Inlet Watershed, flows 7.5 miles along the outskirts of the City. Woodard Creek drains a basin of 4,910 acres, comprised of urban and rural residential as well as commercial areas (Thurston County 2010). Wetlands are located along the depressions and hills following the length of the stream, and collect runoff from high-density commercial areas in Lacey and Olympia. The wetland at the headwaters of the stream is surrounded by industrial and commercial development, and the estuarine wetland located at the stream's mouth is currently protected from development by the Washington State Department of Natural Resources (Ecology 2006).

The water quality of Woodard Creek has been impaired over the years due to harmful pollutants in urban runoff and rural activities (Thurston County 2010). The inlet of Woodard Creek, located in the center of the City, is polluted mainly by stormwater runoff. The middle section of the stream is surrounded by more urban areas, and has a higher potential for pollution from agriculture, livestock, and septic systems. Woodard Creek has a TMDL for fecal coliform bacteria (Category 4A) and is on Ecology's 303(d) list (Category 5) for dissolved oxygen. The TMDL study conducted in 2006 determined that reduction of fecal coliform bacteria is necessary to meet water quality standards (Ecology 2006). Efforts to improve the water quality of the stream and reduce pollution have been made over the years by targeting these point sources and implementing agricultural BMPs in the surrounding area (Thurston County 2010).

#### 2.2.3.6 Deschutes River

The Deschutes River is home to many fish species including coho, Chinook, and chum salmon and flows 57 miles from the Gifford Pinchot National Forest in Lewis County to Budd Inlet in Olympia. The Deschutes River has a total basin area of 162 square miles. The upper and mid-watershed is comprised of forested, rural residential and agricultural areas; the lower watershed consists of primarily urban areas from the surrounding cities of Tumwater, Olympia, and Lacey (Thurston County 2010). Discharge from Big Chambers Lake flows through Little Chambers Lake (located in the City of Lacey), which discharges to the Deschutes River via Chambers Ditch and Chambers Creek. The lower reach of the Deschutes River discharges to South Puget Sound through Capitol Lake and Budd Inlet.

The Deschutes River enters Capitol Lake from the south. Capitol Lake was created in 1951 as a reflecting pool for the Capitol Building in Olympia and is separated into three basins. These basins are bound by Interstate 5 and railroad bridges, with depths varying from an average of 9 feet to maximum of 20 feet (Thurston County 2010). Capitol Lake has a drainage basin of 185 square miles, collecting runoff from commercial forestry, agriculture, and rural residential areas. Urban land uses from areas of the City of Olympia and Tumwater contribute to the lower portion of the watershed. Several public parks and walking trails run along the shore of the lake, making it a popular destination for boating, jogging, and bird watching (Thurston County 2010).

In 1998, the Deschutes River was placed on Ecology's 303(d) list for temperature, fecal coliform bacteria, dissolved oxygen, and fine sediment. Since then, efforts have been made to identify pollution sources, and in 2008, Ecology conducted a TMDL study of the river. Low dissolved oxygen levels in the river have been caused by excess nutrients and algae growth (Roberts and Pelletier 2007). One study by Ecology suggests that increasing riparian shade along the river could potentially decrease river temperatures and increase dissolved oxygen levels however, a decrease in nutrient levels in the river would be required for any observable increase in dissolved oxygen levels (Roberts and Pelletier 2007).The Deschutes River is currently listed on Ecology's 303(d) list for fine sediment, temperature, bacteria, and dissolved oxygen (Ecology 2012a).

The nutrient concentrations decrease as water flows from the Lower Deschutes River to Capitol Lake, indicating that during certain times of year the lake may buffer nutrient loading from the Deschutes River to Budd Inlet (Roberts and Pelletier 2007). Capitol Lake experiences blue-green algae blooms in the summer, contributing to high loading of organic matter, and further decreasing dissolved oxygen into Budd Inlet. Capitol Lake is on Ecology's 303(d) list (Category 5) for total phosphorus and fecal coliform bacteria. The lake is also listed under Category 4C for Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive exotic species. Capitol Lake is also infested by New Zealand mudsnails (*Potamopyrgus antipodarum*) (Deixis 2010).

The Deschutes River, Capitol Lake, and Budd Inlet TMDL Technical Report (Ecology 2012b) published in June 2012 presents the loading capacity for fecal coliform, temperature, DO, pH, and fine sediment in portions of the watershed, and recommends loading reductions to meet water quality standards. This report recommends "zero" waste load targets (or allowable pollutant load) for fine sediment for any NPDES permitted entities (including Phase II Permittees) within the Deschutes watershed. The report recommends actions for decreasing concentrations of fecal coliform bacteria and improving levels of temperature, dissolved oxygen, and pH. Load allocations for each pollutant will be identified in the Water Quality Improvement Report that is being developed by Ecology. Ecology will work with the Deschutes Advisory Group to establish specific details for implementation actions that will be compiled into a Water Quality Implementation Plan.

#### *2.2.3.7 Puget Sound (Nisqually Reach)*

Puget Sound is the largest fjord-like estuary in the continental United States. Located between the Cascade and Olympic mountain ranges in Washington State, the Puget Sound basin covers more than 16,800 square miles of land and water (Hart Crowser et al. 2007). The basin is made up of a series of interconnected underwater basins, separated by shallow ridges or sills. The drainage basins in the City primarily discharge to Henderson Inlet; however, some surface water discharges to Budd Inlet and directly to Puget Sound (in the Nisqually Reach). The Nisqually Reach section of Puget Sound is fed by the Nisqually River. The City's contribution to water quality in the Nisqually Reach is primarily due to stormwater and surface water flows from Little McAllister Creek.

Over the past 150 years, human activity has introduced a wide range of toxic chemicals in the Puget Sound ecosystem at levels that are harmful to aquatic life (Puget Sound Partnership 2006). Despite a ban on some harmful chemicals in the 1970s and numerous cleanup efforts,

toxic chemicals continue to persist and circulate throughout the Puget Sound ecosystem and are still being introduced via stormwater runoff, municipal sewage treatment plants, and atmospheric deposition. These toxic chemicals can have acute and chronic effects on nearshore organisms. Once in the food web, certain toxic chemicals can also be concentrated in larger predatory animals, ultimately affecting marine fish and mammals. These contaminants are also a significant concern for human health, especially for those who frequently consume fish with high contaminant levels.

Budd Inlet, one of the five inlets that comprise South Puget Sound, is on Ecology's 303(d) list (Category 5) for dissolved oxygen and various toxic compounds. While dissolved oxygen levels are low in several South Puget Sound inlets, Budd Inlet consistently experiences the lowest levels each year (Roberts and Pelletier 2007). Excess nutrients (such as nitrogen and phosphorus) from point or non-point sources cause low dissolved oxygen levels in waterbodies, inhibiting the growth and survival of many aquatic species. The largest sources of nutrients to South Puget Sound include the effluent from the Lacey Olympia Tumwater Thurston County (LOTT) Clean Water Alliance wastewater treatment plant, and discharge from the Deschutes River and Capitol Lake, which both contain high levels of dissolved inorganic nitrogen. In 1994, the LOTT Clean Water Alliance began including denitrification in the wastewater treatment process in attempts to reduce nutrient loading into the Puget Sound (Roberts and Pelletier 2007).

In 2001, The Thurston County Commissioners created the Nisqually Reach shellfish protection district. The district is composed of a local stakeholder group who develop water quality restoration recommendations. The district stakeholders currently meet every other month to discuss water clean-up plans for the area (Thurston County 2012). The Nisqually Reach section of Puget Sound is on Ecology's 303(d) list (Category 5) for fecal coliform bacteria.

## 2.3 Climate Change

### *2.3.1 Predicted Climate Changes*

Significant research on climate change predictions has been conducted by the Climate Impacts Group at the University of Washington. This research projects the local effects of global climate change using 20 global climate models and two emissions scenarios. Local climate impacts are identified by downscaling model results and supplementing data with regional climate models. The results indicate that future temperatures in the Pacific Northwest will increase, on average, 2.0ºF by the 2020s, 3.2ºF by the 2040s, and 5.3ºF by the 2080s, compared with the average from 1970 to 1999 (temperatures are averaged across all 20 climate models). This equates to rates of warming ranging from 0.2ºF to 1.0ºF per decade. Therefore, evaporation and transpiration are likely to increase in the future, reducing the amount of water that is available to recharge groundwater during the summer months (Mote and Salathé 2010).

Projected changes in annual precipitation, averaged over all models, are small (+1 percent to +2 percent), but most models project an enhanced seasonal cycle with changes toward wetter autumns and winters, and drier summers (Mote and Salathé 2010). Average projected winter increases in precipitation are not large relative to interannual variability (Littell et al. 2009). Projections of extreme precipitation events also vary significantly, but generally indicate

increases in extreme rainfall magnitudes throughout the state in the future (Littell et al. 2009).

Changes in nearshore sea surface temperatures, though smaller than on land, are likely to substantially exceed interannual variability, but little coastal upwelling changes are anticipated. Rates of twenty-first century sea level rise will depend on poorly known factors like ice sheet instability in Greenland and Antarctica, and could be as low as twentieth century values (8 inches or as large as 50 inches over the century) (Mote and Salathé 2010). Since Lacey has little low bank saltwater shore, sea level rise is not a significant local concern.

### 2.3.2 Predicted Impacts from Climate Change

These predicted climate changes will alter precipitation patterns and, consequently, increase flood risk potential in areas such as near Big Chambers Lake, Hicks Lake, and Southwick Lake. Increased average air temperature will produce increased average and summertime water temperatures as well as evapotranspiration. Higher water temperatures will increase the frequency and duration of algal blooms and incidents of low dissolved oxygen; such incidents are already problematic in a number of the City's waterbodies such as Woodland Creek, and downstream receiving waters including the Deschutes River, Long Lake, Pattison Lake, and Budd Inlet. Table 2-2 outlines the aspects of stormwater management that would be most affected by climate change in Lacey, and the resultant physical and biological responses. These responses are predicted based on the rain-dominated hydrology of the City.

**Table 2-2. Predicted Responses to Climate Change Effects on Stormwater Flows.**

| Stormwater Element | Predicted Response to Climate Change |
|---|---|
| Storm intensity | Increased magnitude and frequency of peak flows |
| Annual precipitation amount and seasonal distribution | Moderate increase in winter precipitation<br>Moderate decrease in summer precipitation<br>Increased average runoff in winter and spring<br>Decreased summer baseflow |
| Flood risk | Increased flood risk from increased peak flow magnitudes<br>Increased flood risk from channel migration |
| Water temperature | Increased average and summer water temperature<br>Lower dissolved oxygen<br>Increased algal blooms |
| Evapotranspiration | Increased evapotranspiration<br>Lower soil moisture<br>Reduced summer baseflow in creeks<br>Reduced groundwater recharge<br>Wetland conversion from perennial to seasonal |

### 2.3.3 Applicability to Stormwater Management in Lacey

The potential hydrologic changes associated with climate change increase the importance of stormwater management practices that control flows, promote infiltration, and preserve and enhance water quality. Because Lacey's water resources are precipitation driven and the

City's water supply is from groundwater, ensuring infiltration of stormwater and groundwater recharge will become increasingly important as population grows, groundwater demands increase (due to higher temperatures and greater population), and water resources become more scarce (due to altered precipitation patterns and higher temperatures).

Changes in the City's hydrologic patterns will have consequent effects on water quality. As average water temperature increases, it will likely exacerbate existing water quality problems of low dissolved oxygen and frequent algal blooms in the City's lakes and downstream waters. Current inflows of excessive nutrient loads will produce even more frequent algal blooms leading to higher incidences and longer periods of low dissolved oxygen events. Such affects can also adversely alter stream and lake ecosystems, affecting the viability of many native aquatic plant and animal species, especially cold-water fish such as cutthroat trout. These changes increase the importance of water quality treatment at new and redevelopment projects, as well as retrofits of the City's existing system. Changes in precipitation patterns could also alter when and how often older stormwater facilities will exceed their design storm capacities and cause flooding and/or bypass into surface waters.

Given these high risk factors, it would be prudent for the City to consider modeling its stormwater management system to determine what areas are at or near flow capacity and thus prone to increased flood risk in the future; particularly in neighborhoods, where redevelopment is expected to occur or where large capital improvement projects are planned. In addition, the City could reduce its vulnerability to increasingly poor water quality by retrofitting existing stormwater facilities for better treatment performance, or constructing new stormwater infrastructure such as constructed wetlands, or LID facilities that more effectively treat water quality in areas that have surface runoff (i.e., areas that don't infiltrate 100 percent of stormwater).

## 2.4 Applicable Regulations

The City's SWMP supports efforts to comply with the following local, state, and federal regulations and other requirements:

Ecology's Phase II Permit, originally issued in February 2007 and modified in June 2009, requires cities and counties that manage small municipal separate storm sewer systems to develop a SWMP focused on reducing discharge of pollutants to the maximum extent practicable and on protecting water quality. The 2009 Phase II Permit modifications included the extension of some permit compliance deadlines and requirements for the City to identify barriers to LID and develop a plan for implementing LID more broadly in the future. Ecology reissued the Phase II Permit with little to no modifications in July 2012 extending the permit requirements until July 31, 2013. Throughout the SCP, the 2007, 2009, and 2012 issuances of the permit are referred to as the 2007-2013 Phase II Permit. The Phase II Permit that becomes effective on August 1, 2013, is referred to as the 2013-2018 Phase II Permit.

The 2013-2018 Phase II Permit, in combination with the 2012 Stormwater Management Manual for Western Washington, will make LID BMPs mandatory where feasible for onsite stormwater management. Additional information on LID BMPs is provided in the following section.

- TMDL cleanup action is required for waterbodies on Ecology's Clean Water Act Section 303(d) list due to significant water quality degradation.
- The Puget Sound Partnership (PSP), formerly the Puget Sound Action Team, is the regional organization that the governor has charged with restoring the health of the Puget Sound by 2020 (PSP 2009). The City's SWMP will need to focus on the major stormwater-related issues that PSP highlights for action to assist in this critically important regional effort.
- The federal Endangered Species Act (ESA) prohibits the take of all listed species, including a take that could result from the City's stormwater facility operations or private development stormwater management activities that are permitted by the City.
- The Washington State Growth Management Act (GMA) requires the City to inventory and protect environmentally critical areas (such as steep slopes, wetlands, and streams) (Chapter 36.70A of the Revised Code of Washington). The GMA also requires the City to develop comprehensive plans in order to ensure environmentally responsible and economically sustainable development, including planning for stormwater-related capital facilities.

Several sections of the LMC govern aspects of stormwater management for new development and redevelopment project sites (see the *Introduction* section of this document). Appendix B provides more detailed information on stormwater-related regulations and municipal code requirements.

## 2.5 Low Impact Development Stormwater Management

Low impact development (LID) encompasses a broad range of land use planning, site design, and policy tools collectively aimed at reducing or eliminating the adverse effects of development and related land use conversion on the environment. Stormwater management is one of the key components of LID. Stormwater management in the context of LID seeks to mimic natural hydrologic processes to negate increases in runoff volumes and peak flow rates, reduce pollutant loadings in runoff to surface waters, and recharge groundwater.

In the Puget Sound area, evolving research and guidance for LID stormwater solutions often uses the terms "natural drainage systems" or "green stormwater infrastructure" to describe LID BMPs. LID stormwater management strategies focus on mimicking pre-disturbance processes of infiltration, filtration, storage, evaporation, and transpiration by emphasizing conservation and use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into the project design (PSP and WSU Extension 2012). Examples of these distributed stormwater management practices include permeable pavements, green roofs, bioretention areas (also referred to as rain gardens), compost or topsoil amendment in lawn areas, and cisterns for water reuse. Different LID BMPs can be selected for onsite stormwater management, flow control, and water quality treatment depending on site-specific conditions. Because LID BMPs blend well with native plant landscaping, they can also be used amidst landscaped areas for a wide range of land uses and can often be designed and constructed alongside roadways and in residential settings.

Incorporation of LID into residential areas can also increase property values and add amenity value that traditional stormwater management cannot achieve (LMI 2005; Bryce et al. 2008).

The 2013-2018 Phase II Permit, in combination with the 2012 Stormwater Management Manual for Western Washington, make LID stormwater management BMPs mandatory where feasible for onsite stormwater management beginning in 2017, including requirements to meet either a specific LID performance standard, or to use BMPs from one of two prioritized lists of LID BMPs whenever LID BMPs are considered feasible. The 2012 Stormwater Management Manual for Western Washington includes BMP design requirements and feasibility and infeasibility criteria, such as recommendations from a geotechnical engineer, infiltration rates, proximity to sensitive areas, proximity to contaminated soils, and potential to threaten existing utilities or road subgrade stability. The 2013-2018 Phase II Permit also requires the City review and revise its development-related codes, rules, standards, and other enforceable documents to incorporate and require LID principles and LID BMPs by December 31, 2016.

## 2.6 Stormwater Utility Fund

Creating a storm and surface water utility and imposing service charges is authorized by RCW Chapter 35.67. Pursuant to that statute, the City of Lacey enacted Chapter 13.70 of the LMC to implement a storm and surface water utility charge. This charge is necessary to fund SWMP activities and projects that are required to provide services to residents, support development and meet regulatory requirements. This type of utility program is authorized by state statute and has been supported by our courts, including the Washington State Supreme Court, which has upheld the creation of such a utility and the imposition of storm and surface water utility fees. The remainder of this section describes the history, purpose, and uses of the City utility fund.

### *2.6.1 History and Purpose*

Early in the 1980s, the cities of Lacey, Tumwater and Olympia, in cooperation with Thurston County, funded a regional study to identify methods to improve surface water quantity and quality conditions in north Thurston County. The analysis and report recommended a regional approach to stormwater management and the creation of a regional stormwater utility that encompassed the needs of all four jurisdictions. Although this recommendation was never adopted, it was the basis for the implementation of individual stormwater utilities.

Based largely on the results of that study, the City of Lacey created the Stormwater Utility Fund on January 24, 1985, by the passage of Ordinance No. 712. In December 1987, Ordinance No. 794 was passed, establishing interim stormwater utility fees. These were flat fees assessed to property owners on a per-parcel basis. Residential homeowners paid $1.45 per month per parcel while commercial and business owners paid $14.50 per month per parcel. This ordinance also established a dedicated Stormwater Enterprise Fund, similar to the City's sewer and water enterprise funds, which means the utility is self-supporting. Between 1982 and 1989, stormwater fees generated approximately $130,000 to $170,000 per year in revenue. These funds were largely used for basin planning to determine the needs of the City's stormwater program.

In 1990, Ordinance No. 886 established the current Stormwater Utility rate structure based more directly on the amount of runoff and pollutant generated by each parcel. The current system includes a rate for two different classes of property:

- **Single-family and duplex-family residential parcels** are each assessed a flat fee (duplex-family is twice as much as single-family) because these types of sites are similar in lot size and impervious area coverage throughout the City. Thus, they generate a similar amount of runoff and pollution, which incurs a similar cost per unit for services provided.
- **All other parcels (multi-family, commercial, industrial, institutional, etc.)** are assessed a fee based on the total parcel area and a sliding fee schedule based on the percentage of impervious area on the parcel. The monthly fee is calculated as the gross parcel acreage multiplied by the monthly service charge per gross acre, where the monthly service charge per gross acre is variable based on the percent of impervious surface on the lot. Thus, more densely developed parcels are assessed a higher charge per acre.

### 2.6.2 Past and Current Use of Funds

Funds received by the stormwater utility are used in the management and control of stormwater or for constructing stormwater facilities. The primary accomplishments of the stormwater utility are summarized in Section 1 of this plan. Over the years, stormwater utility fees collected by the City have been used for an increasing number of purposes as stormwater problems and regulatory requirements have grown. This expansion in the service demands on the stormwater utility has been driven by increasing regulatory mandates for improving water quality and aquatic habitat in the surface waters that receive the City's stormwater runoff, as well as more stringent groundwater protection standards. Economic inflation has also contributed to increasing stormwater rates over time. Table 2-3 presents the stormwater utility fees since 1987. Regulatory mandates and other factors that have increased the burden on the stormwater utility are described below.

#### 2.6.2.1 Regulatory Mandates

In February 2007, Ecology issued the Phase II Permit to the City and more than 80 other jurisdictions in Western Washington. The Phase II Permit outlines SWMP activities and implementation milestones that the City must follow in order to comply with federal law. All Phase II communities are expected to develop a SWMP that includes all the required activities, implement those activities within the required time periods over the permit term, and submit annual reports to Ecology to document progress toward complete permit compliance and program implementation.

The Phase II Permit primarily deals with reducing pollutants discharged from the City's stormwater system into lakes and creeks in the City that ultimately discharge into Puget Sound. The major elements of Phase II Permit compliance that require funding from the stormwater utility include:

- Public Education and Outreach
- Public Involvement and Participation

- Illicit Discharge Detection and Elimination (IDDE)
- Controlling Runoff from New Development, Redevelopment, and Construction Sites
- Pollution Prevention for Municipal Operations

**Table 2-3. City Stormwater Utility Fees from 1987 to Present.**

| Ordinance No. | Ordinance Adoption Date | Monthly Charge (Residential) | Monthly Charge (Commercial) | Effective Dates of Rates |
|---|---|---|---|---|
| 712 | January 24, 1985 | *(Created Stormwater Utility Fund only – rates not set or charged yet)* | | |
| 794 | December 4, 1986 | $1.45 SFR, $2.45 DFR | $14.50 per parcel | Jan. 1, 1987 (interim)[a] |
| 886 | April 26, 1990 | $3.90 SFR, $7.80 DFR | $1.64 to $38.28 per acre[b] | July 1, 1990 |
| 934 | March 26, 1992 | $4.50 SFR, $9.00 DFR<br>$4.75 SFR, $9.50 DFR<br>$5.00 SFR, $10.00 DFR | $1.89 to $44.17 per acre<br>$2.00 to $46.62 per acre<br>$2.11 to $49.07 per acre | 4-1-92 to 3-31-93<br>4-1-93 to 3-31-94<br>4-1-94 to 3-31-95 |
| 1010 | February 9, 1995 | $5.25 SFR, $10.50 DFR<br>$5.50 SFR, $11.00 DFR<br>$5.75 SFR, $11.50 DFR | $2.22 to $51.52 per acre<br>$2.33 to $53.97 per acre<br>$2.44 to $56.42 per acre | 4-1-95 to 3-31-96<br>4-1-96 to 3-31-97<br>4-1-97 to 3-31-98 |
| 1082 | February 26, 1998 | $6.00 SFR, $12.00 DFR<br>$6.25 SFR, $12.50 DFR<br>$6.50 SFR, $13.00 DFR | $2.54 to $58.88 per acre<br>$2.65 to $61.33 per acre<br>$2.76 to $63.78 per acre | 4-1-98 to 3-31-99<br>4-1-99 to 3-31-00<br>April 1, 2000 |
| 1279 | December 7, 2006 | $6.75 SFR, $13.50 DFR | $2.86 to $66.24 per acre | January 1, 2007 |
| 1319 | November 20, 2008 | $7.15 SFR, $14.30 DFR | $3.28 to $76.05 per acre | January 1, 2009 |
| 1403 | November 15, 2012 | $7.36 SFR, 14.73 DFR | $3.38 to $78.33 per acre | January 1, 2013 |

Definitions:
SFR = single-family residential
DFR = duplex-family residential
NOTES:
[a] Ordinance 794 set temporary rates, until permanent rates based on further study could be enacted.
[b] Ordinance 886 established the seven-step "sliding rate" based on impervious area of commercial parcels.

The two most resource-intensive elements of complying with the Phase II Permit are the Controlling Runoff from New Development, Redevelopment, and Construction Sites and Pollution Prevention for Municipal Operations program elements.

Major components of Controlling Runoff from New Development, Redevelopment, and Construction Sites program include:

- Design criteria and guidance for new development and redevelopment
- Permitting process with plan review, inspection, and enforcement capability
- Construction site inspections prior to construction, during construction, and after construction

- Annual inspections of stormwater treatment and flow control facilities permitted by the City (private facility inspections)
- Staff training for permitting, plan review, construction site inspections, and enforcement

Major components of Pollution Prevention for Municipal Operations program include:

- Annual inspections of public and private water quality treatment and flow control facilities
- Maintenance of public stormwater infrastructure and facilities.
- Catch basin inspections and cleaning
- Regular street sweeping
- Managing the waste collected from the catch basin, pipe, and facility cleaning and street sweeping
- Implementing Stormwater Pollution Prevention Plans (SWPPPs) for heavy equipment maintenance, or storage yards and material storage facilities

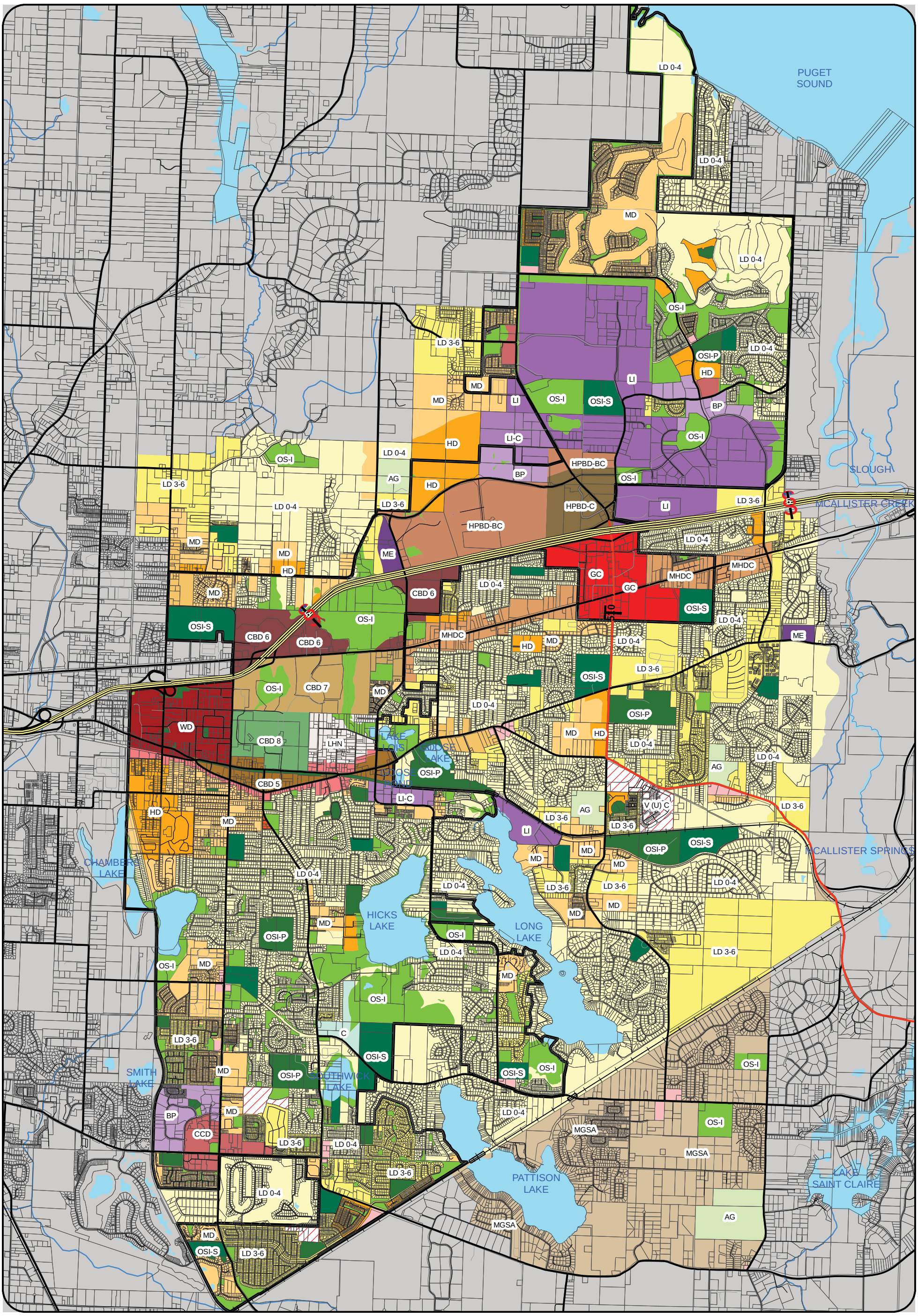
#### *2.6.2.2 Other Factors*

##### Population Growth

The City was incorporated in 1966 with a population of approximately 7,000 residents. Thurston County has been one of the fastest-growing counties in the state since the 1960s, and the City of Lacey has experienced one of the highest growth rates in the county. The population surged in the 1990s due to in-migration and annexation (Lacey and Thurston County 2008). The City's population grew by 4.9 percent annually from 1990 to 2000. The population of Lacey (according to the City of Lacey 2011 Comprehensive Annual financial Report) is 42,830. This population growth over the years has been accompanied by increased land development, greater stormwater runoff, and thus a greater burden on the stormwater program from a capital improvements and operations and maintenance standpoint.

##### Annexation

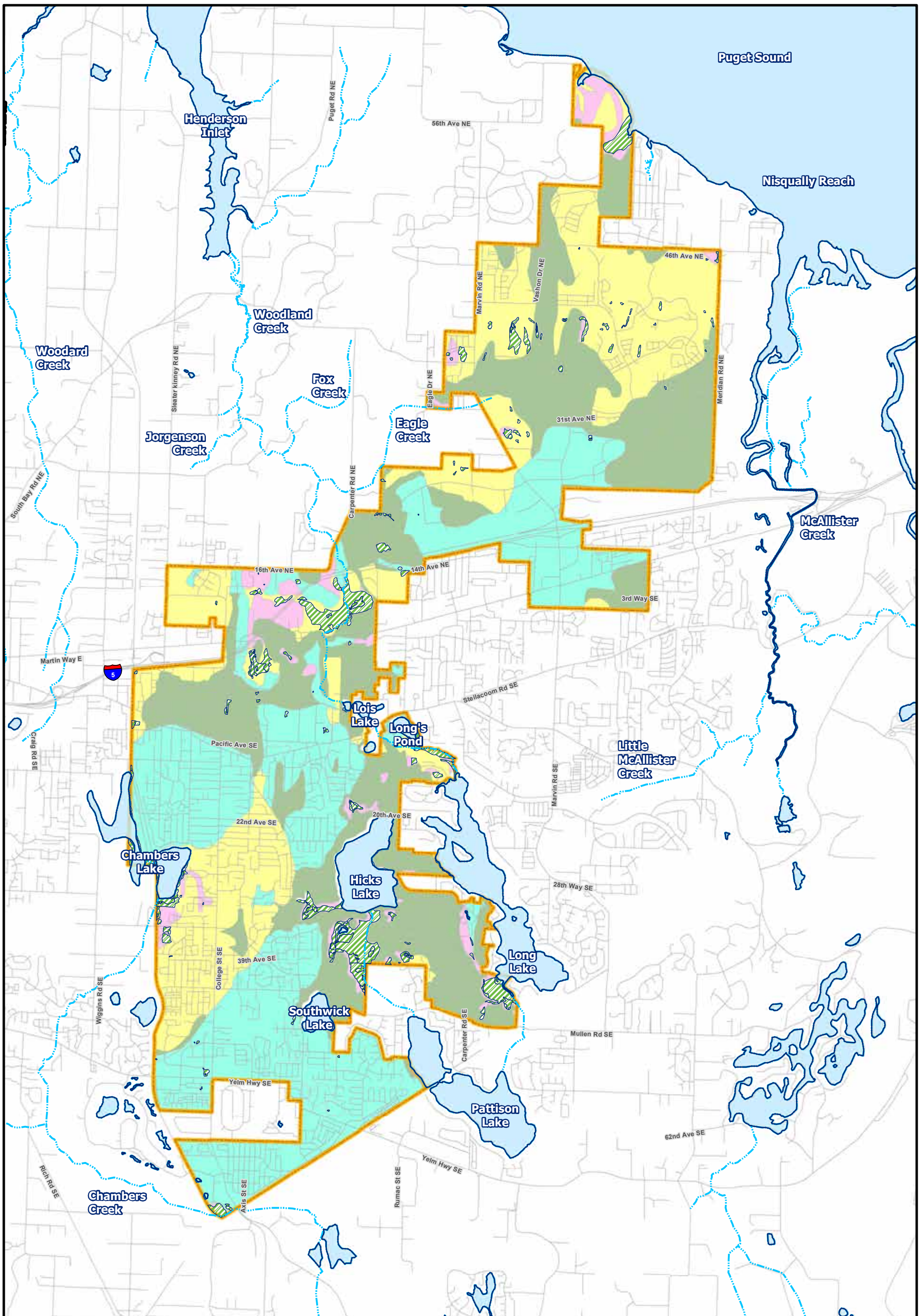
Historic annexations have expanded the size of the City's drainage system and created a demand for system improvements and maintenance in these annexed areas. This demand has led to demand for increased in city-wide stormwater utility revenue. Under the guidance of the Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area, the City of Lacey may ultimately annex almost all (18,986 acres) of the Woodland Creek watershed.




## City of Lacey

**Streets**
**TYPE**
- Interstate 5
- US Routes
- State Routes
- Major Roads
- Minor Roads
- Unnamed
- Outside County, Not Maintained
- Rail Road
- City Limits
- Lakes and Ponds
- Puget Sound
- MGSA McAllister Geologically Sensitive Area
- LHN Lacey Historic Neighborhood
- LD 0-4 Low Density Residential
- LD 3-6 Low Density Residential
- MD Moderate Density Residential
- HD High Density Residential
- MMDC Mixed Use Moderate Density Corridor
- MHDC Mixed Use High Density Corridor
- HPBD-BC Hawks Prairie Business District (Business/Comm.)
- HPBD-C Hawks Prairie Business District (Commercial)
- NC Neighborhood Commercial
- CCD Community Commercial District
- OC Office Commercial
- Woodland District
- Central Business District 4
- Central Business District 5
- Central Business District 6
- Central Business District 7
- Central Business District 8
- GC General Commercial
- BP Business Park
- LI-C Light Industrial Commercial
- LI Light Industrial
- ME Mineral Extraction
- C Cemetery
- AG Agriculture
- OS-I Open Space Institutional
- Recreation/Park in (Urban) Center
- Designated School Site in Village (Urban) Center
- Lake
- Village (Urban) Center
- Streams

**Figure 2-1. Existing Land Uses in the City of Lacey.**




## Legend

- Waterbody
- Stream
- Wetland
- City of Lacey

Hydrologic soil group

- A
- B
- C
- D

**Figure 2-2.**
**Hydrologic soil groups in the City of Lacey.**

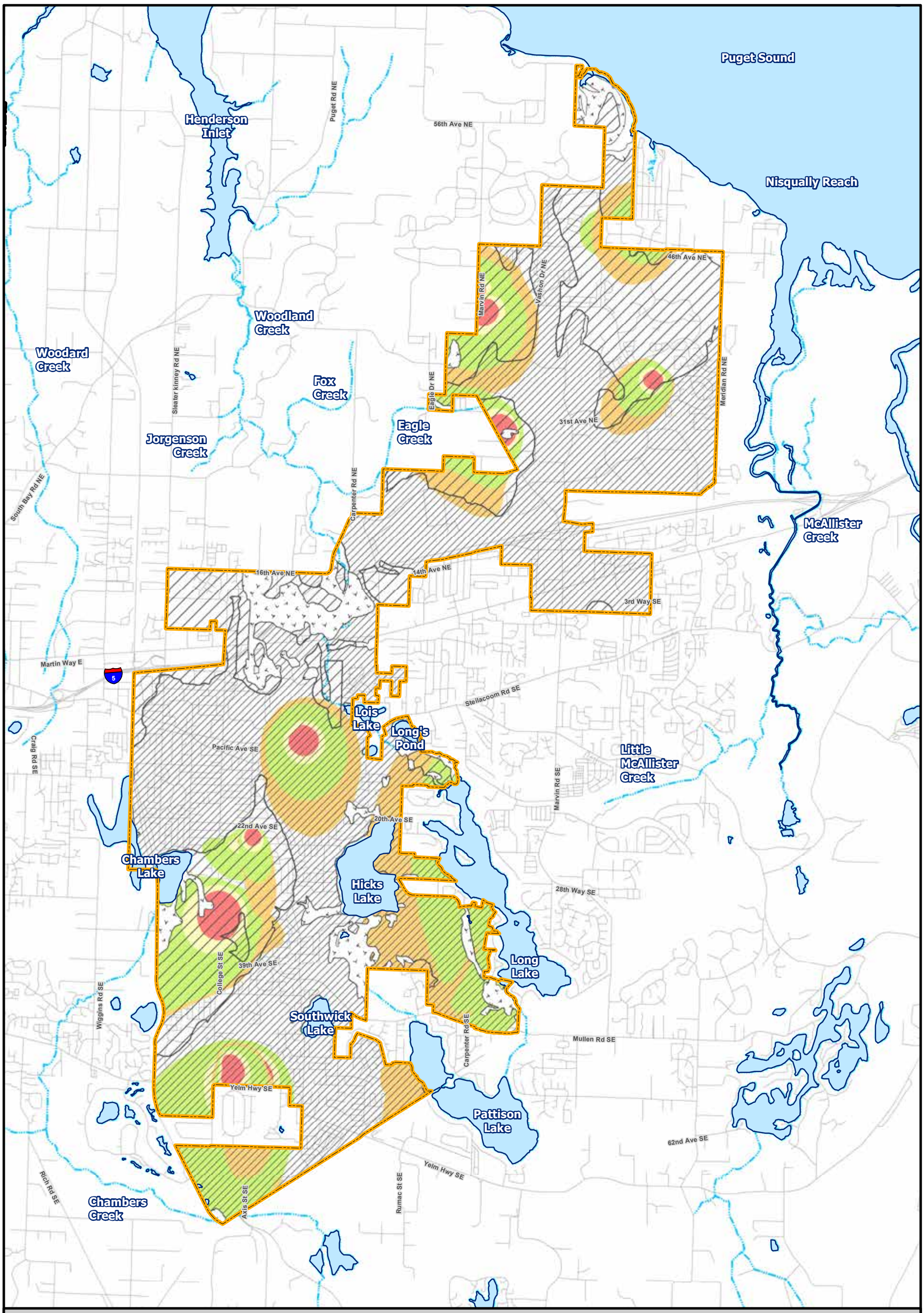
N

0 2,000 4,000 8,000 Feet

HERRERA

Aerial: USDA (2009)

K:\Projects\Y2010\10-04793-000\Project\SoilGroups.mxd (11/5/2013)




## Legend

| | CARA | WHPA |
|---|---|---|
| City of Lacey | | |
| Waterbody | I | 6mo |
| Stream | II | 1yr |
| | III | 5yr |
| | | 10yr |

**Figure 2-3.**
**Critical aquifer recharge areas (CARA) and well-head protection areas (WHPA) Sourced in the City of Lacey.**

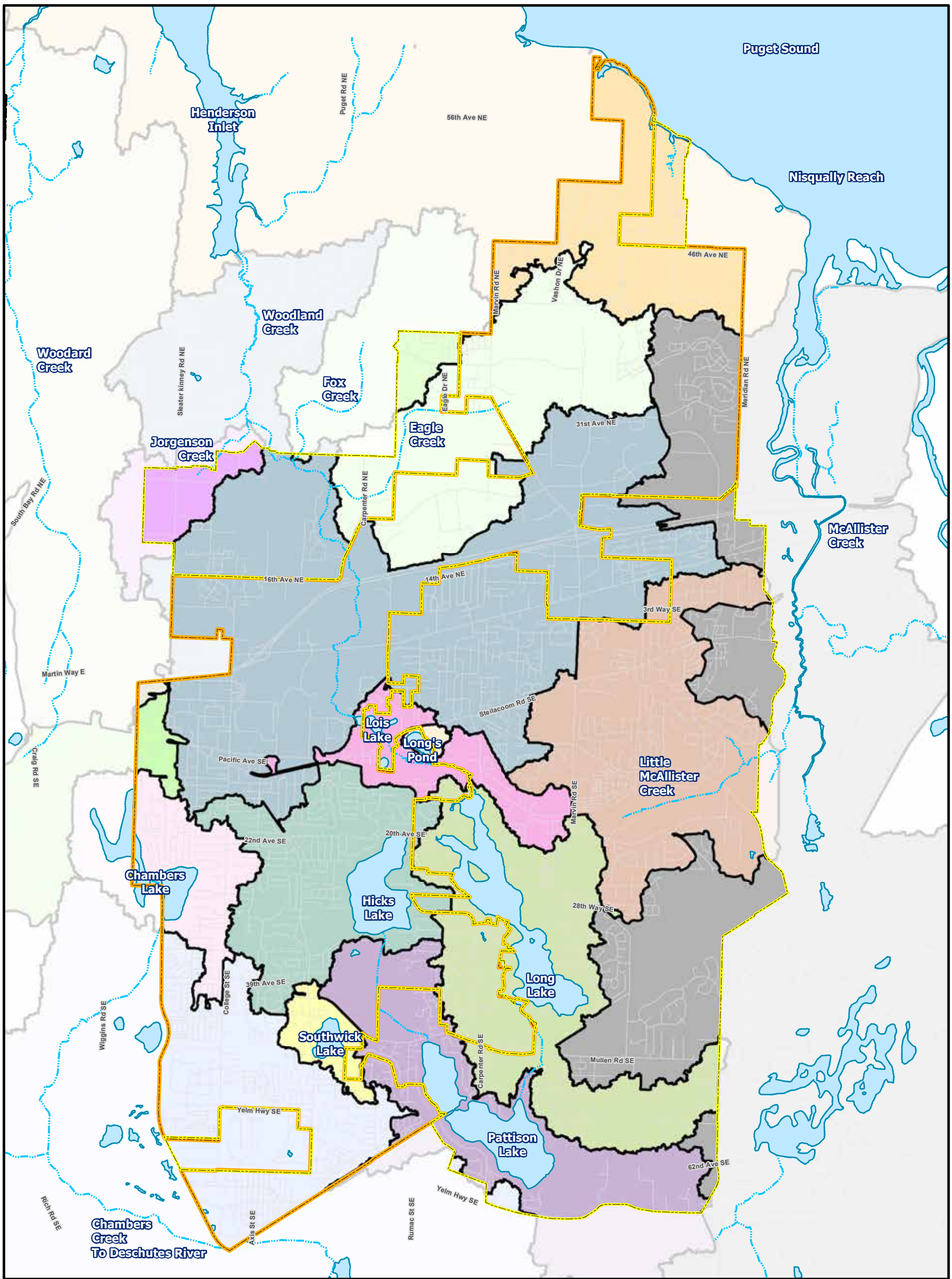
N

0 2,000 4,000 8,000 Feet

HERRERA

City of Lacey, Waterbody, Stream, WHPA, CARA (City of Lacey)

K:\Projects\Y2010\10-04793-000\Project\Critical_aquifer_recharge_areas.mxd (11/5/2013)




## Legend

- Urban growth boundary
- City of Lacey
- Waterbody
- Stream

Basins

- Chambers Lake
- Deschutes River
- Eagle Creek
- Fox Creek
- Long's Pond
- Henderson Inlet
- Hicks Lake
- Indian Creek
- Jorgenson Creek
- Lake Lois
- Little McAllister Creek
- Long Lake
- McAllister Creek
- Pattison Lake
- Southwick Lake
- Woodard Creek Outlet
- Woodland Creek Outlet

**Figure 2-4. Drainage basins within the City of Lacey.**

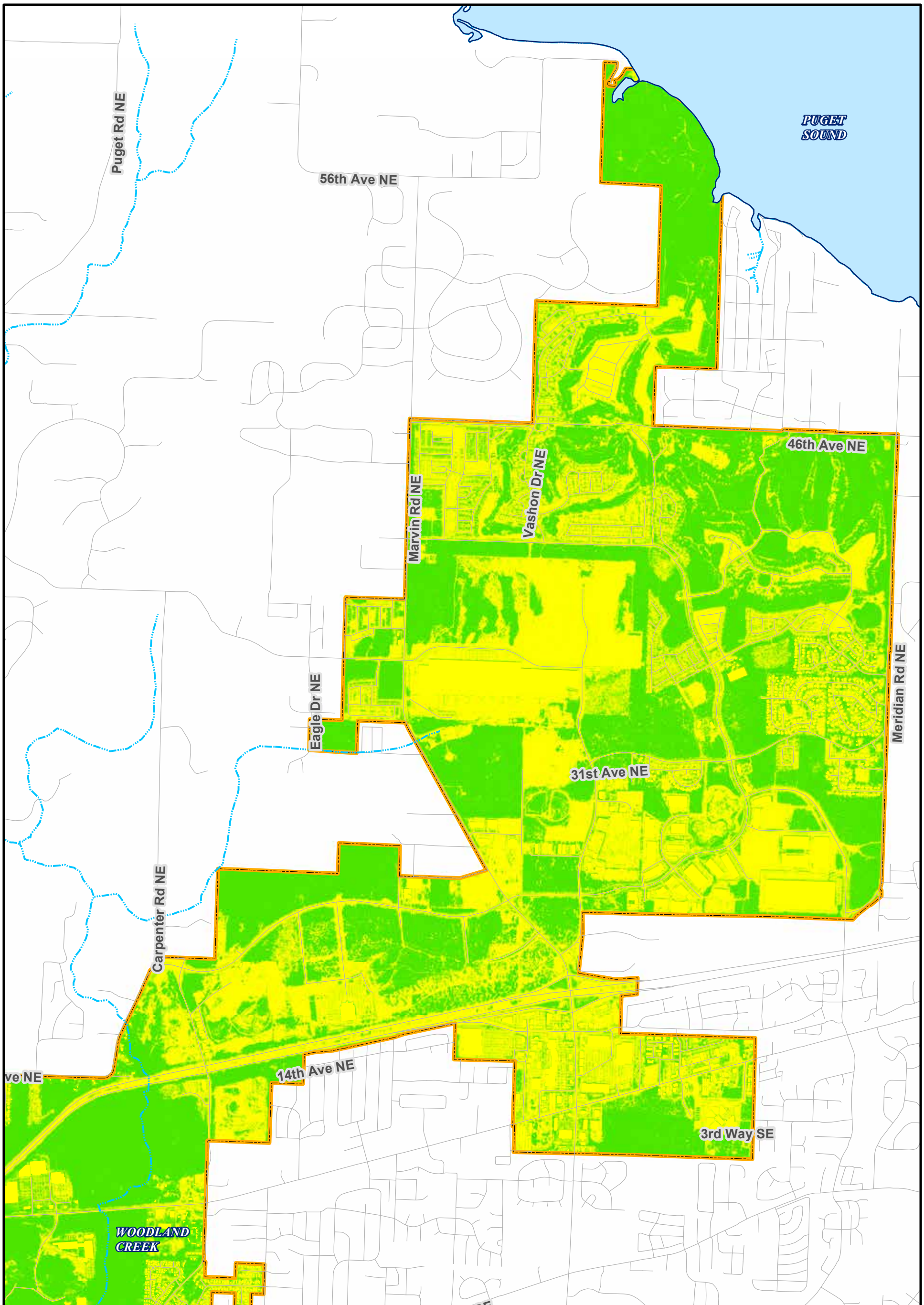
N

0 2,000 4,000 8,000 Feet

HERRERA

City of Lacey, Waterbody, Stream, UGB (City of Lacey)

K:\Projects\Y2010\10-04793-000\Project\DrainageBasins_OnlyWB.mxd (11/15/2013)




**Legend**

- Waterbody
- Stream
- City of Lacey
- Pervious area
- Impervious area

**Figure 2-5.**
**Impervious Area in the City of Lacey (Sheet 1 of 2).**

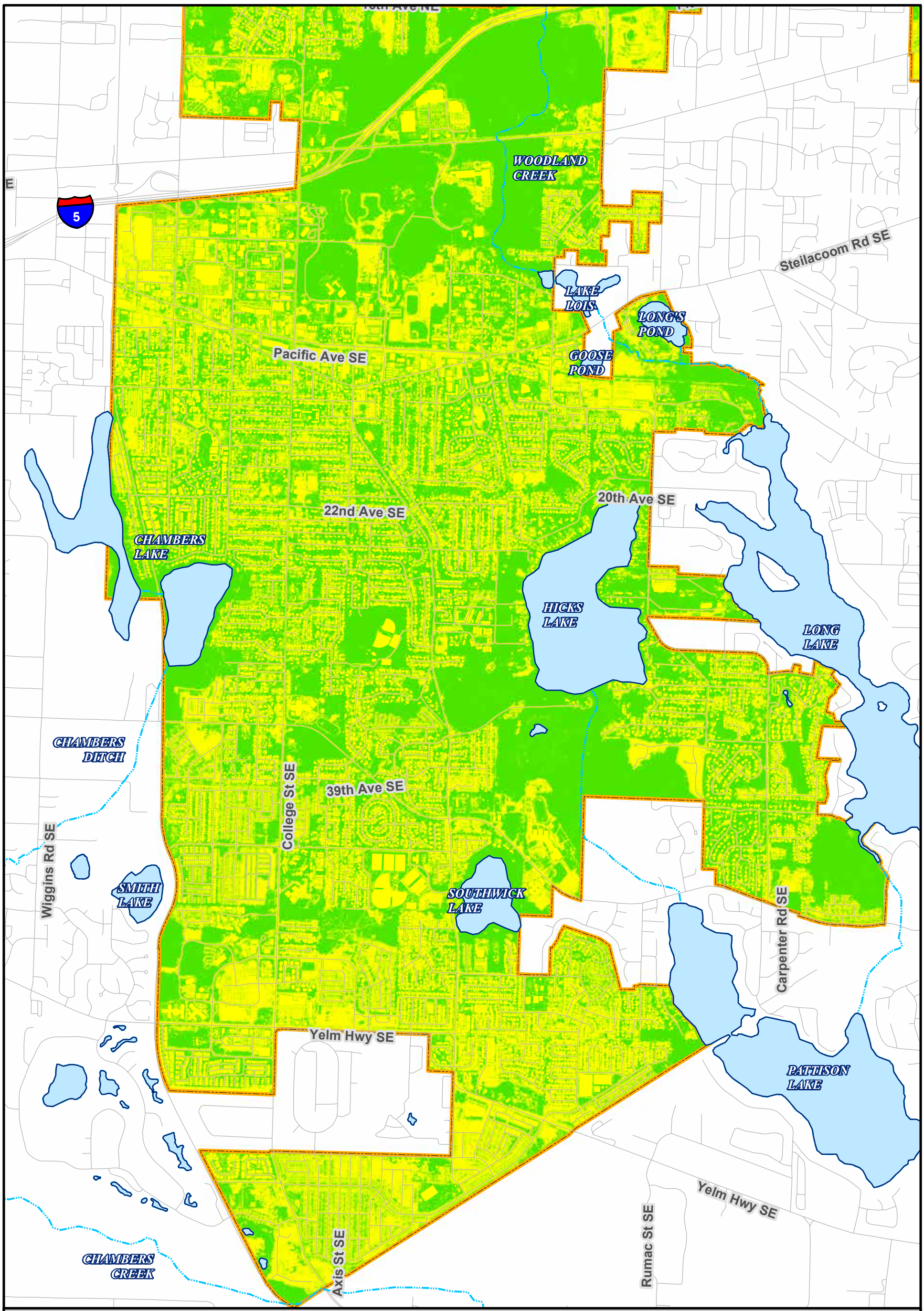
N

0 1,000 2,000 4,000 Feet

HERRERA

Aerial: City of Lacey (2009)

K:\Projects\Y2010\10-04793-000\Project\impervious_area_report_figure.mxd (11/7/2013)




**Legend**

- Waterbody
- Stream
- City of Lacey
- Pervious area
- Impervious area

**Figure 2-5.**
**Impervious Area in the City of Lacey (Sheet 2 of 2).**

N

0 1,000 2,000 4,000 Feet

HERRERA

Aerial: City of Lacey (2009)

K:\Projects\Y2010\10-04793-000\Project\impervious_area_report_figure.mxd (11/7/2013)

# 3.0 Stormwater System Known Problems and Recommended Solutions

This section includes a summary of the stormwater and surface water system within the City followed by citywide flooding and water quality problems, and recommendations for solving these problems. The chapter concludes with site-specific flooding and water quality problems developed based upon interviews with City staff and field reconnaissance, as well as programmatic CIP projects that address regulatory requirements and operations and maintenance projects that are not part of the CIP program. The prioritization process for the CIP project is described, followed by the final CIP project list. Summary sheets for CIP solutions to site-specific problems are provided in Appendix C. Itemized cost estimates for the recommended projects are provided in Appendix D.

## 3.1 Stormwater System Characteristics

The City's Stormwater Utility manages a large and complex storm drainage system in the public right-of-way (Table 3-1).

**Table 3-1. Summary of the City of Lacey Stormwater System.**

| Item | Quantity | Units |
|---|---|---|
| Catch basins and storm drains [a] | 4,951 | each |
| City Storm System pipe | 113 | miles |
| Outfalls (discharging to surface water) | 49 | each |
| Water quality treatment facilities (City owned and maintained) [b] | 17 | each |
| Detention facilities (City owned and maintained) [c] | 4 | each |
| Retention facilities (City owned and maintained) [d] | 21 | each |
| Regional facilities (City owned and maintained) [e] | 9 | each |
| Miscellaneous City stormwater components [f] | 434 | each |
| Vactor/ Sweeper Waste Processing Facility | 1 | each |
| Municipal streets | 153 | centerline miles |
| Impervious surface area coverage in the City [g] | 30.5 | % |

[a] Source: Lacey (2012e).
[b] Water quality treatment facilities include wet ponds and constructed wetlands that are designed to provide treatment of stormwater runoff.
[c] Detention facilities include detention ponds that temporarily store stormwater runoff, reducing peak flows but eventually discharging the same volume. Detention facilities provide little or no infiltration of stored stormwater.
[d] Retention facilities include retention ponds and swales that are designed to hold stormwater runoff and release it by evaporation, plant transpiration, and/or infiltration into the ground, reducing peak flows and the volume discharged.
[e] Regional facilities are large stormwater facilities (typically detention or retention ponds) that are designed to detain stormwater runoff from a number of new developments or areas within a drainage basin.
[f] Includes drywells, manholes, junction boxes, ponds, drop inlets, scuppers, slotted grates, oil-water separators, control structures, and wet vaults (Lacey 2012e).
[g] Impervious area calculated using updated impervious surface coverage developed specifically for the SCP.

The City stormwater system takes advantage of the high-infiltrating soils found in many parts of the City by controlling flow, using facilities that retain and infiltrate runoff. In places where infiltration is possible, the City uses retention ponds, infiltration ponds, or infiltration trenches for flow control. Most of these infiltration facilities are coupled with facilities that provide stormwater treatment prior to infiltration. Because groundwater is the primary source of drinking water in Lacey, source control to prevent stormwater contamination and treatment of stormwater before infiltration are important parts of the City's stormwater program.

Stormwater that is not infiltrated, either due to lack of stormwater management facilities, poorly infiltrating soils, or large storm events, runs off into surface waterbodies described in Section 2. The majority of this surface runoff ultimately flows to Henderson inlet, with a smaller portion flowing to Budd Inlet via the Deschutes River and another small portion of the City draining to the Nisqually Reach of Puget Sound. A map of the City's stormwater system is provided in Figure 3-1.

## 3.2 Citywide Problems and Recommendations

Citywide problems in Lacey are primarily issues that result from local or regional factors, such as trends in development and behavior of the public, unfavorable site conditions, or aging infrastructure. For example, conversion of forestland to residential development is a regional development trend that has caused increases in stormwater quantity, flooding of the public right-of-way and private property, and stream erosion and sedimentation problems. Identification of citywide problems was primarily based on input from City staff and review of relevant background documents.

The primary citywide drainage problems are nuisance flooding and replacement of deteriorating infrastructure. The primary citywide water quality problems are nonpoint source pollution from older development, including residential and commercial development from vehicle use in the City-owned rights-of-way, and potentially illicit discharges and illicit connections to the storm drainage system.

Lack of maintenance of private stormwater facilities has been identified as a citywide problem that causes flooding and water quality problems, but that issue and the City's approach for dealing with it, is described in Section 4.4.

### *3.2.1 Citywide Flooding Problems and Recommendations*

Increased impervious surfaces are the result of urbanization that has occurred since European settlers arrived. Conventional development disrupts the natural hydrology of the landscape by converting natural, permeable surfaces (such as meadows or forests) into impermeable surfaces (such as streets and roofs). Impervious surfaces can deliver precipitation directly to the stormwater system and the stream channel rather than allowing it to be collected by vegetation and infiltrate into the soil. Therefore, increased impervious surfaces cause higher peak flow rates in the stormwater system and stream channels to which the stormwater system discharges, resulting in flooding, and erosion and sedimentation in streams.

Residential development in the Puget Lowland has been shown to increase peak flow rates by as much as 10 times compared to forested conditions (Burges et al. 1998). Peak runoff flows can be expected to increase even more for commercial or industrial development areas where a greater proportion of the landscape is converted to impervious surfaces or otherwise compacted, reducing infiltration of stormwater into the natural soil.

Roadway flooding in January 2006 along 32nd Avenue NE.

The science of stormwater management has evolved significantly in the Puget Sound region. Stormwater facility designs frequently employ computer-modeling software to simulate existing and proposed site conditions, and stormwater management solutions are commonly integrated into the development site planning process. Effective stormwater management can control runoff to make a developed landscape behave more like a forest by retaining runoff with flow control facilities (e.g., LID natural drainage systems, storage pipes, detention vaults, detention ponds, and infiltration facilities). Unfortunately, concentrated urban development occurred in much of the City before strict stormwater management standards were put in place, so a significant percentage of the land area in the City sheds rainfall runoff quickly to pipes, ditches, streams, and wetlands. Many older developments that do have stormwater systems, exhibit drainage problems either because the systems were not designed to modern standards, or are in need of rehabilitation. Five site-specific problems (See CIP project numbers 4, 7, 12, 14, and 16 in Table 3-2) will address some of the more site-specific issues that have been identified, but according to City staff, there are many more areas in the City in need of system rehabilitation or retrofit. The City should systematically develop a list of known drainage problem neighborhoods, assign staff responsible for maintaining the list, and encourage field staff to contribute to the list on a quarterly basis, especially after storm events when they may have noted problems in the field.

The effects of urbanization patterns on the physical processes of Puget Sound lowland streams have been well-documented (Booth and Henshaw 2001; Castro 2002; Konrad 2000; Moscrip and Montgomery 1997). The physical character of the City's creeks is largely the result of such development-induced impacts to the drainage network and land cover. However, studies have also shown that urban creek channels can restabilize after extensive development has occurred (Booth and Henshaw 2000; Finkenbine et al. 2000), though native aquatic biota are not likely to adapt to these new flow conditions (Hartley et al. 2001). Increased winter flood flows have significantly degraded fish habitat in some reaches of Woodland Creek (Thurston County et al. 1995b), the City's largest downstream creek. Hydrologic analysis has indicated that stream flows in Woodland Creek are much greater than they would be under naturally forested conditions. The City should continue to implement the

requirements of the City of Lacey 2010 Stormwater Design Manual for private and public development projects and may consider flow control retrofits through modification of existing facilities or LID development practices when opportunities arise during projects that are programmed through other utility departments. The Stormwater Comprehensive Plan should be implemented to the maximum amount possible as allowed by state and Federal case law.

#### *Recommendations*

The City should consider the following activities to address the Citywide flooding and erosion problems identified above:

- Develop and maintain a list of known drainage problem neighborhoods, assign staff responsible for maintaining the list, and encourage field staff to contribute to the list on a quarterly basis, especially after storm events when they may have noted problems in the field
- Consider flow control retrofits through modification of existing facilities or LID development practices as part of projects programmed through other departments. When opportunities arise during projects that are programmed through other utility departments, e.g., consider stormwater retrofits as part of transportation projects
- Add flow control retrofit CIP projects or neighborhood drainage improvement CIP projects to the site-specific problems list on an annual basis
- Continue to implement requirements of the Stormwater Design Manual for private and public development projects to the maximum extent possible as allowed by state and Federal case law.

The City may also consider contributing to implementation of projects identified by Basin Plans for receiving waterbodies such as Woodland Creek, particularly when these projects could have a lower cost for an equivalent or greater benefit to water resources than projects implemented within the City of Lacey.

### *3.2.2 Citywide Water Quality Problems and Recommendations*

Nonpoint source pollution is a common water quality issue in developed urban settings (Ecology 2013). Some nonpoint sources of pollution in the City include:

- Pesticides and fertilizers from residential and commercial property landscaping
- Oil, grease, metals, and toxic organic pollutants from industrial/commercial areas and roadways
- Bacteria from pet waste
- Sediment transport from eroding stream banks
- Sediment transport from construction sites

Illicit discharges and illicit connections to the stormwater system have been identified as a primary concern in the Phase II Permit. Within the City, the most common examples of illicit

discharges include vehicle fluids from accidents, and wastewater from system overflows and RV dumping. Other examples of illicit dicharges include illegal dumping of engine oil by residents and businesses; illegal dumping of cooking oil and other wastes by restaurants; inadvertent connections of sanitary sewer pipes to the storm drainage system; leaks and spills at commercial storage and maintenance facilities; and unregulated discharges of washwater from mobile businesses such as carpet cleaners, internal building drains, sump overflows, process wastewater discharges, or sanitary sewer pipes (i.e., toilets, sinks, appliances, showers, bathtubs) that are incorrectly plumbed to the separate storm drainage system.

Pollution generates a petroleum sheen on a parking lot surface.

The City has found very few illicit pipe connections to the storm drain system. At a minimum the City should meet the minimum IDDE requirements of the Phase II permit, as described in Section 4 of this plan, and should notify Thurston County regarding illicit discharges that are identified entering the City stormwater system or surface waterbodies from points outside of the city limits.

Based on responses from City staff, additional source control at private commercial and industrial sites could have significant water quality benefits, particularly at gas stations. In order to address these sources, the City should evaluate the appropriateness of adopting pollutant source control requirements, such as those contained in the Stormwater Management Manual for Western Washington (Volume IV Source Control BMPs, Ecology 2005b), and apply the requirements to existing development. Implementation of source control BMPs Citywide is already a requirement in larger jurisdictions, such as Tacoma, Pierce County, and Seattle that are regulated by the NPDES Western Washington Phase I Municipal Stormwater Permit (Phase I Permit). These Phase I permit programs are required to include an ordinance, manual, inspection program, and enforcement procedures. If the City decides to implement a pollutant source control program similar to the Phase I jurisdictions, they should build from information already developed by in the Phase I stormwater programs. In the long term (past 2018), the City may be required to implement source control requirements under the Phase II permit.

The following waterbodies located within the City limits, or that receive surface water or stormwater from within the City limits currently have a TMDL established by Ecology to address fecal coliform bacteria:

- Eagle Creek
- Fox Creek
- Jorgenson Creek
- McAllister Creek
- Woodland Creek

Other waterbodies located within the City limits, the UGA, or that receive surface water or stormwater from within the City limits are on Ecology's Section 303(d) list of impaired waters (Ecology 2012a); however, a TMDL implementation plan has not yet been developed for all of these waterbodies:

- **Budd Inlet** – dissolved oxygen, various toxics (tissue)
- **Deschutes River** – temperature, fecal coliform bacteria, dissolved oxygen, fine sediment
- **Henderson Inlet** – dissolved oxygen
- **Long Lake and Patterson (south arm) Lake** – total phosphorus
- **Long Lake** – PCB (tissue), 2,3,7,8 TCDD (tissue)
- **Woodard Creek** – dissolved oxygen
- **Woodland Creek** – temperature

As in other urban areas of western Washington, the City's creeks exhibit high concentrations of fecal coliform bacteria during storm events and in the low flow summer months. Pet wastes are a common source of bacteria in residential settings, such as the City's neighborhoods.

### *Recommendations*

The City should consider the following activities to address the Citywide water quality problems identified above:

- Consider water quality retrofits through modification of existing facilities or LID development practices when opportunities arise during projects that are programmed through other utility departments
- Add water quality retrofit CIP projects to the site-specific problems list on an annual basis
- Continue to implement the requirements of the Stormwater Design Manual for private and public development projects to the maximum extent possible as allowed by state and Federal case law.
- Implement the Illicit Discharge Detection and Elimination (IDDE) recommendations in Section 4 of this plan

- Consider implementation of a source control program as resources permit

## 3.3 Site-Specific Problems and Solutions

The City evaluated several site-specific problems to develop planning level solutions and cost estimates for use in establishing the City's stormwater CIP plan for 2013 to 2023, and for scheduling non-CIP project implementation. Problems were identified by conducting interviews with City staff and performing field reconnaissance. Engineering solutions were developed to address the problems in a cost effective manner, and were prioritized based on several criteria (described below). This section of the plan identifies the problems, solutions, and prioritization process. Project summary sheets and itemized planning level cost estimates for the proposed solutions are provided in Appendices C and D, respectively. The development and prioritization of these site-specific solutions helps support policies G1, G9, and M1.

Flooding at the intersection of Impala Drive SE and 32 Avenue SE in September 2011.

Yelm Highway / Bush Park Wetpond in need of maintenance in 2012 (above), and after maintenance was performed (below).

### *3.3.1 Site-specific Problems and CIP Solutions*

Site-specific problems, proposed CIP solutions, and supported stormwater policies are identified in Table 3-2. A map of the problem and solution locations is provided in Figure 3-2.

The majority of the problems addressed by this plan are flooding issues, caused by inadequate system capacity, reduced performance of aging stormwater system components, or poor development practices (such as development within closed depressions). Several large maintenance problems or needs, such as reducing chronic maintenance issues, or rehabilitating large stormwater facilities, will also be addressed by

this plan, in addition to three programmatic projects. Many of the maintenance related problems have the potential to result in water quality impacts if left uncorrected. This plan also includes several projects that have been specifically developed to address water quality problems.

### 3.3.2 CIP Project Prioritization

CIP projects that address physical problems were prioritized based on the results of a qualitative evaluation that considered multiple criteria. The programmatic projects (18, 19, and 20) were not included in the prioritization because they are considered mandatory to remain in regulatory compliance; therefore, the scheduling of these projects is driven by regulation. The prioritization process input data are provided in Table 3-3 and include findings from field reconnaissance, input from City staff, and review of background documents such as GIS data and pre-design reports. A workshop was held with City staff on April 24, 2012, to discuss the prioritization data in Table 3-3 and identify the priority for each project.

The objective of the prioritization process was to identify the most important projects and develop a schedule for project implementation (design and construction). Based on the cumulative input shown in Table 3-3, each project was assigned a design year and construction year; in general, high priority projects were scheduled to occur sooner than low priority projects.

Projects were also divided into two tiers: Tier One or Tier Two projects. Tier One projects are necessary to provide fundamental utility services and include essential maintenance projects and critical upgrades, replacement, or expansion, such as projects that deal with long-standing and frequent flooding issues. Tier One projects also enable compliance with applicable regulations. Tier Two represents a greater level of funding to position the City to implement additional CIP projects that support the stormwater utility's mission and improve water quality near Lacey or address lower priority drainage problems. Implementation of Tier Two projects could be accelerated if grant funding becomes available to support a portion of the project. During the prioritization process, each project was assigned a classification category (i.e., maintenance, replacement, upgrade, or expansion of the existing system), and the following prioritization factors were evaluated as high, moderate or low:

- Problem Risk
- Project Efficiency
- Funding Potential
- Public Sentiment
- Data Quality

Each of the prioritization factors is described in more detail below. Since Tier Two projects will have a smaller financial impact on the City's budget, the Financial Plan presented in Chapter 6 represents a scenario that assumes complete funding of both Tier One and Tier Two projects.

In addition to the CIP projects classified as maintenance, replacement, upgrade, or expansion projects, three additional projects were identified that focus on mandatory and routine stormwater program and code updates (Projects 18, 19, and 20). While these are not construction projects, the stormwater program and code updates will require funding through the surface water utility, and were therefore included in the CIP project list and the financial analysis.

#### 3.3.2.1 Problem Risk

The assessment of risk includes consideration of problem probability/frequency and the potential losses resulting from the problem. Problems that occur frequently and have major potential losses have higher risk, and thus are typically assigned a higher priority. Problems that occur infrequently with minor potential losses have less risk, and thus are typically assigned a lower priority. Probability/frequency and potential losses are summarized below.

- **Probability/Frequency:** Probability of the problem occurring was evaluated qualitatively, based on the perceptions of City staff. Problems that occur more frequently were assigned a higher priority.
- **Potential Losses:** The potential losses of surface water problems can vary greatly. The highest potential losses were assigned to problems that cause a significant public safety hazard or extreme property damage, such as flooding of a major intersection that creates hazardous conditions. Problems with moderate potential losses could damage property, but pose a limited hazard to public safety. Problems with minor potential losses could have limited negative effects on property, but result in only a minor loss of use, such as flooding in the parking lane of a residential street. These minor losses only result in a public nuisance, but not economic losses or public safety hazards.

#### 3.3.2.2 Project Efficiency

There are often opportunities to reduce costs or increase project efficiency by implementing multiple projects at once. For example, a storm drain replacement or extension project can be scheduled to coincide with other right of way improvements performed by the transportation department, such as an asphalt overlay, or construction of other utilities, such as replacement of a water main. Significant cost savings can be realized in these cases because the cost of surface removal or re-surfacing may be minimized or performed at a larger scale and provide economies of scale. Economies of scale can also be realized in reduced mobilization costs. Combining projects can minimize the loss of service, such as reducing the amount of time that traffic is disrupted or that a road is out of service. In some instances, lower risk projects were scheduled to occur earlier in time in order to take advantage of opportunities to gain efficiencies from combining projects.

#### 3.3.2.3 Funding Potential

Project funding opportunities also play a role in project prioritization. Projects with likely cost sharing or grant opportunities were assigned a higher priority. For example, grant funding is regularly available for water quality improvement projects and some flood improvement projects have potential cost sharing with Thurston County.

#### 3.3.2.4 Public Sentiment

Public sentiment and political will are often difficult to quantify, but can play an important role in prioritizing one project over another. For example, the visibility of a flooding problem to the general public and perceived impact on commerce could affect the priority level.

#### 3.3.2.5 Data Quality

The quality of data used to assess the above factors, especially problem risk, is also important to consider during prioritization. For example, problem risk was evaluated primarily based on input from City staff and field observations, so problems with better data quality (e.g., more or better field observations, more complaints, video or photo documentation) were identified as higher priority. The quality of the proposed solution was also considered. Projects with a higher level of design definition were identified as higher priority because the cost estimates are more accurate and there is more certainty in the size and scope of these solutions. For example, a project with an engineering pre-design report was identified as a higher priority than a project with only a basic conceptual design.

#### 3.3.2.6 Prioritization Process Summary

Table 3-2 presents a qualitative assessment of the factors listed above. These factors were considered during a workshop held on April 24, 2012, with staff from Water Resources, Public Works, and Public Works Operations. The overall priority of each project was assigned during this workshop based on consideration of all the factors in Table 3-2. Risk was considered the primary factor during this evaluation, and other factors were considered secondary in importance.

### 3.3.3 CIP Project Implementation Schedule

The CIP project implementation schedule shown in Table 3-4 was generated based upon the overall priority shown in the right hand column of Table 3-3. In general, high priority projects are scheduled to occur sooner than low priority projects; however, an effort was also made to maintain linear annual CIP expenses in order to minimize stormwater rate fluctuation or bonding, and in some cases projects were scheduled to occur earlier or later to coincide with projects being planned by other utilities (see project efficiency in Section 3.3.2).

### 3.3.4 Non-CIP Projects

In addition to the CIP projects discussed in sections 3.3.1 through 3.3.3, eleven non-CIP projects were identified (Table 3-5). The non-CIP project list includes eleven projects that rehabilitate existing stormwater facilities and that would be performed in-house. Six specific stormwater pond rehabilitation projects and five non-specific annual rehabilitation projects are included in the eleven non-CIP project list.

The non-CIP project implementation plan is provided in Table 3-6.

**Table 3-2. Site-specific Problems, CIP Solutions, and Relevant Policies.**

| Proj. No. | Project Name | Problem Description | Proposed Solution | Relevant Policies [a] |
|---|---|---|---|---|
| 1 | Vactor Decant Facility Project | A portion of the site is being used as a vactor decant station. This project will enhance the function of current operations by improving pollutant and debris removal. | Constructions of a sloped concrete pad with roof structure, drainage system, storage tanks and piping. The concrete pad will serve as a surface for wet debris collected by Vactor trucks during maintenance of the municipal storm drainage system. Decant water will drain to the storage tanks for settling and discharge to an on-site sanitary sewer. | WQ2, WQ4 |
| 2 | Ulery Drainage System Improvements | Lack of drainage infrastructure in this area is causing nuisance flooding of the roadway and shoulder. Stormwater sheet flows north on Ulery Street SE and ponds at the intersection with 7th Avenue SE. There is also nuisance flooding of driveways due to sheet flow along the north edge of 7th Avenue SE. | Install new catch basins at the intersection of Ulery Street SE and 7th Avenue SE. Connect to existing storm drain system. | FC2, FC4 |
| 3 | Lacey Boulevard Pipe Replacement | An existing storm drain pipe is crushed and causes frequent flooding of a major roadway. | Replace the crushed pipe in Lacey Boulevard. | FC2, FC4 |
| 4 | Brentwood Stormwater Installation | Lack of drainage infrastructure in this area is causing nuisance flooding. All stormwater runoff flows overland towards Ruddell Road SE causing chronic flooding on residential streets and in some driveways. Flooding is most significant at the downstream end of the neighborhood. Drainage infrastructure is needed in this neighborhood. | Install storm drain along Brentwood Drive SE to convey stormwater to Ruddell Road Stormwater Treatment Facility. | FC2, FC4 |
| 5 | Chambers Lake Stormwater Facility Project | Chambers Lake has been classified as eutrophic and this is the largest untreated stormwater outfall to Chambers Lake. The City proposes constructing a stormwater treatment wetland to improve stormwater quality entering Chambers Lake and create habitat and recreational amenity. | Treatment wetland integrated into the Chambers Lake Natural Area. The wetland will remove up to 61% of total suspended solids and 92% of total phosphorus from the stormwater outfall and may be conducted in coordination with a future road project and a future sewer upgrade. | WQ2, WQ4 |
| 6 | 22nd Avenue SE System Rehabilitation | Three existing drywells are no longer functioning and causing flooding on several properties. Ponded water extends up to the front steps of residences. However, residents don't want to sacrifice parking for open conveyance or bioretention facilities | Manage stormwater onsite using permeable pavers for 360 LF on the east side of 22nd Ave SE between Golf Club Road SE and College Street SE. Install pavers between existing asphalt road edge and sidewalk. This solution manages stormwater while preserving current parking uses. Also install pipe on the northeast end of 22nd Avenue SE to connect existing drainage pathway to the existing catch basin in College Street SE. | FC2, FC3, FC4 |
| 7 | Diamond Stormwater Alternative | Stormwater at this location is pumped away during extreme storm events (i.e., every couple years). An alternative solution is needed that would manage stormwater without pumping it away. | Install backflow preventers on two existing storm drain outfalls to pond. Install a new storm pump station adjacent to the sanitary sewer pump station on Diamond Loop SE, a force main to convey flow to the stormwater outfalls, and a filtration system at the pump station inlet to provide water quality treatment. | WQ3, FC2, FC3, FC4 |
| 8 | 25th Loop Storm Improvements | Drainage from neighborhood to the north overflows to 25th Loop SE and the outlet of this basin has been partially blocked by a private driveway. A stormwater pump station has been installed but requires frequent maintenance so a better long term solution is needed. | Convert 500 linear feet of existing grassy swale to bioretention facilities. Install new storm drain from the existing pump station location southward, across private property, to an existing depression. | FC2, FC4 |
| 9 | Clearbrook Drainage System Improvements | The aging storm drain in this area has limited slope and there is no fall between the storm drain outlets and Clearbrook Pond. The system frequently gets backwatered, causes street flooding, and threatens to flood one house during any significant rain event. | Lower invert of pond outlet and increase pipe size (larger pipe at reduced slope). Excavate a linear swale around the perimeter to provide adequate fall for the pipes and install two pedestrian bridges. Add an upstream infiltration facility in 19th Court NE with stormwater treatment. | WQ3, WQ4, FC2, FC4 |
| 10 | Homann Area System Rehabilitation | Drywells and infiltration trenches in this area are no longer functioning and causing localized nuisance flooding. | Install 10 new bioretention facilities in the right of way to enhance local infiltration and take advantage of high infiltrating soils in the area. | WQ3, FC2, FC3 |
| 11 | 1010 Midway Storm Improvements | A clogged storm drain pipe and blind connection into the County storm drain is causing flooding. | Replace a portion of the existing storm drain pipe and install new catch basins at both ends. | FC2, FC4 |
| 12 | Belair / Impala Stormwater Installation | Lack of drainage infrastructure in this area is causing nuisance flooding. All stormwater runoff flows overland towards Wonderwood Park causing chronic flooding on residential streets and in some driveways. Flooding is most significant at the downstream end of the neighborhood. Drainage infrastructure is needed in this neighborhood. | Install storm drain along Impala Drive SE and 32nd Avenue SE to convey stormwater to Ruddell Road Stormwater Treatment Facility. | FC2, FC4 |

| Table 3-2 (continued). Site-specific Problems, CIP Solutions, and Relevant Policies. | | | | |
|---|---|---|---|---|
| **Proj. No.** | **Project Name** | **Problem Description** | **Proposed Solution** | **Relevant Policies [a]** |
| 13 | College Regional Stormwater Facility Expansion / Modification | Under a 2008 agreement between the City and St. Martin's Abbey/University, the City is required to modify the facility to accommodate additional flow from the University resulting from campus growth and improvements. The facility outfall may require improvements to accommodate additional flow. | Construct a new storm drain from College Regional Stormwater Facility to Woodland Creek. Option A would reroute the flow path to the eastward down an alignment that slopes correctly, but does not currently connect. Option B would route flow under Martin Way and northward. | FC1, FC3, FC4 |
| 14 | Alder and Gemini Drainage System Improvements | Lack of drainage infrastructure along Alder Street and Gemini Street causing frequent nuisance flooding. | Rehab existing drywells, install new storm drain to convey stormwater to new infiltration galleries in community open space, and an overflow from the infiltration facility to the storm drain in Lacey Boulevard. | WQ3, FC2, FC4 |
| 15 | White Fir Stormwater Installation | Lack of drainage infrastructure in this area is causing nuisance flooding. | Install new permeable gravel shoulder with underdrain pipe on north and south shoulders of White Fir Drive NE. Connect underdrain to existing storm drain system. Existing system discharges to infiltration area that is functioning well. | WQ3, FC2, FC4 |
| 16 | 5th Ct SE and 5th Way Easement Storm Improvements | Pipes/ structures in backyard area creating a maintenance problem because access is limited. | Construct channelized inverts in the bottom of existing CBs to enable jetting of pipes as needed for maintenance. Will also require increased maintenance of upstream and downstream structures. | G11 |
| 17 | Shady Lane Treatment Facility Improvements | A large amount of sediment has accumulated in the wet pond and needs to be removed. High water levels have resulted in backwatering but no flooding. The outfall to the lake has become partially obstructed with sediment and needs to be dredged out and modified to make it easy to maintain. | Remove sediment and vegetation. Replant in accordance with the Lacey Stormwater Design Manual. Install maintenance access, install structure at inlet to reduce sediment buildup, install low-maintenance outlet structure. | G11 |
| 18 | Code Revisions for LID | The City is required to review, revise, and make effective local development-related codes, rules, standards, and other enforceable documents to incorporate and require LID principles and LID BMPs by December 31, 2016, per Section S5.C.4.f of the 2013-2018 NPDES Phase II permit. | The City has conducted a preliminary evaluation of barriers to LID; however, this effort will be more extensive and will involve reviewing additional codes, rules, standards, and enforceable documents, and revising them as needed to remove barriers to LID implementation. | G1 |
| 19 | Stormwater Design Manual Update | The 2013- 2018 NPDES Phase II Permit requires the City to implement a stormwater manual that is technically equivalent to Ecology's 2012 Stormwater Management Manual for Western Washington (SWMMWW) by December 31, 2016. | The 2010 Stormwater Design Manual will need to be updated to meet this requirement. | G1 |
| 20 | Stormwater Comprehensive Plan Update | The growth management act requires Cities to periodically update their comprehensive plan, of which the Stormwater Comprehensive Plan (SCP) is a part. Ecology plans to update the 2013-2018 Phase II Permit for the next permit cycle (2018-2023). | The City will need to update the SCP to reflect the 2018 updates to the Phase II Permit. The SCP will build on the City's existing stormwater management program and known stormwater problems to ensure that the stormwater infrastructure, policies, and funding mechanisms will meet the City's stormwater management needs for the 2018-2023 permit cycle. | G1, G12 |
| 21 | Hicks Lake to Pattison Lake Conveyance Replacement | Existing 400' long culvert is collapsing. The condition of the pipe may make repair impossible / uneconomical and conditions of the hydraulic project approval may require the solution to meet WDFW water crossing design guidelines. The culvert has the potential to flood homes within city limits if it collapses. | Work with Thurston County to construct a new fish passable channel and culvert on new alignment to the north, extend existing stream channel to meet new pipe channel, and fill existing pipe with CDF. | G1, G13 |

Notes.

[a] Refer to Section 1.2 for more information on policies.

**Table 3-3. Qualitative CIP Project Prioritization.**

| Proj. No. [a] | Project Name | Design Year | Const. Year | Const. Dur. (yrs) | Tier | Problem Type | Project Classification | | Risk | | Project Efficiency | | Funding Potential | | Public Sentiment | | Data Quality | | Overall Priority | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Class | Reason for Class | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Priority | Reason for Priority |
| 1 | Vactor Decant Facility Project | 2013 | 2014 | 1 | 1 | Drainage | Expansion | Replace concrete pad, settling tanks, drainage system, and roof. | High | Current vactor decant facility is not able to meet the current demands because the sediment holding area is too small, the dewatering design is inadequate, and single set of settling tanks makes maintenance inefficient. | Moderate | A portion of the site is already used for this purpose. No concurrent projects planned. | High | Project has received grant funding and is scheduled for design in 2013 and construction in 2014. | Low | Residents are unaware of the problem. | High | Obsevations made by City staff. | High | Will enhance the efficiency of decant operations, improve the process of debris and pollutant-removal, improve efficiency of system maintenance, and enable the faciltiy to handle a higher rate disposal resulting from increased catch basin cleaning required by the NPDES permit. |
| 2 | Ulery Drainage System Improvements | 2013 | 2013 | 1 | 1 | Drainage | Upgrade | New CB's and pipe. | Low | Minor nuisance flooding of street but some flooding of private property. High frequency, low traffic. | High | Coordinate with overlay in 2013. | Low | Conveyance only. | Moderate | Resident calls to complain. | Moderate | Field observations made by City staff. | High | Well documented frequent nuisance flooding with opportunity to couple with transportation project in 2013. |
| 3 | Lacey Boulevard Pipe Replacement | 2014 | 2015 | 1 | 1 | Drainage | Replacement | Replace crushed pipe. | High | Causes flooding in intersection with Lacey Boulevard and Alder. Likelihood of future sink holes due to observed sediment. | Low | No concurrent projects planned. | Low | Conveyance only. | Low | No complaints. | High | Field observations made by City staff. | High | Well documented high risk problem. |
| 4 | Brentwood Stormwater Installation | 2014 | 2015 | 1 | 1 | Drainage | Upgrade | Pipes are an improvement from existing drywells and gutters. | High | Significant nuisance flooding. Affects large geographic area and at least one private property. Affects Ruddell Road. High frequency. | Moderate | Potential water line and overlay in entire neighborhood in the near future. | Low | Conveyance only. | Moderate | Residents complain. | High | Field observations made by City staff. | High/ Moderate | Significant nuisance flooding of street and private property impacts. |
| 5 | Chambers Lake Stormwater Facility Project | 2016 | 2017 | 2 | 2 | Water Quality | Expansion | Provides new stormwater treatment. | Moderate | Lost opportunity to treat stormwater from 187 acres of currently untreated property (largest untreated basin in Chambers Lake watershed). Lost opportunity to remove 78% of TSS and 49% of Phosphorus from stormwater at this outfall. | Moderate | On City owned property. Potential to combine with sanitary sewer upsize or transportation project. | High | Strong contender for water quality grant funding. | Moderate | Neighbors already use facility for walking corridor and have expressed interest in future improvements. | High | Pre-design report prepared for the project in 1995. | High/ Moderate | Provides treatment for a significant water quality problem. Solution is well defined. |

**Table 3-3 (continued). Qualitative CIP Project Prioritization.**

| Proj. No. [a] | Project Name | Design Year | Const. Year | Const. Dur. (yrs) | Tier | Problem Type | Project Classification | | Risk | | Project Efficiency | | Funding Potential | | Public Sentiment | | Data Quality | | Overall Priority | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Class | Reason for Class | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Priority | Reason for Priority |
| 6 | 22nd Avenue SE System Rehabilitation | 2014 | 2015 | 1 | 1 | Drainage | Upgrade | Infiltration system is an improvement upon existing drywells. | Moderate | Surface ponding has flooded several structures (garages). Flooding along roadway shoulders. | High | Construct with College and 22nd Ave round-about in 2013. | Low | Limited water quality improvements. | Low | Public calls annually to complain. | High | Field observations made by City staff and complaints received. | Moderate | Moderate risk, but scheduled to coincide with College and 22nd Avenue round-about construction. |
| 7 | Diamond Stormwater Alternative | 2016 | 2017 | 1 | 1 | Drainage | Replacement | Replaces existing pump station. | Moderate | Roadway and sidewalks flood severely. Potential to affect private properties. Low frequency - couple times per year on wet years. | Low | No concurrent projects planned. | Low | Conveyance only. | High | Major complaints during wet years. | Moderate | Field observations made by City staff. Solution needs more detailed evaluation. | Moderate | Moderate risk. Project definition needs refinement. |
| 8 | 25th Loop Storm Improvements | 2017 | 2018 | 1 | 1 | Drainage | Upgrade | Replaces high maintenance pump station. | Moderate | Ongoing maintenance costs are high. Pump has failed on multiple occasions in the last 2 years. Electrical panel is substandard. | Low | No concurrent projects planned. | Low | Conveyance only. | Moderate | Input from City. | Moderate | Field observations made by City staff. Project definition needs refinement. | Moderate | Significant maintenance burden. Project definition needs refinement. |
| 9 | Clearbrook Drainage System Improvements | 2018 | 2019 | 1 | 2 | Drainage | Upgrade | City would assume responsibility for private system. | Moderate | Surface ponding threatens to flood one home. Flooding in multiple streets. | Low | No concurrent projects planned. | Moderate | Potential cost share with Parks Department. | Low | Field observations made by City staff. | Moderate | Field observations made by City staff. Project definition needs refinement based on infiltration data. | Moderate | Risk is significant, but facility is currently privately owned. |
| 10 | Homann Area System Rehabilitation | 2018 | 2019 | 1 | 1 | Drainage | Upgrade | Pipes and bioretention are an improvement from existing gutters and infiltration galleries. | Moderate | Minor nuisance flooding of roadway. Has affected private property regularly in the past (but not currently). High frequency. | Moderate | Coordinate with future sewer expansion project and project 9. | Moderate | Contender for water quality grant funding. | Moderate | Affects large area. | Moderate | Field observations made by City staff. | Moderate | Frequent nuisance flooding that affects a large geographic area. Scheduled to occur with project 9. |
| 11 | 1010 Midway Storm Improvements | 2018 | 2019 | 1 | 2 | Water Quality | Replacement | Replace structure to increase ease of maintenance. | High | Affects multifamily residential. Historically flooded multiple apartments. | Moderate | Perform as add on to future sewer expansion project (could be many years off). | Low | Potential cost share with Thurston County. | Moderate | Affects multifamily residential. | Moderate | Field observations made by City staff. | Moderate | Affects multifamily residential property. |
| 12 | Belair / Impala Stormwater Installation | 2019 | 2020 | 1 | 1 | Drainage | Upgrade | Pipes are an improvement from existing drywells and gutters. | Moderate | Significant nuisance flooding. Affects large geographic area. High frequency. | Low | Recent overlay on 32nd Avenue SE. No other projects currently planned. | Low | Conveyance only. | Moderate | Residents complain. | High | Field observations made by City staff. | Moderate | Significant nuisance flooding of street and private property impacts. |

**Table 3-3 (continued). Qualitative CIP Project Prioritization.**

| Proj. No. [a] | Project Name | Design Year | Const. Year | Const. Dur. (yrs) | Tier | Problem Type | Project Classification | | Risk | | Project Efficiency | | Funding Potential | | Public Sentiment | | Data Quality | | Overall Priority | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Class | Reason for Class | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Rating | Reason for Rating | Priority | Reason for Priority |
| 13 | College Regional Stormwater Facility Expansion / Modification | 2020 | 2021 | 2 | 1 | Drainage | Upgrade | Replaces undersized pipe. | Low | City is legally obligated to upgrade the facility, but significant development on the College campus is still required before the project is triggered. Modeling indicates potential future flooding on Martin Way. | High | Include as a component of the I-5 / Exit 109 overcrossing project. Construction year uncertain. | Moderate | Potential cost share with transportation department or outside agency. | Low | Low visibility site. | Moderate | City is legally obligated to take action. More detailed analysis of existing flow and solution for this high cost project. | Moderate | Legally obligated to perform project, but limited technical/empirical justification for project. Schedule segment along cloverleaf to coincide with I-5 construction. |
| 14 | Alder and Gemini Drainage System Improvements | 2022 | 2023 | 1 | 2 | Drainage | Upgrade | Pipes are an improvement from existing drywells, gutters, and ditches. | Low | Minor nuisance flooding. | Moderate | Coordinate with 12" waterline on Gemini (not funded yet). | Low | Conveyance only. | Moderate | Some complaints received from neighbors. | Moderate | Field observations made by City staff. | Low | Minor nuisance flooding. |
| 15 | White Fir Stormwater Installation | 2023 | 2023 | 1 | 1 | Drainage | Upgrade | Pipes are an improvement from existing drywells and gutters. | Moderate | Minor nuisance flooding. High frequency. | Moderate | Coordinate with future sewer expansion project. | Low | Conveyance only. | Low | Resident calls to complain infrequently. | Moderate | Drainage complaints. Field observations made by City staff. | Low | Frequent nuisance flooding. Project can be coupled with sewer expansion. |
| 16 | 5th Court SE and 5th Way Easement Storm Improvements | 2023 | 2023 | 1 | 1 | Drainage | Upgrade | Modify structures to increase ease of maintenance. | Low | Potential minor downstream impacts if structures are not maintained. No problems yet. | Low | No concurrent projects planned. | Low | Conveyance only. | Low | Low visibility site. | Moderate | Field observations made by City staff. | Low | Low risk problem. |
| 17 | Shady Lane Treatment Facility Improvements | 2016 | 2016 | 1 | 1 | Water Quality, Drainage | Maintenance | Regular system maintenance. | Moderate | Current condition reduces water quality benefit of facility. | Low | No concurrent projects planned. | Moderate | Contender for water quality grant funding. | Low | Low visibility site. | High | Field observations made by City staff. | Moderate | Well documented problem with moderate risk. 1 pond maintenance project scheduled per year. |
| 21 | Hicks Lake to Pattison Lake Conveyance Replacement | 2014 | 2015 | 1 | 1 | Drainage | Replacement | Replaces existing culvert. | High | High demand for maintenance staff time. Flooding at Hicks Lake could affect multiple homes. Collapse of existing pipe could affect private property. Emergency solution would have major impact on operations and higher cost. | Low | No concurrent projects planned. In Thurston County | Moderate | Potential cost share with Thurston County. | High | High water levels in Hicks Lake affect multiple homes. Residents call every time the lake water level gets high. | High | Weekly monitoring of water levels at culvert inlet. Video inspection of existing culvert condition. | High | Well documented high risk problem. Potential cost share with Thurston County. |

Notes.

[a] Projects 18, 19, and 20 are not included in this prioritization. They are programmatic projects and are necessary to remain in compliance with the Phase II Permit.

**Table 3-4. CIP Project Implementation Schedule with Inflation.**

| Proj. No. | Project Name | Priority | Tier | Total Cost (2013 Dollars) | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Ulery Drainage System Improvements | High | 1 | $58,000 | $58,000 | | | | | | | | | | |
| 1 | Vactor Decant Facility Project [a] | High | 1 | $456,000 | $46,000 | $426,400 | | | | | | | | | |
| 5 | Chambers Lake Stormwater Facility Project [a] | High/ Moderate | 2 | $2,414,000 | $169,000 | $2,109,120 | $234,707 | | | | | | | | |
| 21 | Hicks Lake to Pattison Lake Conveyance Replacement [b] | High | 1 | $630,000 | $0 | $117,000 | $559,728 | | | | | | | | |
| 4 | Brentwood Stormwater Installation | High/ Moderate | 1 | $446,000 | | $94,640 | $383,968 | | | | | | | | |
| 19 | Stormwater Design Manual Update | Mandatory | 1 | $200,000 | | $41,600 | $86,528 | $89,989 | | | | | | | |
| 18 | Code Revisions for LID | Mandatory | 1 | $90,000 | | | $43,264 | $56,243 | | | | | | | |
| 17 | Shady Lane Treatment Facility Improvements | Moderate | 1 | $134,000 | | | | 150,732 | | | | | | | |
| 3 | Lacey Boulevard Pipe Replacement | High | 1 | $53,000 | | | | | $26,907 | $36,500 | | | | | |
| 6 | 22nd Avenue SE System Rehabilitation | Moderate | 1 | $133,000 | | | | | $39,775 | $120,449 | | | | | |
| 7 | Diamond Stormwater Alternative | Moderate | 1 | $306,000 | | | | | $115,816 | $251,847 | | | | | |
| 20 | Stormwater Comprehensive Plan Update | Routine | 1 | $150,000 | | | | | $11,699 | $85,166 | $88,572 | | | | |
| 8 | 25th Loop Storm Improvements | Moderate | 1 | $324,000 | | | | | | $103,415 | $302,411 | | | | |
| 9 | Clearbrook Drainage System Improvements | Moderate | 2 | $378,000 | | | | | | $88,816 | $385,922 | | | | |
| 10 | Homann Area System Rehabilitation | Moderate | 1 | $406,000 | | | | | | $189,798 | $316,330 | | | | |
| 11 | 1010 Midway Storm Improvements | Moderate | 2 | $38,000 | | | | | | $17,033 | $30,368 | | | | |
| 12 | Belair / Impala Stormwater Installation | Moderate | 1 | $489,000 | | | | | | | $124,001 | $514,529 | | | |
| 13 | College Regional Stormwater Facility Expansion / Modification | Moderate | 1 | $4,131,000 | | | | | | | | $744,817 | $2,439,474 | $2,537,053 | |
| 14 | Alder and Gemini Drainage System Improvements | Low | 2 | $430,000 | | | | | | | | | | $123,828 | $507,724 |
| 15 | White Fir Stormwater Installation | Low | 1 | $151,000 | | | | | | | | | | | $223,517 |
| 16 | 5th Court SE and 5th Way Easement Storm Improvements | Low | 1 | $24,000 | | | | | | | | | | | $35,526 |
| **Total Annual Expenditures (Inflation 4% /Year)** | | | | **$11,441,000** | **$273,000** | **$2,788,760** | **$1,308,195** | **$296,964** | **$194,197** | **$893,023** | **$1,247,605** | **$1,259,347** | **$2,439,474** | **$2,660,881** | **$766,767** |

Notes.

[a] Project is partially funded by a grant from the Department of Ecology. This table presents total costs.

[b] Hicks Lake to Pattison Lake Conveyance Replacement Project would be funded at the 50 percent level with the other 50 percent coming from Thurston County. Reaching an agreement with Thurston County for 50 percent participation is a condition for beginning design on the project. This table presents cost to the City of Lacey only.

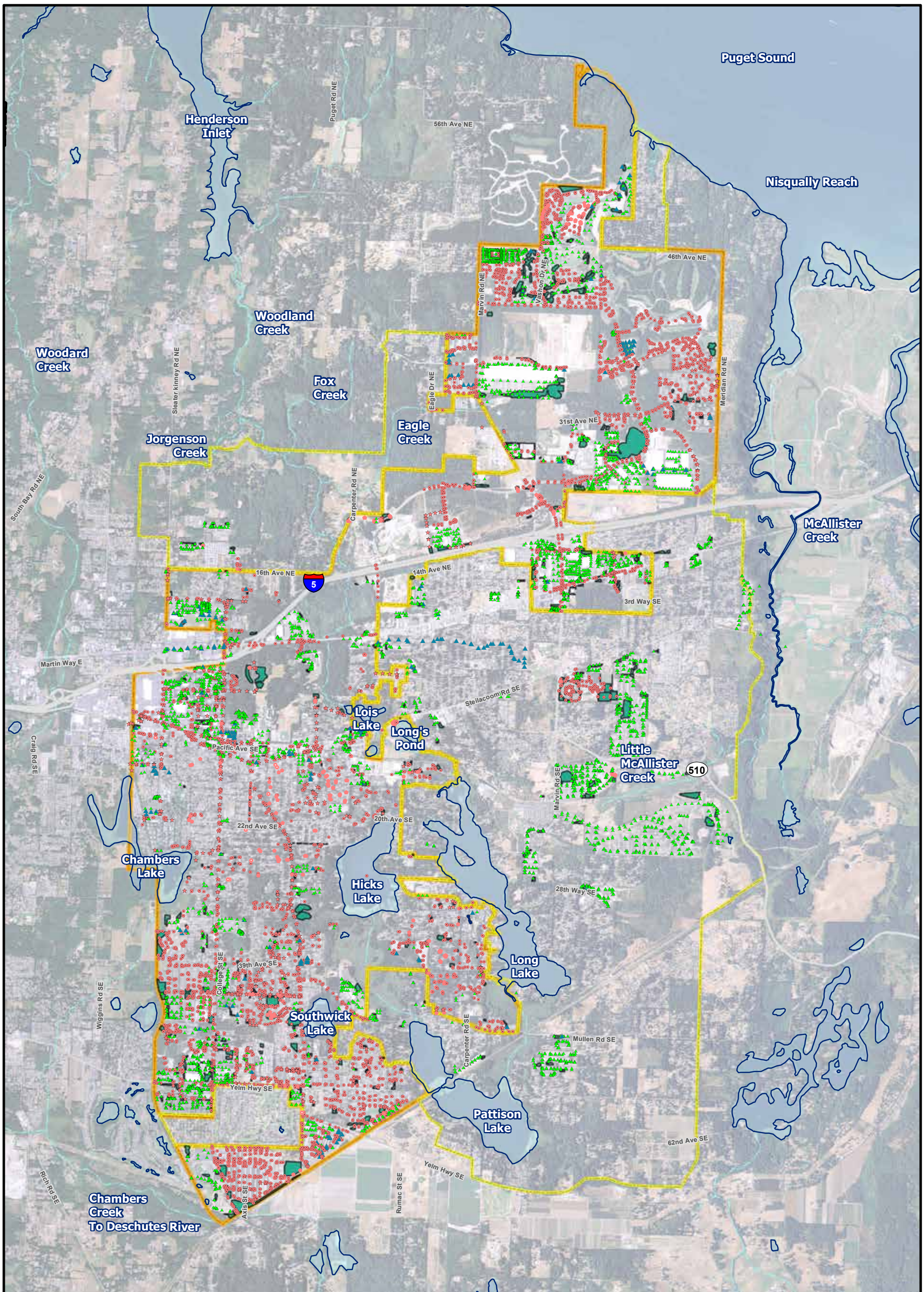
**Table 3-5. Non-CIP Project Problems, Solutions, and Relevant Policies.**

| Proj. No. | Project Name | Problem Description | Proposed Solution | Relevant Policies [a] |
|---|---|---|---|---|
| OM1 | Rehabilitation of Existing Ruddell Road SE Stormwater Facility | A large amount of sediment has accumulated in the wet pond and needs to be removed. The outlet is prone to clogging and needs to be replaced or modified. | Remove sediment and vegetation and replant in accordance with the Lacey Stormwater Design Manual. Modify or replace outlet to prevent clogging. | FC2, FC4, G11 |
| OM2 | Rehabilitation of Existing College Street SE at 53rd Avenue SE Ponds | A large amount of sediment has accumulated in the wet pond and needs to be removed. | Remove sediment and replant in accordance with the Lacey Stormwater Design Manual. | G11 |
| OM3 | Rehabilitation of Existing Lakepointe Park Ponds - Compton Pond and Stockton Pond | A large amount of sediment has accumulated in the wet ponds and needs to be removed. Water levels in the ponds are too high and cause backwater and occasional flooding in the upstream pipe network. | Remove sediment and replant in accordance with the Lacey Stormwater Design Manual. | G11 |
| OM4 | Rehabilitation of Existing Fones Road Stormwater Facility | Remove sediment & vegetation from wet ponds. Do in-house for under $50,000 | Remove sediment and replant in accordance with the Lacey Stormwater Design Manual. | G11 |
| OM5 | Rehabilitation of Existing College Regional Stormwater Facility | Remove sediment & vegetation from wet pond. Do in-house for under $50,000 | Remove sediment and replant in accordance with the Lacey Stormwater Design Manual. | G11 |
| OM6 | Rehabilitation of Existing Woodland Creek/7th Avenue SE Stormwater Facility | Remove sediment & vegetation from wet pond. Do in-house for under $50,000 | Remove sediment and replant in accordance with the Lacey Stormwater Design Manual. | G11 |
| OM7-OM11 | Annual Stormwater Pond Rehabilitation | Stormwater ponds throughout the City collect sediment and other debris over time reducing their water quality treatment effectiveness, contributing to water quality degradation and clogging of downstream systems, and leading to flooding problems. | Annually rehabilitate one or more stormwater ponds. | G11 |

Notes.
[a] Refer to Section 1.2 for more information on policies.
OM = Operation and maintenance project

**Table 3-6. Non-CIP Project Implementation Schedule with Inflation.**

| Project. No. | Project Name | Total Cost (2013 Dollars) | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OM1 | Rehabilitation of Existing Ruddell Road SE Stormwater Facility | $50,000 | $50,000 | 0 | | | | | | | | | |
| OM2 | Rehabilitation of Existing College Street SE at 53rd Avenue SE Ponds | $50,000 | | $52,000 | | | | | | | | | |
| OM3 | Rehabilitation of Existing Lakepointe Park Ponds - Compton Pond and Stockton Pond | $50,000 | | | $54,080 | | | | | | | | |
| OM4 | Rehabilitation of Existing Fones Road Stormwater Facility | $50,000 | | | | $56,243 | | | | | | | |
| OM5 | Rehabilitation of Existing College Regional Stormwater Facility | $50,000 | | | | | $58,493 | | | | | | |
| OM6 | Rehabilitation of Existing Woodland Creek/7th Avenue SE Stormwater Facility | $50,000 | | | | | | $60,833 | | | | | |
| OM7 | Annual Stormwater Pond Rehabilitation -No. 1 | $50,000 | | | | | | | $63,266 | | | | |
| OM8 | Annual Stormwater Pond Rehabilitation -No. 2 | $50,000 | | | | | | | | $65,797 | | | |
| OM9 | Annual Stormwater Pond Rehabilitation -No. 3 | $50,000 | | | | | | | | | $68,428 | | |
| OM10 | Annual Stormwater Pond Rehabilitation -No. 4 | $50,000 | | | | | | | | | | $71,166 | |
| OM11 | Annual Stormwater Pond Rehabilitation -No. 5 | $50,000 | | | | | | | | | | | $74,012 |
| **Total Annual Expenditures (Inflation 4% / Year)** | | $550,000 | **$50,000** | **$52,000** | **$54,080** | **$56,243** | **$58,493** | **$60,833** | **$63,266** | **$65,797** | **$68,428** | **$71,166** | **$74,012** |




Legend

Storm structure type
- Public catch basin
- Public dry well
- Public junction box
- Public manhole
- Public miscellaneous
- Private
- Thurston County

Storm line ownership
- Public
- Private
- Unknown
- Waterbody
- Storm ponds

- Urban growth boundary
- City of Lacey (COL)
- Stream

**Figure 3-1.**
**City of Lacey stormwater system map.**

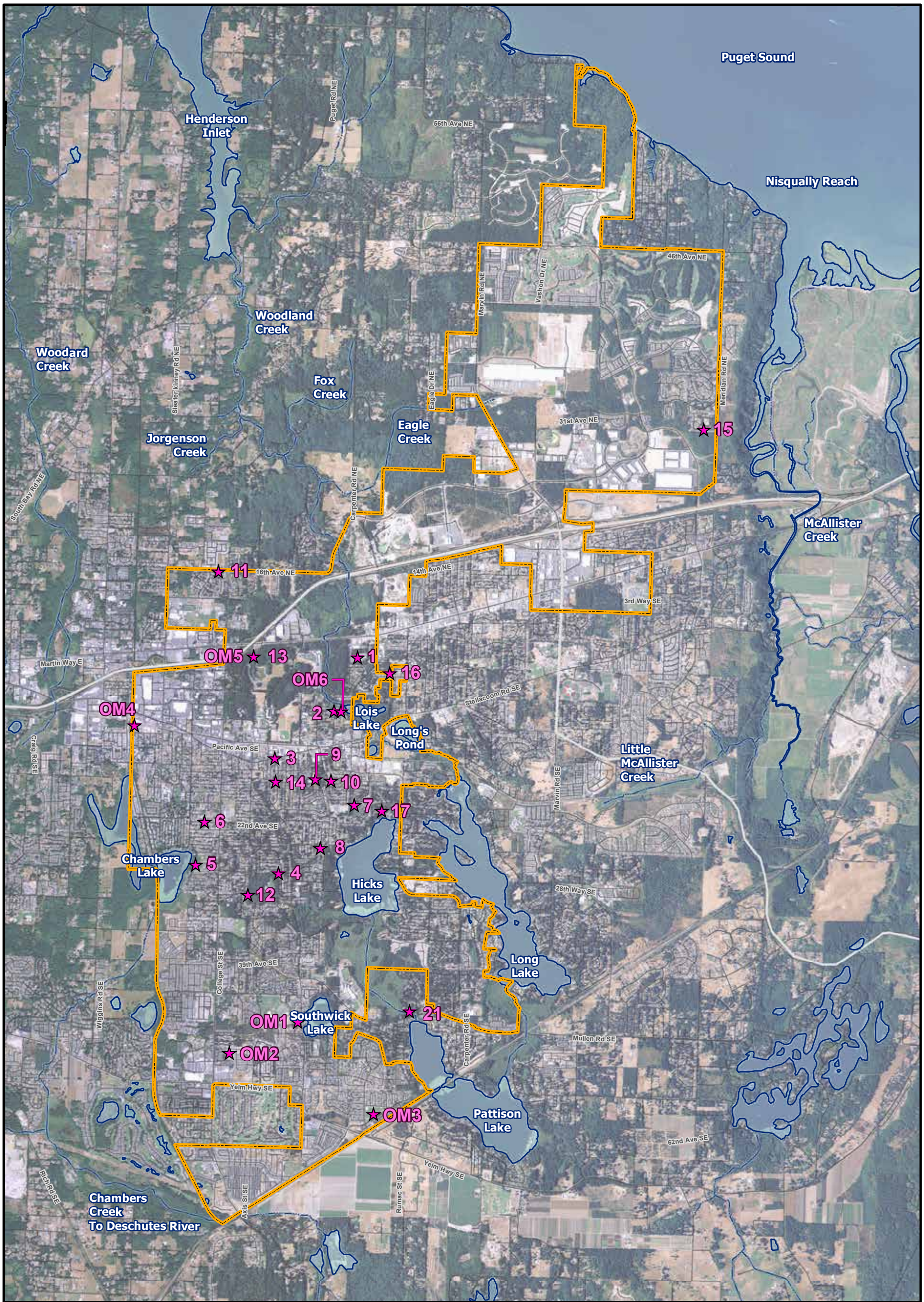
N

0 2,000 4,000 8,000 Feet

HERRERA

Aerial: USDA (2009)
City of Lacey, Waterbody, Stream (City of Lacey)

K:\Projects\Y2010\10-04793-000\Project\Stormwater_system_map.mxd (11/26/2013)




## Legend

- ★ CIP project location
- City of Lacey
- Waterbody
- Stream

Note: CIP projects 18, 19, and 20 are programmatic and are therefore not included in this figure.

**Figure 3-2. Capital improvement program project locations.**

N

0 2,000 4,000 8,000 Feet

HERRERA

Aerial: USDA (2009)
City of Lacey, Waterbody, Stream (City of Lacey)

K:\Projects\Y2010\10-04793-000\Project\CapitalImprovementProgram_11x17.mxd (11/18/2013)

# 4.0 Stormwater Management Program Evaluation and Recommendations

The City has achieved compliance with the Phase II Permit through implementation of the Stormwater Management Program (SWMP) by a well-informed staff. However, there is still significant room for improvement of the SWMP. Key stormwater program accomplishments and recommendations are summarized below for the 2007-2013 Phase II Permit requirements and the 2013-2018 Phase II Permit requirements. The recommendations were developed based on a gap analysis and needs assessment conducted in 2011 and 2012 to evaluate specific components of the City's SWMP with respect to Phase II Permit requirements (Lacey 2012b).

The section is organized by the five major SWMP components:

- Public education and outreach
- Public involvement and participation
- Illicit Discharge Detection and Elimination (IDDE)
- Controlling runoff from new development, redevelopment, and construction sites
- Municipal operations and maintenance

In addition to the five SWMP components, this section also includes a summary of the accomplishments and recommendations for the following Phase II Permit requirements:

- Compliance with TMDLs
- Monitoring
- Reporting

Underground injection control (UIC) is also discussed in this section. Although it is not a Phase II Permit requirement, UICs are generally considered to be part of the storm drainage system in the City, so they were included in the gap analysis and needs assessment evaluation of the City's SWMP.

## 4.1 Public Education and Outreach

The City has a well-developed public education and outreach program that has and will continue to meet the Phase II Permit requirements. The City currently provides the following educational materials and public outreach materials and activities:

- **Printed materials:** News releases, newspaper/newsletter articles, *The Wet Street Journal*, brochures, and posters
- **Media:** Radio and television ads, City website
- **School program support:** Project Global Rivers Environmental Education Network (GREEN), "Lost and Puget Sound" middle school program
- **Workshops:** Naturescaping, rain garden, shoreline protection, and Storm Pond Maintenance for HOAs
- **Educational tours:** Henderson and Nisqually watersheds
- **Programs:** Pet waste awareness program, private facility inspection program

The Wet Street Journal is published periodically and available online and at City Hall.

Public education is conducted regularly at events like the spring Fun Fair.

The City also participates in the Stormwater Outreach for Regional Municipalities (STORM) forum, which is a regional effort to raise public education and awareness about the effects of stormwater runoff on Puget Sound.

Specific permit requirements for public education and outreach are listed in Appendix B. A summary of the accomplishments and recommendations of the public education and outreach program are provided below.

### 4.1.1 Accomplishments

The City has met the following Phase II Permit requirements for public education and outreach:

- **Provide an education and outreach program**: The City has provided many opportunities to the general public, students, businesses, and property managers regarding stormwater awareness and BMP information. The public education and outreach accomplishments are summarized each year in the City's periodic report to Ecology which is posted on the City website: www.ci.lacey.wa.us/city-government/city-departments/public-works/water-resources/storm-and-surface-water-programs/storm-and-surface-water-policies-and-regulations.

- **Measure the understanding and adoption of target behaviors**: The City worked with a consultant to perform a telephone survey (in early 2011) to evaluate the baseline level of understanding of the public's stormwater awareness, behaviors, and attitudes. This survey covered understanding of issues related to vehicle maintenance, yard care, and pet waste management, general water quality issue awareness, and awareness of educational issues.

- **Track and maintain records**: The City maintains detailed records of all public education and outreach activities and summarizes them in the SWMP on an annual basis.

The City sponsors the Stream Team.

## 4.1.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for public education and outreach are summarized below.

### 4.1.2.1 2007-2013 Phase II Permit

The City plans on continuing all of the public education and outreach activities described in the 2011 annual report (Lacey 2012f) and developing new educational materials to reach new target audiences and subject areas. The planned activities are summarized in the 2011 annual report (Lacey 2012f):

- **Provide an education and outreach program**: It is recommended that the City develop new educational materials or workshops and/or promote educational materials or workshops developed by other jurisdictions to benefit the following target audiences:
    - Home-based and mobile businesses:
        1. BMPs for use and storage of automotive chemicals, hazardous cleaning supplies, carwash soaps, and other hazardous materials
        2. Impacts of illicit discharges and how to report them
    - Engineers, contractors, developers, review staff, and land use planners to address the following topics:
        1. Technical standards for stormwater site and erosion control plans
        2. LID techniques, including site design, pervious paving, and retention of forests and mature trees
        3. Stormwater treatment and flow control BMPs

- Mobile businesses and specialized businesses

- **Measure the understanding and adoption of target behaviors**: The City plans to conduct a follow-up survey in 2014 to measure education program effectiveness (e.g., understanding and adoption of target behaviors).

- **Track and maintain records**: The City should continue to maintain detailed records of all public education and outreach activities and summarize them in the SWMP on an annual basis.

#### *4.1.2.2 2013-2018 Phase II Permit*

Most of the new public education and outreach requirements of the 2013-2018 Phase II Permit are already being addressed, but some new programs will need to be added or expanded to fully comply with permit requirements:

- **Provide an education and outreach program**:

  - The City will need to develop a public education program to target a new audience and subject area. This requirement can be met by the City alone or can be addressed through participation in a regional group (such as STORM) as long as the City contributes a meaningful level of effort, implements Educational approach in the City, and ensures that message is applicable to City audiences and issues.

  - The City's current public education and outreach program already includes school age children, so this new target audience is already being addressed.

  - Slight modifications will need to be made to the current public education and outreach program to address new subject areas (equipment and dumpster maintenance) that have been added to the permit.

  - The information discussed in the Storm Pond Maintenance Workshops for HOAs should be expanded to address maintenance of other stormwater facilities in addition to ponds.

- **Provide stewardship opportunities**: All of the examples of stewardship opportunities listed in the 2013-2018 Phase II Permit (stream teams, storm drain stenciling, volunteer monitoring, and riparian plantings) are also currently provided by the City, thus the City is already meeting this permit requirement.

- **Measure the understanding and adoption of target behaviors**: The City will need to measure the understanding and adoption of targeted behaviors and modify the public education program targeting a new audience and subject area based on the results.

- **Track and maintain records**: The City should continue to maintain detailed records of all public education and outreach activities and summarize them in the SWMP on an annual basis.

## 4.2 Public Involvement and Participation

Public involvement and participation is an important component of the City's SWMP. Many opportunities for the public to provide input are provided throughout the year via website postings, Council Committee meetings, Council Public Hearings, and general Council meetings.

Specific permit requirements for public involvement and participation are listed in Appendix B. A summary of the public involvement and participation accomplishments and recommendations are provided below.

### *4.2.1 Accomplishments*

The City has met the following Phase II Permit requirements for public involvement and participation:

- **Create stewardship opportunities:** The City sponsors the regional Stream Team program, including coordinating the regional quarterly Stream Team Newsletter and sponsoring volunteer work parties. The City has also organized buffer and habitat enhancement projects along Woodland Creek and Lake Lois Habitat Reserve.
- **Keep the public informed of SWMP activities:** The City published its first periodic stormwater utility newsletter (*The Wet Street Journal*) in November 2011. A total of 11,875 newsletters were mailed to utility customers, including 590 apartment dwellers in the City Limits, and more were distributed at public events and at public locations in the City. The newsletter will update the public on recent stormwater utility activities and encourage public involvement and participation, and will be published periodically.
- **Develop and implement a process for public comments:**–The public is encouraged to provide comments or questions to the City Public Works Department, Water Resources Division.
- **Make the SWMP document and annual report available to the public:** The most recent SWMP document and annual report submitted to Ecology is available on the City website: www.ci.lacey.wa.us/city-government/city-departments/public-works/water-resources/storm-and-surface-water-programs/storm-and-surface-water-policies-and-regulations.

### *4.2.2 Recommendations*

No gaps were identified for this SWMP component for the 2007-2013 or 2013-2018 permit; however, the City should continue to promote public involvement and participation through the website as well as through printed media.

## 4.3 Illicit Discharge Detection and Elimination

Detecting and eliminating illicit discharges is important, because the municipal storm drainage system in the City is connected to local lakes and streams and can adversely affect the health of these receiving waters, and Puget Sound. Specific permit requirements for IDDE

are listed in Appendix B. A summary of the accomplishments and recommendations of the IDDE program are provided below.

### 4.3.1 Accomplishments

The City has met the following Phase II Permit IDDE requirements:

- **Storm sewer map:** The City has developed an electronic stormwater infrastructure map that includes public and private facilities.
- **Illicit discharge ordinance and related codes:**
  - The City adopted an updated illicit discharge ordinance (Ordinance No. 1332, LMC Chapter 13.08) in 2009.
  - City code (LMC 13.08.020) requires all new homes and businesses constructed within the City limits or UGA to connect to the sanitary sewer system if the structure is within 200 feet of a public sewer main.
  - On-site sewage system repair requirements are provided in WAC 246-272A-0280.
- **Illicit discharge hotline:** The City maintains a spill response hotline and the number is advertised on the City's website: http://www.ci.lacey.wa.us/city-government/city-departments/public-works/water-resources/storm-and-surface-water-programs/report-a-spill.
- **IDDE implementation plan:** The City has a Hazardous material spill response plan, a standard operating procedure (SOP) for spill response, and a stormwater outfall illicit discharge screening program.
- **Dry weather outfall screening:** Field assessments were initiated in 2010 on Long Lake, Hicks Lake, and along portions of Woodland Creek. In 2011, field assessments were conducted along the shoreline of Chambers Lake that lies within the City limits.
- **Staff training:** Staff training sessions on identification of illicit discharges and illegal connections were held.
- **Record-keeping:** City staff document incidents of emergency response to flooding or spills.

### 4.3.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for IDDE are summarized below.

#### 4.3.2.1 2007-2013 Phase II Permit

The City plans on continuing all the IDDE activities summarized above and enhancing the existing IDDE program through the following:

- **Business education:** Develop additional public education and outreach materials to inform businesses and the general public about the proper disposal of waste and the potential hazards associated with illegal discharges.
- **Illicit discharge hotline:**
  - Adopt and implement procedures for responding to calls to the spill response hotline
  - Develop a tracking form or otherwise improve tracking for calls to the spill response hotline
- **IDDE implementation plan:**
  - Adopt and implement procedures for IDDE program evaluation and assessment
  - Improve coordination between the Community Development/Building and the Public Works Departments regarding response and enforcement of non-stormwater discharges to the City storm drainage system from construction projects (e.g., when concrete washwater reaches the street and enters the City storm system)
  - Address any deficiencies in the communication between inspector and public works departments through additional training, modifications to field forms, and improvements to ongoing reporting/tracking that would be needed to follow up on the illicit discharge
  - Work cooperatively with the Health Department and the Fire District to ensure that hazardous materials in the designated McAllister Springs Geologically Sensitive Area are contained properly and are not discharged in ways that can contaminate groundwater or the environment

#### *4.3.2.2 2013-2018 Phase II Permit*

The City's 2007-2013 IDDE program addresses most of the ongoing requirements specified in the 2013-2018 Phase II Permit including mapping, an illicit discharge hotline, staff training, implementation of the IDDE program, and record-keeping. Public education regarding IDDE is currently a gap listed above that will be expanded before the new permit term begins in 2013. The new requirements of the 2013-2018 Phase II Permit related to IDDE that the City will be required to implement include the following:

- **Illicit discharge ordinance:** Minor edits to the illicit discharge ordinance
- **IDDE implementation plan:**
  - Develop a compliance strategy that includes public education and informal technical assistance.
  - Modify IDDE field screening methods to include the City's storm drainage system (storm drainage pipe, catch basins and storm drains, municipal streets, curbs and gutters, ditches, and manmade channels) in addition to outfalls.

- **Staff training:** Expand staff training to include law enforcement officers, building inspectors, fire fighters, health department staff, sewer and water utility staff, and animal control officers in addition to maintenance staff, stormwater staff, and planners.

Implementation of the IDDE related activities under the 2013-2018 Phase II Permit will demand a significant amount of additional time. A detailed Stormwater Program staffing analysis was conducted to determine additional support needed to meet 2007-2013 and 2013-2018 Phase II Permit requirements, and is discussed in Section 5.

## 4.4 Controlling Runoff from New Development, Redevelopment, and Construction Sites

The City currently has a well-developed permitting process that requires plan review and site inspections for new development and redevelopment projects; however, additional staff time and resources are needed to support plan review, tracking processes and procedures, and inspections. Specific Phase II Permit requirements for controlling runoff from new development, redevelopment, and construction sites are listed in Appendix B. A summary of the accomplishments and recommendations of this portion of the SWMP are provided below.

Bioretention facilities provide flow control and water quality treatment for hard surfaces.

Permeable pavers manage stormwater where it lands.

### *4.4.1 Accomplishments*

The City implements a variety of regulations, procedures, activities and programs related to controlling runoff from new development, redevelopment, and construction sites that include the following:

- **Stormwater management guidance:** Minimum requirements for stormwater treatment, conveyance, storage, and disposal consistent with Ecology's Stormwater Management Manual for Western Washington (Ecology 2005b) are contained in Lacey's 2010 Stormwater Design Manual (Lacey 2010b).

- **Stormwater site plan review:**
  - Project application and permitting procedures, standard notes and details, and other Public Works considerations are specified in Lacey's 2009 Development Guidelines and Public Works Standards (Lacey 2009b).
  - Work with developers to determine where and when new public facilities are to be placed to permit proper development of commercial and residential projects.
- **Stormwater management ordinance:**
  - City code (Chapter 14.36 – Critical Aquifer Recharge Areas Protection) ensures that new development is in conformance with the City's Environmental Protection and Resource Conservation Plan section on aquifer protection and the Northern Thurston County Ground Water Management Plan
  - Zero Effect Drainage Discharge Ordinance (Ordinance 1113, LMC Chapter 14.31) allows for non-traditional approaches for new developments and provides potential exemptions from public works standards to encourage use of LID techniques. This ordinance aims to improve habitat, ground water, and surface water conditions through innovative development designs and reduction of effective impervious surface. Applicants are granted a deviation from certain City Public Works Standards based on the proposed project's design innovation, increased stormwater retention potential, improvement to on-site water quality, and reduction of impervious surface to near zero. Deviations from standard designs must promote one or more of the following:
    - Innovative site or housing design that leads to zero effective impervious surface
    - Increased on-site stormwater retention using native vegetation
    - Retention of at least 60 percent of the natural on-site habitat
    - Improved on-site stormwater quality (beyond current requirements)
    - Retention or re-creation of pre-developed natural hydrologic conditions to the maximum extent possible
    - Reduction of effective impervious surface to near zero
    - Ongoing review of codes and standards for consistency with the 2010 Stormwater Design Manual (Lacey 2010b)
- **Staff training:** Conduct staff training on implementing the 2010 Stormwater Design Manual (Lacey 2010b).
- **Inspections:**
  - Construction and stormwater site inspections during post-construction phase
  - Private facility inspections of stormwater treatment and flow control facilities permitted by the City

- **Record-keeping and enforcement:**
  - Standardized inspection and compliance documentation and tracking processes and procedures
  - Tracking inspections and enforcement actions by City staff

### 4.4.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for controlling runoff from new development, redevelopment, and construction sites are summarized below.

#### 4.4.2.1 2007-2013 Phase II Permit

The City plans on continuing all the activities summarized above related to controlling runoff from new development, redevelopment, and construction sites and enhancing the existing program through the following:

- **Stormwater management guidance:**
  - Update the City's Development Guidelines and Public Works Standards regularly.
  - Update the City of Lacey 2010 Stormwater Design Manual as needed to keep current with Ecology's Stormwater Management Manual for Western Washington (Ecology 2005b).
  - Consider additional groundwater protection measures within wellhead protection areas throughout the planning area, such as using subdivision CCRs to help regulate land use activities that affect groundwater, encouraging developments with open space areas to preserve native vegetation, or to landscape with vegetative materials certified as low input and other appropriate measures.
  - Revise and adopt post-construction private drainage system maintenance standards for new approved facility types.
- **Stormwater site plan review:**
  - Improve plan review and enforcement coordination, documentation, and tracking processes and procedures.
  - Improve coordination between departments, implementation, and tracking for erosion and sediment control plan review, approval, and inspections.
  - Add staff time and resources for quick and thorough stormwater plan reviews of new and redevelopment projects.
  - Develop and implement a process for notifying owners and operators of active construction sites that the summer construction season ends September 30, and October 1 is the annual start of the seasonal work limitations on land-disturbing activities, per Core Requirement #2 of the City of Lacey 2010 Stormwater Design Manual (Construction Stormwater Pollution Prevention).

- Ensure that new development is in conformance with requirements and standards of the City of Lacey 2010 Stormwater Design Manual (Lacey 2010b) within the City limits, and with the requirements and standards of the Drainage Design and Erosion Control Manual (Thurston County 2009) (formerly the Drainage Design and Erosion Control Manual for City of Lacey and Thurston Region) in the UGA and surrounding unincorporated areas (there is currently no designated Public Works code enforcer on staff).

- **Staff training:**
  - Improve the implementation of the City of Lacey 2010 Stormwater Design Manual through additional staff training
- **Inspections:** Add staff time and resources assigned to:
  - Pre-construction inspections
  - Private facility inspection and enforcement program
  - Annual inspections of stormwater treatment and flow control facilities permitted by the City after facilities have been constructed, and any follow up enforcement that is triggered

There are nearly 500 privately owned stormwater ponds in the City. Many of these are owned and operated by HOAs, and in some cases these HOAs are unable (financially or technically) to conduct inspection and maintenance of these ponds. Without proper maintenance, these stormwater facilities fail to operate as designed. In addition to being a permit requirement, maintenance of ponds is critical for ensuring pond performance; pond underperformance has been identified as a cause of drainage and water quality problems on a citywide basis. The City's current code Section 12.28.010, through Public Works Standard 5A, gives the Public Works Department the authority to conduct maintenance on inadequately maintained facilities and bill the facility owner for time and materials. The City also has the authority to issue maintenance orders to facility owners and pursue further legal action (i.e., enforcement). However, this authority is not being fully implemented. The City's current approach is focused on education and outreach to owners of these stormwater ponds; however, this education and outreach approach has not been effective when dealing with facilities owned by defunct and dysfunctional HOAs or in cases where the facility owner is unknown.

The City is currently reevaluating its policy on oversight of privately owned flow control or water quality treatment facilities. The City is collecting data to evaluate the feasibility of implementing one of three potential approaches to private facility oversight:

1. **Continue with the current approach of outreach and education of private facility owners.** This model is used in many jurisdictions throughout western Washington, but most encounter the same difficulties that the City has encouraging unresponsive or unwilling owners to perform inspections and maintenance of their facilities. The scale of these challenges is directly related to the number of facility owners that are resistant or unable to perform maintenance.

2. **More assertive implementation of the existing City code (i.e., stiffer enforcement).** The City's Public Works Standard 5A authorizes the City Public Works Operations Division to conduct maintenance on private facilities when the facility owner is unwilling or unable to perform the necessary maintenance. The code also allows the City to bill the owner. This model of private facility oversight is not widely used as a primary means of managing these facilities, but some jurisdictions use it during extreme cases when unmaintained facilities are causing significant impacts, or are viewed as a high risk. The additional cost for City-performed maintenance could be partially recovered by billing facility owners; however, the City may not be able to recover costs from bankrupt or defunct HOAs. The City would also incur additional costs to collect payments and this approach may be unfavorable to the public. The unrecovered costs for maintenance, legal, and other expenses associated with this approach could be funded through increased rates, or by reducing the level of service provided in other areas of the City.
3. **Take over responsibility for operations and maintenance of privately owned stormwater facilities.** Several jurisdictions take this approach in part or whole. King County assumes maintenance responsibilities for private facilities after the owner has demonstrated proper facility function over a short trial period. Other jurisdictions take over maintenance for some facilities and require private facility owners to maintain others. Jurisdictions do not always adjust the stormwater rates to account for whether facilities are maintained by the owner or by the jurisdiction.

If the City begins assuming maintenance responsibility for these facilities via option 2 or 3 above, the Public Works Operations Division will incur additional costs and there will also be additional administrative costs. These additional costs could be equitably distributed using a rate structure that includes the following categories:

- Properties with no flow control or water quality treatment
- Properties with undermaintained or City-maintained flow control or water quality treatment facilities
- Properties with functional (verified through inspection) self-maintained flow control and water quality treatment facilities

The rate structure may also take the stormwater facility design standard into account, because more modern facilities were designed to more rigorous standards. However, accounting for the date of each facility and design standards used could be very difficult to implement for minimal improvements in equitability.

The challenge with administering a rate structure that accounts for facility maintenance is the administrative burden. A reasonable alternative to a rate structure could be a rate credit program. The facility owner could be required to provide inspection and maintenance documentation to the City when applying for the credit, thereby creating less administrative burden on the City to determine which facilities are maintained. Through a credit program, the City could also have a simpler rate structure, where all residential parcels (or equivalent units) pay a flat monthly rate (per unit) unless they can demonstrate through documentation that their facility is functional. The flat rate could be adjusted to adequately fund Public Works Operations time to maintain facilities that are not maintained by the owner.

#### 4.4.2.2 2013-2018 Phase II Permit

The City's current and ongoing new development, redevelopment, and construction sites program addresses most of the ongoing requirements specified in the 2013-2018 Phase II Permit including plan review, construction site inspections, and staff training. The new requirement for watershed-scale stormwater planning does not apply to the City because Lacey is not located in any of the proposed Phase I watershed planning basins. However, significant staff time and resources will be required to update the City's codes, rules, standards, and other enforceable documents, such as the Lacey 2010 Stormwater Design Manual, to meet the requirements of the 2013-2018 Phase II Permit. These updates include incorporating new site design criteria, thresholds and LID BMPs into the Lacey Municipal code, the 2009 Development Guidelines and Public Works Standards, and the 2010 Stormwater Design Manual. This effort will most likely be led by stormwater program staff, but will involve many personnel from other City departments. Training for staff, contractors, and developers will also be necessary to educate City staff and local companies on how to implement the new LID requirements in particular, and how they should be applied to new development and redevelopment projects.

#### 4.4.2.3 Revision of Stormwater Code and the Lacey 2010 Stormwater Design Manual

The primary new requirements for controlling runoff from new development, redevelopment, and construction sites is the addition of mandatory LID BMPs to Appendix 1 of the 2013-2018 Phase II Permit and updated design guidelines in the 2012 Stormwater Management Manual for Western Washington. When LID BMPs are feasible, developers will be required to use them for onsite stormwater management. The developer is given the option of either selecting BMPs from a mandatory prioritized list of LID BMPs or opting to meet an LID performance standard. The LID performance standard requires the post-development flow durations to match the predeveloped flow durations from 8 percent of the 2-year peak flow to 50 percent of the 2-year peak flow (as demonstrated by hydrologic modeling), which is a very difficult standard to achieve without using infiltrating BMPs. The Lacey 2010 Stormwater Design Manual will need to be revised to address these regulatory changes; however, these new requirements can be implemented in a way that leverages the existing Zero Effect Discharge Ordinance.

The LID requirements of the 2013-2018 Phase II Permit differ from the City's requirements in the Zero Effect Drainage Discharge Ordinance (Ordinance 1113, LMC Chapter 14.31) discussed in Section 4.4.1 above. While the Zero Effect Drainage Discharge Ordinance *promotes* the reduction of stormwater runoff and improvement of water quality through exemptions from the City's Public Works Standards for use of non-traditional approaches, the 2013-2018 Phase II Permit and 2012 Stormwater Management Manual for Western Washington *requires* the use of LID BMPs where feasible (or the LID Performance Standard). However, both sets of requirements seek to improve habitat, ground water, and surface water conditions through innovative designs that reduce the quantity and improve the quality of stormwater runoff. Therefore, as the City revises its stormwater code requirements and the Lacey 2010 Stormwater Design Manual as required by the 2013-2018 Phase II Permit, the City can take steps to ensure that the Zero Effect Drainage Discharge Ordinance and the revised requirements are complementary.

The incentives offered by the Zero Effect Drainage Discharge Ordinance can help to make the mandatory LID requirements stemming from the 2013-2018 Phase II Permit more palatable for developers, while the mandatory LID requirements of the 2013-2018 Phase II Permit provide a discrete standard that developers can understand and the City can enforce.

The following Zero Effect Drainage Discharge Ordinance advantages should be maintained to the extent feasible during the course of revising the Lacey 2010 Stormwater Design Manual:

- **Incentivized**. The current regulation seeks to make LID more appealing by allowing a variance from the City's Public Works Standards. These incentives can be maintained.
- **Voluntary**. Under future requirements, LID will be mandatory where feasible, but the City may still encourage and provide incentives for voluntary LID in cases where the soils or other site conditions do not meet the specific feasibility criteria included in the 2012 Stormwater Management Manual for Western Washington.
- **Allows innovation**. Though the 2013-2018 Phase II Permit includes more prescriptive LID requirements, the City may include provisions in the Lacey 2010 Stormwater Design Manual that allow more flexibility and innovation, as long as the standards are not less protective than the 2013-2018 Phase II Permit requirements.

The process of revising the City stormwater code and the Lacey 2010 Stormwater Design Manual will provide an opportunity to address the following limitations of the current requirements:

- **Not Required.** The voluntary nature of the current requirements has resulted in infrequent implementation of LID practices to achieve the goal of zero effective discharge. The 2013-2018 Phase II Permit requires that the City revise its requirements to make LID mandatory, which will ensure that LID approaches are implemented more frequently. In addition, the 2013-2018 Phase II Permit also requires implementation of mandatory LID requirements in surrounding jurisdictions, ensuring that the City of Lacey is still attractive to developers.
- **Variability and Uncertainty**. The new mandatory LID requirements and standards of the 2013-2018 Phase II Permit and 2012 Stormwater Management Manual for Western Washington provide a well-defined set of standards that the Zero Effect Drainage Discharge Ordinance currently lacks. In revising the City stormwater code and the Lacey 2010 Stormwater Design Manual, the City has the opportunity to provide a more discrete framework through which developers can demonstrate that their proposed development achieves zero effective discharge and City reviewers will have a more defensible benchmark by which to review designs. Examples of this increased specificity include mandatory lists of LID BMPs, pre-sized BMPs, and the LID performance standard (requires developed discharge durations to match pre-developed durations for 8 percent of the 2-year peak flow to 50 percent of the 2-year peak flow as demonstrated through hydrologic modeling).

In conjunction with the new LID stormwater requirements, the City may also further develop alternative development standards that include elements such as narrower road width and

alternative density requirements that are preapproved when specific LID elements are implemented. This will provide developers with additional guidance regarding the deviations allowed based on the type and/or extent of LID implemented on site.

Finally, the process of updating the code and manuals will present an opportunity to evaluate the City's current policy in dealing with sites that were are vested under older stormwater regulations, such as the 1994 Manual, and whether implementing current stormwater requirements on these properties is appropriate.

## 4.5 Municipal Operations and Maintenance

The City currently conducts O&M activities at City-owned facilities and in rights-of-way across the City. Specific permit requirements for pollution prevention and O&M are listed in Appendix B. A summary of the accomplishments and recommendations for pollution prevention and O&M are provided below.

### *4.5.1 Accomplishments*

The City implements a variety of pollution prevention and O&M activities and programs that include the following:

- **O&M program**: Includes catch basin inspection and cleaning, street sweeping, facility cleaning and maintenance, spill response and control, and flooding response and repair
- **Inspections:**
  - Inspecting ponds, catch basins, vaults, and stormwater outfalls annually
  - Conducting spot checks of potentially damaged permanent treatment and flow control facilities (other than catch basins) after major (greater than 24-hour, 10-year recurrence interval rainfall) storm events.
- **Stormwater pollution prevention plan (SWPPP):** Developing and implementing a SWPPP for City-owned and managed facilities. The SWPPP primarily applies to the City's Operations and Maintenance Facility, but also includes elements that are applicable to the following facilities:
  - Vactor/Sweeper Decant Facility
  - The Regional Athletic Complex
  - Rainier Vista Park
  - Waste Water Odor Control Facilities (five sites)
  - Chlorine Storage Sites (16 sites)
  - Hawks Prairie Water Treatment Plant

- **Stormwater policies and procedures:** Standard operating procedures (SOPs) have been developed for catch basin maintenance; catch basin inventory; culvert, ditch, and swale maintenance; equipment maintenance; flood response; inspections; lines maintenance; and pond maintenance.
- **Staff training:** Provide ongoing O&M staff training
- **Tracking and record-keeping:**
  - Track and respond to stormwater-related problems (i.e., plugged drain grates, failed facilities, and localized flooding)
  - Maintain records of inspections and maintenance or repair activities

### 4.5.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for pollution prevention and O&M are summarized below.

#### 4.5.2.1 2007-2013 Phase II Permit

The City plans on continuing all the activities summarized above related to pollution prevention and O&M and enhancing the existing program through the following:

- **Ongoing retrofit program:** Establish an ongoing retrofit program to inspect, maintain, repair, and rehabilitate aging City stormwater facilities
- **CIP project list:** Maintain and update a CIP project list for stormwater infrastructure to address flooding and water quality problems when these problems cannot be addressed through maintenance or improvement of the existing infrastructure
- **Public education:** Continue to provide education and technical assistance for owners of private stormwater facilities
- **Stormwater practices:**
  - Develop a line inspection program to cover programmatic inspection/repair/ replacement of the storm drainage system
  - Maintain resources to develop and maintain an active ditch inspection and maintenance program
  - Maintain resources to develop and maintain an active culvert inspection and maintenance program
- **Tracking and record-keeping:**
  - Improve tracking of stormwater-related problems (e.g., plugged drain grates, failed facilities, and localized flooding)
  - Purchase or develop software to track catch basin cleaning that can be linked to route books developed by the City

#### 4.5.2.2 2013-2018 Phase II Permit

The City's current O&M program addresses most of the ongoing requirements specified in the 2013-2018 Phase II Permit including annual inspections of municipally owned or operated permanent stormwater treatment and flow control BMPs/facilities, spot checks of potentially damaged permanent stormwater treatment and flow control BMPs/facilities after major storm events, staff training, SWPPP implementation, and record-keeping.

Updating maintenance standards to be consistent with those in Ecology's Final 2012 Stormwater Management Manual for Western Washington (Ecology 2012c) and modifying O&M practices, policies, and procedures should not involve a significant amount of effort, with the exception of updating the Lacey 2010 Stormwater Design Manual for consistency with the new Ecology Stormwater Manual (also discussed under *Controlling Runoff from New Development, Redevelopment, and Construction Sites*).

Shortening the inspection frequency for catch basins and inlets to once every 2 years may involve some additional effort. Currently, the City has 35 catch basin route books which are grouped into the following maintenance cycles: 1-year (College Street, arterials), 2-year, and 3-year (low traffic residential areas). If the City provides a written statement to Ecology justifying a specific, less frequent inspection schedule based on maintenance records of double the length of time for the proposed inspection frequency (6 years), the City can continue O&M activities using the current inspection schedule. If the City would like to shorten the inspection frequency to once every 2 years to meet the permit schedule, additional O&M staff time may be necessary.

## 4.6 Compliance with TMDLs

The City is currently not affected by any TMDLs listed in Appendix 2 of the 2007-2013 Phase II Permit. However, several receiving waters within the City limits, receiving waters within the UGA, and waterbodies outside of the City limits that receive drainage from tributaries or stormwater facilities within the City limits are listed for water quality impairments under Category 5 of Ecology's Clean Water Act Section 303(d) list (impaired waters exceeding water quality standards that require a TMDL), and Category 4A (waterbodies that have an approved TMDL in place that is actively being implemented). These waterbodies and the status of their TMDL implementation plans are described in Appendix B. Specific permit requirements for compliance with TMDLs are also listed in Appendix B. A summary of the accomplishments and recommendations for compliance with TMDLs are provided below.

The City makes dog waste bags available at City parks.

### 4.6.1 Accomplishments

The City was not affected by any TMDLs listed in Appendix 2 of the 2007-2013 Phase II Permit; however, they have been proactively complying with action items specified in the water quality implementation plan (WQIP) for the Henderson Inlet TMDL, which covers Henderson Inlet, Woodland Creek,

and Woodard Creek. The City is currently implementing the following action items in the Henderson Inlet WQIP (Ecology 2008):

- Implementing the Private Stormwater Facilities Maintenance Program
- Maintaining pet waste bag dispenser units in City parks
- Offering pet waste stations and signage to HOAs
- Managing vegetation along Woodland Creek and its tributaries

### 4.6.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for compliance with TMDLs are summarized below.

#### 4.6.2.1 2007-2013 Phase II Permit

No specific gaps were identified for this program component. The City will comply with TMDL implementation plans developed by Ecology in the future for TMDLs that affect waterbodies or watersheds within the City limits.

#### 4.6.2.2 2013-2018 Phase II Permit

Appendix 2 of the 2013-2018 Phase II Permit contains the action items in the Henderson Inlet WQIP as permit requirements that the City must meet when the new permit becomes effective. The City is proactively complying with four action items (summarized above in the *Accomplishments* section). The City is also planning to implement the following requirements in 2012, before the new permit becomes effective:

- Offering bacteria pollution reduction brochures to HOAs
- Installing educational signage at City facilities/property

The requirements of the 2013-2018 Phase II Permit that may require some additional staff time and resources include the following:

- Develop and implement a fecal coliform bacteria wet weather sampling program for the College Regional Stormwater Facility
- Develop and implement a coordinated plan with the City of Olympia to detect and eliminate fecal coliform bacteria discharges from the Fones/Taylor wetland treatment facilities

## 4.7 Monitoring and Assessment

The 2007-2013 Phase II Permit requires the City to plan for a comprehensive long-term monitoring program to evaluate SWMP effectiveness. The monitoring program was required to address two components: monitoring of stormwater discharges and SWMP effectiveness. Specific permit requirements for monitoring are listed in Appendix B. A summary of the accomplishments and recommendations for monitoring are provided below.

### 4.7.1 Accomplishments

The SWMP annual report (Lacey 2011b) included the following monitoring plans or activities:

Water quality monitoring provides educational opportunities.

Macroinvertebrate sampling.

- **Stormwater monitoring planning:**
  - Identification of sites for long-term stormwater monitoring
  - Identification of two SWMP effectiveness questions
- **Existing monitoring programs:**
  - Interlocal Agreement for Joint Storm and Surface Water Monitoring Program (Thurston County, City of Olympia, City of Tumwater, and City of Lacey) that focuses on stream flow monitoring, precipitation monitoring, macroinvertebrate monitoring, ambient water quality monitoring, Phase II Permit monitoring, and special projects
  - South Sound Green Volunteer Monitoring Program – dissolved oxygen, pH, temperature, and conductivity monitoring twice per year at various locations on Woodland Creek and its tributaries
  - Groundwater Monitoring – quarterly wellhead protection monitoring at dedicated monitoring wells
  - Flow monitoring at the Woodland Creek stormwater treatment facility

### 4.7.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for monitoring are summarized below.

#### 4.7.2.1 2007-2013 Phase II Permit

Gaps in the City's monitoring program identified in the SWMP Annual Report (Lacey 2011b), the City of Lacey and Thurston County Land Use Plan for the Lacey UGA (Lacey and Thurston County 2008), and the City's agreement with St. Martin's Abbey to perform flow monitoring at the College Regional Stormwater Facility include:

- Gather data on pollutant loading to better assess the effectiveness of the existing Woodland Creek and Ruddell Road stormwater treatment facilities
- Improve monitoring coordination for shared facilities (e.g., the Fones Road Stormwater Facilities) or for areas with multiple authorities (e.g., the Woodland Creek basin where Thurston County has most of the authority at the mouth and headwaters).
- Add data and research on the effects of residential development on groundwater quality to be considered in future evaluation of appropriate density and standards for zoning
- Identify how much rainfall would trigger likelihood of needing to sample discharge from the College Regional Stormwater Facility, and develop a protocol to perform required monitoring

The recommendations listed above are based on the City's agreement with St. Martin's Abbey to perform flow monitoring at the College Regional Stormwater Facility. Under the 2007-2013 permit, the City is not required to conduct any monitoring other than the following (summarized in Appendix B):

- Conduct water quality monitoring required for compliance with TMDLs listed in Appendix 2 of the Phase II Permit (does not apply to the City for the 2007-2013 Phase II Permit)
- Conduct sampling or testing required for characterizing illegal discharges
- Provide a description of stormwater monitoring or studies conducted during the reporting period

#### *4.7.2.2 2013-2018 Phase II Permit*

The same TMDL and IDDE monitoring requirements included in the 2007-2013 Phase II Permit are discussed in the TMDL and IDDE sections of the 2013-2018 Phase II Permit. The monitoring section of the 2013-2018 Phase II Permit describes the option of participating in the Regional Stormwater Monitoring Program (RSMP). The City will need to decide by December 1, 2013, if they would like to participate in the RSMP outlined in the 2013-2018 Phase II Permit. If the City selects the opt-in option (participating in the RSMP), the total monitoring cost, not including IDDE and TMDL monitoring, will be $27,639 per year beginning with the first payment on August 15, 2014. If the City selects the opt-out option, the current stormwater monitoring activities will have to be expanded considerably to meet the requirements specified in the 2013-2018 Phase II Permit. Participating in the RSMP will likely be more cost effective than implementing the opt-out monitoring option.

Advantages of opting to participate in the RSMP include:

- The City does not have to use limited staff time and availability on stormwater monitoring because it will be contracted out to a third party.
- The City does not have to contend with the high capital costs in the initial year of monitoring since the cost will be spread out evenly over the permit term.

- The City does not have to contend with the costs of replacing equipment that is stolen or vandalized.
- Opting in is less expensive than if the City implemented its own monitoring program.

Disadvantages of opting to participate in the RSMP include:

- Monitoring most likely will not be focused on the waterbodies within the City limits.
- Monitoring may not address the specific SWMP effectiveness monitoring questions that the City would like to have answered because the effectiveness monitoring questions will be selected at a regional and not a local scale.

The following monitoring activities are not covered under the RSMP and are required by the City under the 2013-2018 Phase II Permit (summarized in Appendix B), regardless of the City's participation in the RSMP:

- Conduct water quality monitoring required for compliance with TMDLs listed in Appendix 2 of the Phase II Permit (Section 4.6)
- Conduct sampling or testing required for characterizing illicit discharges

## 4.8 Reporting

The City is required to submit an annual report and SWMP update to Ecology each year in March. Specific permit requirements for reporting are listed in Appendix B. A summary of the accomplishments and recommendations for reporting are provided below.

### 4.8.1 Accomplishments

The SWMP annual report (Lacey 2011b) included the following information related to reporting:

- Appendix G report on barriers to LID acceptance and use
- Appendix G report on LID practices, goals, planned actions, and timelines
- Appendix H annual report form for cities, towns, and counties (Appendix 3 of the Permit) for Permit Year 2010

### 4.8.2 Recommendations

Recommendations for 2007-2013 and 2013-2018 Phase II Permit requirements for reporting are summarized below.

#### 4.8.2.1 2007-2013 Phase II Permit

No gaps were identified for this SWMP component; however, the City should continue to keep all records related to the Phase II Permit and the SWMP for at least 5 years and make records related to the Phase II Permit and the SWMP available to the public.

#### 4.8.2.2 2013-2018 Phase II Permit

No gaps were identified for this SWMP component for the 2013-2018 Phase II Permit since the submittal of the annual report form will be simplified and the annual report form has been shortened. The additional reporting requirement in the First Year Annual Report involving internal staff organization, roles, and responsibilities is not expected to require a significant effort.

## 4.9 Underground Injection Control

Specific requirements for UIC are summarized in Appendix B. A summary of the accomplishments and recommendations for underground injection control are provided below.

### 4.9.1 Accomplishments

The City registered 146 UIC wells with Ecology in June of 2013, most of which are drywells along with infiltration drainfield systems.

### 4.9.2 Recommendations

The City needs to complete its UIC well assessments as soon as possible.

Well assessments must be completed to determine if any of the existing UIC wells are a high threat to groundwater. The City may begin by performing a desktop GIS analysis to evaluate land use around the wells (indicates potential for pollution), soil type and depth to groundwater (indicates likelihood of soil treatment potential), and location relative to groundwater protection areas. UIC wells that are a high threat to ground water must be retrofitted to protect groundwater quality.

UIC requirements also have implications for the City's O&M and CIP programs. Prior to constructing new small infiltration facilities, such as infiltration trenches, the City should evaluate the site conditions and develop a design that is consistent with requirements for new UIC wells. The City will also need to evaluate the presence of UIC wells when designing and constructing CIP projects. Existing UIC facilities may be retrofitted or reconstructed in place without being considered a new well, which means that existing UIC wells may be incorporated into new stormwater facilities (e.g., using an existing drywell as a junction box for a conveyance system) as long as the pollutant loading is not increased and a high threat to groundwater is not created. The components of existing UICs may also be reconstructed in place by the City (e.g., replacing an existing drywell with a drywell of equivalent size) without triggering requirements for new UICs.

After the list of high-threat UIC wells is developed, the City should begin developing plans for retrofitting wells. Retrofits may be most efficiently completed as part of ongoing system maintenance or through the CIP program by developing a new series of UIC retrofit projects for construction during the next CIP period.

# 5.0 PLAN IMPLEMENTATION

## 5.1 Staffing Needs

The City currently has 2.45 FTE personnel allocated to stormwater program management (i.e., 2 full time equivalent in the [FTE] Water Resources Division of the Public Works Department and 2 part time Water Resources employees allocated to the stormwater program [40 percent and 5 percent, respectively]), 5 FTEs allocated to stormwater O&M, and seasonal employees assisting with stormwater O&M (during the summer months). Under the current level of staffing, the stormwater management personnel are able to address stormwater problems that arise on a daily basis and troubleshoot specific issues that arise with development project reviews, but are not fully able to perform activities that would enable continual improvement of the City's stormwater system.

### *5.1.1 Stormwater Program Management*

Based on an analysis of the hours allotted to Stormwater Program Management (Appendix E), 3 full time equivalent (FTE) personnel are needed to fulfill the 2013-2018 Phase II Permit requirements and defined program goals (requires approximately 2.5 FTE) and other administrative duties in which they are currently involved (requires 0.5 FTE), while only 2.45 FTE are currently available to work on these tasks. Therefore, a 0.5 FTE of additional staff are recommended to continue current activities and address additional future activities required by the 2013-2018 Phase II permit.

#### *5.1.1.1 Current Staff Activities*

In addition to all the current activities listed in Appendix E, stormwater program staff spend 0.5 FTE conducting the following activities that are not included in the hours estimate in Appendix E:

- Customer service, both internal (City staff) and external (citizens)
- Technical consultations with project proponents, design engineers and geotechnical consultants
- Plan review and engineering design analysis
- Grant administration
- Utility billing support
- Inter-local coordination
- Briefings to staff and decision-makers

#### 5.1.1.2 Future Additional Activities

The following new and expanded activities will be performed by the current stormwater staff under the 2013-2018 Phase II Permit and to meet defined program goals (Note: Only new and expanded activities are listed below; see Appendix E for a complete list of activities that includes current and ongoing activities):

- **Public Education and Outreach Activities**:
  - Develop new and updated educational materials for home-based and mobile businesses on the topics of: impacts of stormwater on surface waters, impacts from impervious surfaces, impacts of illicit discharges and how to report them, LID principles and BMPs, and opportunities to get involved in stewardship activities
  - Develop educational materials for engineers, contractors, developers, review staff, and land use planners on the topics of: technical standards for stormwater site and erosion-control plans, LID principles and BMPs, and stormwater treatment and flow control BMPs/facilities
  - Develop new educational materials and update old educational materials as future needs are identified
  - Develop and distribute educational materials for at least one target audience and in at least one subject area
  - Measure the understanding and adoption of the targeted behaviors for at least one targeted audience and in at least one subject area
  - Evaluate the changes in adoption of the targeted behaviors and modify public education and outreach program as needed
- **Illicit Discharge Detection and Elimination**:
  - Develop educational materials to inform businesses and the general public of the hazards associated with illegal discharges and improper disposal of waste
  - Work cooperatively with the Health Department and the Fire District to ensure that hazardous materials in the designated McAllister Springs Geologically Sensitive area are properly managed
  - Improve coordination between the Community Development Department, Building Division, and the Public Works Departments regarding response and enforcement for construction projects
  - Update the City's IDDE ordinance, particularly with regard to allowable and conditionally allowable discharges
  - Implement an IDDE compliance strategy that includes informal compliance actions such as public education and technical assistance as well as enforcement

- Select and implement a field screening methodology appropriate to the City's storm drainage system
- Complete field screening for 40 percent of the storm drainage system by December 31, 2017, and on average 12 percent each year thereafter.

- **Controlling Runoff from New Development, Redevelopment, and Construction Sites**:
  - Pre-, during, and post-construction site inspections
  - Conduct staff training on record-keeping of permit-related activities
  - Revise information management systems to track and report construction, new development and redevelopment permits, inspection and enforcement actions for private drainage systems, including inspection reports, warning letters, notices of violations, and other enforcement records
  - Implement erosion and sediment control inspection program, including interdepartmental coordination and tracking
  - Inspect stormwater treatment and flow control facilities annually
  - Inspect all permanent stormwater treatment and flow control BMPs/facilities and catch basins in new residential developments every 6 months until 90 percent of the lots are constructed, to identify maintenance needs and enforce compliance with maintenance standards
  - Review stormwater plans for new and proposed development projects
  - Develop and implement a process for notifying owners and operators of active construction sites that the summer construction season ends on September 30
  - Evaluate and implement additional groundwater protection measures within wellhead protection areas
  - Develop and esablish post-construction private drainage system maintenance standards for newly approved facility types
  - Update the Lacey 2010 Stormwater Design Manual and stormwater codes to meet requirement S5.C.4.a of the 2013-2018 Phase II Permit, which requires local standards, requirements, limitations and criteria to be equivalent to those in the 2012 Stormwater Management Manual for Western Washington
  - Review, revise and adopt local development codes, rules, standards and other enforceable documents to incorporate and require LID principles and practices by no later than December 31, 2016.
  - Summarize the results of the review and revision process for incorporating LID principles and LID BMPs in the Annual Report due on March 31, 2017

- **Municipal Operation and Maintenance**:
  - Implement an ongoing program to inspect, maintain, repair, and rehabilitate aging City stormwater facilities
  - Maintain and update a CIP project list for stormwater infrastructure
  - Research, purchase, and implement software to track catch basin cleaning that can be linked to route books developed by the City
  - Implement a line inspection program to cover programmatic inspection, repair, and replacement of the storm system
  - Develop and implement a ditch inspection and maintenance program
  - Develop and implement a culvert inspection and maintenance program
  - Improve tracking of stormwater related problems
- **Compliance with total maximum daily load requirements**:
  - Continue the Private Stormwater Facilities Maintenance Program (additional resources for commercial and residential stormwater facility/BMP owners)
  - Offer bacteria pollution reduction brochures, signage, and pet waste stations to home owner associations
  - Maintain pet waste bag dispenser units in City parks
  - Install educational signage at City facilities and property
  - Develop and implement a coordinated plan with the City of Olympia to detect and eliminate fecal coliform bacteria discharges from the Fones/Taylor wetland treatment facilities
  - Manage vegetation along Woodland Creek and its tributaries
- **Monitoring**:
  - Decide whether to pay into a collective fund to implement the Regional Stormwater Monitoring Program (RSMP) (i.e., pay-in option) for the following program components: Status and Trends Monitoring and Effectiveness Studies (the pay-in option for the Source Identification and Diagnostic Monitoring program is required)
  - Send payments for the RSMP to Ecology annually (if selecting the pay-in option) or develop a Quality Assurance Project Plan (QAPP) and submit results to Ecology annually
  - Gather data on pollutant loading to better assess the effectiveness of the existing Woodland Creek and Ruddell Road stormwater treatment facilities

- Improve monitoring coordination for shared facilities (e.g., coordination with Olympia regarding the Fones Road Stormwater Facilities) or for areas with multiple authorities (e.g., the Woodland Creek basin where Thurston County has most of the authority at the mouth and headwaters)
- Consider additional data and research on the effects of residential development on groundwater quality in future evaluation of appropriate density and standards for zoning

- **Reporting**:
  - Update Stormwater Management Program (SWMP) Plan in early 2014 and post on the City's website by May 31, 2014 (this submittal is not required to be sent to Ecology)
  - Prepare and submit Annual Report and SWMP Plan update to Ecology by March 31 of 2015, 2016, 2017, and 2018; post submittal on City's website by May 31 of each year. Annual reports shall be submitted electronically through Ecology's WQWebDMR.
  - Keep all records related to the permit and the SWMP for at least 5 years
- **Underground Injection Control Regulations**:
  - Conduct well assessments for all City UIC wells

#### *5.1.1.2 Staffing Need*

The sum of all activities listed above constitutes a total of 3 FTE, while only 2.45 FTE are currently available to work on these tasks. In order to continue the above activities as well as implement the activities required by the 2013-2018 Phase II permit, 0.5 FTE additional staff will be required. The 0.5 additional FTE will allow the City to continue meeting regulatory requirements while still providing other services, such as management of customer service related activities, listed above. Not increasing staffing by 0.5 FTE could risk non-compliance with the Phase II permit or unsatisfactory levels of customer service.

### *5.1.2 Operations and Maintenance Management*

Based on an analysis of the hours allotted to the Stormwater O&M Crew (within the Public Works Operations Division), 8.3 FTE personnel are needed to fulfill the Phase II Permit requirements and defined program goals, but only 5 FTE are currently available to work on these tasks (Appendix E). Based on an analysis of City O&M staffing, the City will need to increase O&M staffing by approximately 3 FTE personnel to address the new requirements of the 2013-2018 Phase II Permit and meet overall City goals. This estimate takes into account the seasonal hiring for the summer months; however, at least two additional staff members are necessary to support stormwater O&M activities year-round.

The additional FTE for O&M are needed to perform the following activities to meet the new 2013-2018 Phase II Permit requirements or address gaps in current SWMP coverage (Appendix E):

- **Illicit Discharge Detection and Elimination**:
  - Implement an IDDE compliance strategy that includes informal compliance actions such as public education and technical assistance as well as enforcement
  - Complete field screening for 40 percent of the City's storm drainage system by December 31, 2017, and on average 12 percent each year thereafter
- **Controlling Runoff from New Development, Redevelopment, and Construction Sites**:
  - Pre, during, and post construction site inspections
  - Annual inspection of stormwater treatment and flow control facilities
- **Municipal Operations and Maintenances**:
  - Ongoing retrofit program to inspect and, maintain, repair, and rehabilitate aging City stormwater facilities
  - Maintain and update a CIP project list for stormwater facilities
  - Research, purchase, and implement software to track catch basin cleaning that can be linked to route books already developed by the City
  - Implement a line inspection program to cover programmatic inspection, repair, and replacement of the storm system
  - Develop and implement a ditch inspection and maintenance program
  - Develop and implement culvert inspection and maintenance program
  - Improve tracking of stormwater related problems
- **Non-NPDES Permit Activities**:
  - Register City UIC wells with Ecology
  - Conduct well assessments on City UIC wells

## 5.2 Capital Improvement Program

The CIP and non-CIP project implementation schedules are identified in Section 3.3. The financing for Scenario 1 (All CIP projects [Tier One and Tier Two]) or Scenario 2 (only Tier One projects) are defined in Section 6. In addition to implementation of the projects and funding described in other sections of this plan, the City should take the following steps:

1. Annually meet with all with all Public Works Operations staff to:
   - Ascertain any changes in the risk related to the problems addressed by the current CIP project list

- Identify ongoing or new stormwater problems that should be considered for addition to the project list

2. Annually review the data contained in Tables 3-2 and 3-5, and add any new information that is collected regarding each problem and solution.
3. Annually add new potential projects to the list in Table 3-2 and 3-5. More detailed project definition and prioritization can be conducted later.
4. Store all the information collected during the three previous steps in a paper or electronic file that can be revisited on an annual basis, and used to formally update the CIP and non-CIP elements of the SCP.
5. Review the CIP Section when the SCP is updated every 6 years or sooner if the plan is updated sooner. Use the information collected in prior steps to justify adding, removing, or modifying projects.

## 5.3 Interdepartmental Collaboration

The City is committed to both meeting compliance requirements and deadlines of the Phase II Permit and providing its citizens with exemplary stormwater management services. The stormwater management program is led by the City's Water Resources Engineer in the Public Works Department, Water Resources Division. The Water Resources Engineer works closely with other City departments and divisions, including the Public Works Operations Division, Parks and Recreation, and Community Development, to implement activities in the program areas of flood protection and water quality. Table 5-1 summarizes the roles and responsibilities of the various City departments and divisions.

## 5.4 Interagency Collaboration

The policies in the City of Lacey and Thurston County Land Use Plan for the Lacey UGA (Lacey and Thurston County 2008) discuss regional coordination through City involvement in the regional plans listed below. The publication dates of these plans vary considerably, and most of the coordination and City involvement has occurred and/or is ongoing.

- Puget Sound Water Quality Management Plan
- Northern Thurston County Ground Water Management Plan
- North Thurston County Coordinated Water System Plan
- Chambers Lake Stormwater Management Plan
- Woodland Creek/Lake Lois Enhancement Plan
- Chambers Creek Comprehensive Drainage Basin Plan
- Woodland and Woodard Creek Comprehensive Drainage Basin Plan
- Chambers/Ward/Hewitt Comprehensive Basin Management Plan
- McAllister/Eaton Creek Comprehensive Drainage Basin Plan

- Henderson Inlet Watershed Action Plan
- Budd/Deschutes Watershed Action Plan
- McAllister Springs Wellhead Protection Plan
- City of Lacey Wellhead Protection Plan

**Table 5-1. Interdepartmental Responsibilities.**

| Department | Responsibilities |
|---|---|
| Public Works – Water Resources | ▪ Overall stormwater management planning and Phase II Permit compliance responsibilities<br>▪ Public education and outreach related to stormwater issues<br>▪ Public involvement and participation<br>▪ IDDE program management<br>▪ Review of plans for development, redevelopment, and construction sites<br>▪ Compliance with TMDLs established for waterbodies in the City<br>▪ Annual reporting requirements associated with the Phase II Permit<br>▪ Stormwater Comprehensive Plan development and implementation<br>▪ CIP project planning, design, and, construction.<br>▪ Implement Stormwater Pollution Prevention Plan (SWPPP) at multiple facilities<br>▪ Update and implement stormwater regulations and design criteria<br>▪ Technical consultation for development projects |
| Public Works - Operations | ▪ Public education and outreach for homeowners and businesses<br>▪ Illicit discharge reporting and response<br>▪ Inspection of public and privately-owned flow control and water quality BMPs<br>▪ O&M of City-owned stormwater infrastructure<br>▪ Pollution prevention in municipal operations<br>▪ Implement Stormwater Pollution Prevention Plan (SWPPP) at multiple facilities |
| Parks and Recreation | ▪ Stocking pet waste bag dispensers in City parks<br>▪ Implement Stormwater Pollution Prevention Plan (SWPPP) at multiple facilities |
| Community Development | ▪ Review of plans for development, redevelopment, and construction sites<br>▪ Wetland and other critical areas issues<br>▪ Administers SEPA review of City CIP projects<br>▪ Floodplain management issues |

In addition, the City of Lacey and Thurston County Land Use Plan for the Lacey UGA (Lacey and Thurston County 2008) recommends participating in regional efforts towards developing and protecting long range domestic drinking water supplies outside of Urban Growth Management boundaries, and identifying groundwater watershed protection areas. Coordination on regional water supply management and protection currently occurs through active participation in watershed planning in the Nisqually Watershed, including implementation of the Nisqually Watershed Management Plan.

The 2007-2026 Capital Facilities Plan (Lacey 2007) also states that the City should continue to work cooperatively with other local governments through joint basin planning in shared

drainage basins to provide regionally coordinated planning, construction, and maintenance for regional stormwater facilities.

To address ongoing regional coordination needs, the City will continue to work with regional stakeholder groups and other local governments in shared drainage basins to protect groundwater and surface water quality and to manage and treat stormwater effectively.

# 6.0 FINANCIAL PLAN

## 6.1 Introduction

The purpose of the stormwater system financial plan is to identify the total cost of providing stormwater service, and to present a financial program that allows the stormwater utility to remain financially viable during the execution of the Capital Improvement Program (CIP) developed for this plan. This viability analysis considers the historical financial condition of the utility, the sufficiency of utility revenues to meet current and future obligations, and the financial impact of executing the CIP.

## 6.2 Past Financial Performance

This section contains a review of historical financial performance from 2007 through 2012. Historical financial statements for the City of Lacey Stormwater Fund are summarized in Tables 6-1 and 6-2 and discussed in the following pages.

Between 2007 and 2012, the Lacey stormwater utility's rate revenues increased by 24 percent, from $1.69 million to $2.1 million. New development in the City contributed to this growth, as new properties were added to the stormwater utility. In addition, the City implemented a rate increase of 5.93 percent in 2009, taking the monthly single family rate from $6.75 to $7.15. At the beginning of 2013, the City increased rates by about 3 percent, making the current single family rate $7.36. For the future, the City intends to update stormwater rates annually, in order to keep the impact of any single increase from becoming too large.

During the same period (i.e., 2007 through 2012), total operating expenses (including depreciation) grew by 42 percent. The main driver of this increase was depreciation expense. Depreciation is a non-cash expense intended to recognize the use of utility fixed assets. As new development occurs, developers build drainage infrastructure and transfer it to the City, which makes depreciation expense rise.

Excluding depreciation, total cash operating expenses rose 33% between 2007 and 2012.Operating expense grew by 8 percent over that period, while maintenance expense grew by 84 percent.The growth in maintenance expense reflects growth in the utility's fixed asset base over the past decade and more demanding maintenance requirements associated with the Phase II Permit, including the first 2 years of this review period, before the national recession slowed development to a trickle. In 2007 and 2008, capital contributions totaled $20.6 million. In contrast, in the 4 years from 2009 through 2012, capital contributions totaled only $4.1 million. The contrast in the pace of development can be seen even more dramatically if we look at earlier years. During the 4 years from 2004 through 2008, stormwater capital assets net of depreciation grew from $15.3 million to $47.4 million, a 210 percent increase. In the 4 years since 2008, that figure has decreased—it now stands at $45.9 million—as capital contributions have not even kept up with depreciation. Since staffing

| Table 6-1. Statement of Revenues, Expenses, and Changes in Fund Net Position ($1,000). | | | | | | |
|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| **Operating Revenues:** | | | | | | |
| Charges for Services | $ 1,685 | $ 1,826 | $ 1,929 | $ 1,992 | $ 2,103 | $ 2,090 |
| **Operating Expenses:** | | | | | | |
| Operating Expense | $ 879 | $ 927 | $ 955 | $ 997 | $ 1,015 | $ 947 |
| Maintenance Expense | 431 | 538 | 782 | 610 | 727 | 793 |
| Depreciation Expense | 1,038 | 1,358 | 1,496 | 1,531 | 1,554 | 1,581 |
| Taxes | 27 | 28 | 31 | 36 | 40 | 40 |
| **Total Operating Expenses** | **$ 2,374** | **$ 2,850** | **$ 3,264** | **$ 3,174** | **$ 3,386** | **$ 3,360** |
| **Operating Income/(Loss)** | **$ (689)** | **$ (1,025)** | **$ (1,335)** | **$ (1,182)** | **$ (1,233)** | **$ (1,270)** |
| *Operating Income Excluding Depreciation* | *$ 349* | *$ 333* | *$ 161* | *$ 349* | *$ 321* | *$ 311* |
| **Non-Operating Revenue/(Expense):** | | | | | | |
| Intergovernmental Revenue | $ - | $ - | $ 75 | $ 9 | $ 124 | $ - |
| Investment Earnings | 114 | 35 | 10 | 4 | 4 | 5 |
| Miscellaneous Non-Operating Revenue | 4 | 1 | - | 1 | - | - |
| **Total Non-Oper. Revenue/(Expense)** | **$ 119** | **$ 36** | **$ 85** | **$ 14** | **$ 129** | **$ 5** |
| Income/(Loss) before Contributions & Transfers | $ (571) | $ (988) | $ (1,250) | $ (1,168) | $ (1,104) | $ (1,265) |
| Capital Contributions | $ 11,673 | $ 8,953 | $ 785 | $ 1,714 | $ 398 | $ 1,226 |
| Transfers In | 250 | 335 | 250 | - | - | - |
| Transfers Out | (302) | (349) | (250) | (5) | (73) | - |
| **Changes in Net Position** | **$ 11,051** | **$ 7,951** | **$ (465)** | **$ 541** | **$ (779)** | **$ (38)** |
| **NET POSITION - Beginning** | **$ 29,885** | **$ 40,936** | **$ 48,887** | **$ 48,422** | **$ 48,963** | **$ 48,963** |
| **NET POSITION - Ending** | **$ 40,936** | **$ 48,887** | **$ 48,422** | **$ 48,963** | **$ 48,184** | **$ 48,184** |

| Table 6-2. Statement of Net Assets ($1,000). | | | | | | |
|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| **ASSETS** | | | | | | |
| ***Current Assets*** | | | | | | |
| Cash and Cash Equivalents | $ 652 | $ 615 | $ 739 | $ 1,900 | $ 1,684 | $ 2,032 |
| Receivables (Cust. Accounts) | 102 | 142 | 108 | 110 | 192 | 206 |
| Accrued Interest & Penalty | 7 | - | - | - | - | - |
| Due from Governmental Units | - | - | - | 8 | 18 | 30 |
| ***Total Current Assets*** | ***$ 761*** | ***$ 757*** | ***$ 846*** | ***$ 2,018*** | ***$ 1,894*** | ***$ 2,268*** |
| ***Non-Current Assets*** | | | | | | |
| Restricted Cash/Cash Equiv. | $ 1,086 | $ 751 | $ 891 | $ - | $ - | $ - |
| Capital Assets, net of Deprec. | | | | | | |
| Land | $ 771 | $ 2,776 | $ 2,776 | $ 2,779 | $ 3,290 | $ 3,308 |
| Improvements | 37,280 | 44,654 | 43,946 | 44,209 | 43,044 | 42,599 |
| Equipment | 15 | 12 | 10 | 7 | 4 | 4 |
| Construction in progress | 1,350 | - | - | - | - | - |
| *Total Capital Assets* | *$ 39,416* | *$ 47,442* | *$ 46,731* | *$ 46,995* | *$ 46,339* | *$ 45,908* |
| ***Total Non-Current Assets*** | ***$ 40,503*** | ***$ 48,193*** | ***$ 47,622*** | ***$ 46,995*** | ***$ 46,339*** | ***$ 45,908*** |
| **TOTAL ASSETS** | **$ 41,264** | **$ 48,949** | **$ 48,468** | **$ 49,012** | **$ 48,232** | **$ 48,176** |
| **LIABILITIES** | | | | | | |
| ***Current Liabilities:*** | | | | | | |
| Accounts Payable | $ 318 | $ 46 | $ 23 | $ 25 | $ 25 | $ 8 |
| Due to Other Gov't Units | 2 | 3 | 2 | 5 | 5 | 3 |
| Compensated Absences | 4 | 7 | 9 | 11 | 11 | 10 |
| ***Total Current Liabilities*** | ***$ 324*** | ***$ 55*** | ***$ 34*** | ***$ 42*** | ***$ 41*** | ***$ 22*** |
| ***Non-Current Liabilities:*** | | | | | | |
| Compensated Absences | $ 4 | $ 8 | $ 12 | $ 8 | $ 7 | $ 9 |
| **TOTAL LIABILITIES** | **$ 328** | **$ 63** | **$ 46** | **$ 49** | **$ 49** | **$ 30** |
| **NET POSITION** | | | | | | |
| Investment in Capital Assets | $ 39,416 | $ 47,442 | $ 46,731 | $ 46,995 | $ 46,339 | $ 45,908 |
| Unrestricted | 1,519 | 1,445 | 1,691 | 1,968 | 1,845 | 2,238 |
| **TOTAL NET POSITION** | **$ 40,936** | **$ 48,887** | **$ 48,422** | **$ 48,963** | **$ 48,184** | **$ 48,146** |

costs often lag behind increased maintenance responsibilities, the 84 percent growth in maintenance expense from 2007 through 2012 is really a reflection of system growth prior to 2009.

Despite the growth in total cash operating expenses, the utility has been able to generate positive cash flow from operations throughout the review period. This positive cash flow has allowed the utility to pay for its capital improvements on a pay-as-you-go basis.

As of the end of 2012, the City's stormwater utility has no outstanding debt. The utility's available cash balances and cash equivalents significantly outstripped its total liabilities throughout the 2007-12 review period. This gives the utility the flexibility to debt-finance any significant capital improvements in the future when necessary.

In short, the City has been managing its stormwater utility in a financially prudent way, and the utility is in a healthy financial position.

## 6.3 Capital Funding Resources

The City may fund the stormwater CIP from a variety of sources. In general, these sources can be summarized as: 1) governmental grant and loan programs; 2) publicly issued debt (tax exempt or taxable); and 3) cash resources and revenues. These sources are described below.

### *6.3.1 Government Programs*

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However due to budgetary constraints, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Nonetheless, the benefit of even the very low-interest loans makes the effort of applying worthwhile. The major funding sources are as follows:

#### *6.3.1.1 Department of Ecology Grants and Loans*

The Washington Department of Ecology (Ecology) administers an integrated funding program for three state and federal financial assistance programs to improve and protect water quality. Each funding cycle begins in the fall when Ecology accepts project applications. Ecology rates and ranks applications based on the highest-priority needs: projects include stormwater control and treatment, nonpoint pollution abatement and stream restoration activities, and water quality education and outreach. The amount of available grant and loan funding varies from year to year based on the state's biennial budget appropriation process and the annual congressional federal budget. The three sources of funding for water quality projects are:

1. Centennial Clean Water Grant Program
2. Federal Clean Water Act Section 319 Nonpoint-Source Grant Program
3. Washington State Water Pollution Control Revolving Fund Loan Program

The City has successfully acquired a grant from Ecology to fund a portion of Chambers Lake Stormwater Facility Project.

#### 6.3.1.2 Public Works Trust Fund (PWTF) Loans

State of Washington Public Works Trust Fund (PWTF) loans were designed for cities, towns, counties and special purpose districts to address the capital needs of water, sewer, stormwater, bridges, roads, and solid waste/recycling facilities and infrastructure. Under normal circumstances, loans are available for repair, replacement, rehabilitation, reconstruction, and improvements needed to accommodate reasonable growth.

Due to budget-balancing measures taken by the State Legislature during its last session, there is no appropriation for new PWTF construction loans in the 2013-15 biennium. However, the Public Works Board will be accepting applications for pre-construction loans in Spring 2014, to be prepared for potential funding of new construction loans in July 2015, subject to legislative approval. Recent legislation and Public Works Board action has also changed the standard terms of PWTF loans. After construction lending resumes. the standard interest rate will be 60% of market rate over a 20-year term. Applicants may qualify for interest rate reductions based on financial distress. In addition, in the future the Public Works Board will be able to offer grants or forgivable loans where there is sufficient financial hardship, and applicants will not necessarily be required to contribute a local match toward project costs. As in the past, applicants may request alternative loan terms, and all loan terms are subject to negotiation and Public Works Board and legislative approval.

### 6.3.2 Public Debt

#### 6.3.2.1 General Obligation Bonds

General obligation (G.O.) bonds are bonds secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, G.O. bonds have relatively low interest rates and few financial restrictions. However, the authority to issue "councilmanic" G.O. bonds (i.e. non-voted bonds, to be repaid within existing taxing authority) is restricted in terms of the amount and use of the funds, as defined by the Washington State constitution and statute. Specifically, the amount of debt that can be issued without a public vote is linked to assessed valuation.

RCW 39.36.020 states:

> *"(ii) Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half percent of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.*
>
> *(b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half percent of the value of the taxable property therein."*

While bonding capacity can limit availability of councilmanic G.O. bonds for utility purposes, they can sometimes play a role in project financing. Rate savings may be realized through two avenues: the lower interest rate and related bonding costs; and the extension of the repayment obligation to all tax-paying properties (not just developed properties) through the authorization of an ad valorem property tax levy.

#### 6.3.2.2 Revenue Bonds

Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the rate revenues of the issuing utility and the debt obligation does not extend to the City's other revenue sources. With this limited commitment, revenue bonds typically bear higher interest rates than G.O. bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (debt service coverage). The City agrees to satisfy these requirements by ordinance as a condition of the bond sale.

Revenue bonds can be issued in Washington without a public vote. There is no bonding limit, except perhaps the practical limit of the utility's ability to generate sufficient revenue to repay the debt and provide coverage. In some cases, poor credit might make issuing bonds problematic.

### 6.3.3 Cash Resources

#### 6.3.3.1 Capital Facilities Charges

A capital facilities charge (CFC) as provided for by RCW 35.92.025, refers to a one-time charge imposed on new customers as a condition of connection to the utility system. The purpose of the CFC is two-fold: (1) to promote equity between new and existing customers; and (2) to provide a source of revenue to fund capital projects. Equity is served by providing a vehicle for new customers to share in the capital costs incurred to support their addition to the system. CFC revenue can only be used to fund utility capital projects or to pay debt service incurred to finance those projects.

In the absence of a CFC, growth-related capital costs must be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers, whether through rates, charges and/or assessments, would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments. To establish equity, a CFC recovers a proportionate share of the existing and future infrastructure costs from a new customer. From a financial perspective, a new customer becomes financially equivalent to an existing customer by paying the CFC.

The City does not impose a stormwater CFC on new development. However, as an alternative, undeveloped parcels are levied a monthly utility charge which is not billed; instead, it accumulates until the undeveloped parcel is developed. At the time of development, the accumulated charges are collected within the framework of utility connection charge section of the City of Lacey Municipal Code as a condition of development/construction permit. The City has considered revising its current practice and replacing it with a CFC, but currently there are no plans to implement at CFC.

#### 6.3.3.2 Utility Funds and Cash Reserves

User charges (rates) paid by the utility's customers are the main funding source for all stormwater utility activities. The rates cover total annual costs associated with operation and maintenance of the stormwater system, and other ongoing costs of providing stormwater services. Funding capital projects through current-year rates only could cause volatility in the rates and disruption to customers. For that reason, the impact of capital costs is usually

"smoothed" over time in one of two ways: by borrowing or saving up in advance. The rate revenue is used to either pay debt service or to fund an annual system reinvestment policy commitment.

### 6.3.4 Summary

An ideal funding strategy would include the use of grants and low-cost loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes. It is recommended that the City pursue these funding avenues but assume for planning purposes that bond financing will be utilized to meet needs above the utility's available cash resources. G.O. bonds may be useful for special circumstances, but due to the bonding capacity limits, this vehicle is most often reserved for other City (non-utility) purposes. Revenue bonds are a more secure financing mechanism for utility needs. The Capital Financing Strategy developed to fund the updated CIP assumes the following funding priority:

1. Available grant funds
2. Accumulated capital cash reserves
3. Annual use of excess cash (above minimum balance targets) from operating reserves
4. Capital reserves and other miscellaneous capital resources, including government program loans to the extent that they are accessible
5. Revenue bond financing
6. Direct rate funding

## 6.4 Financial Plan

The City of Lacey's stormwater utility operates as an enterprise fund, and so it is responsible for funding all of its related costs. It is not dependent on general tax revenues or General Fund resources. The primary source of funding for the utility is stormwater service charges. The City controls the level of service charges by ordinance, and subject to statutory authority, can adjust user charges as needed to meet financial objectives.

The financial plan must take in account the total system costs of providing stormwater service, both operating and capital. To meet these objectives, the following analytical elements are needed:

- **Capital Funding Strategy** – The CIP identifies total capital obligations for a planning period that extends from 2013–2023. The capital funding strategy shows how the CIP can be funded. It includes projections of available resources from rate revenues, existing reserves, capital facilities charges, debt financing and any special resources that may be readily available (e.g. grants, developer contributions, etc.). The end result of the capital funding strategy is the amount of revenue bond proceeds needed and the level of direct rate funding needed.

- **Annual Financial Forecast** – This forecast identifies annual costs associated with the operation, maintenance, and administration of the stormwater system. Included in the forecast is a reserve analysis that forecasts cash flow and fund balance activity along with testing for satisfaction of actual or recommended minimum fund balance policies. The financial plan evaluates the sufficiency of utility rate revenues in meeting all obligations, including "pay as you go" capital uses as well as operating expenses, debt service, and reserve contributions, net of non-rate revenues. It also forecasts coverage requirements that may be associated with long-term debt. The end result of the annual financial forecast is the amount of rate increases needed.

  The capital funding strategy affects the annual financial forecast, because debt service creates an annual requirement. At the same time, the annual forecast affects the capital funding strategy, because current rate revenue (along with reserves, which are driven by the level of rate revenue) is one of the sources to fund capital projects.

### 6.4.1 Financial Policies

Following is a discussion of the key types of policy assumptions used in the financial plan for the Lacey stormwater system.

#### 6.4.1.1 Reserve Policies

Utility reserves serve multiple functions. They can be used to address variability and timing of expenditures and receipts; requirements associated with issuing debt; or to soften the impact of disruptions in activities, costs or revenues. The collective use of individual reserves helps to limit the City's exposure to revenue shortfalls and meet long-term capital obligations. Among municipal utilities, common types of reserves are operating reserves, capital contingency reserves, and bond reserves.

When evaluating fund reserve levels and objectives, it is important to recognize that the value of reserves lies in their potential use. A reserve strategy that deliberately avoids any use of reserves negates their purpose. Fluctuation of reserve levels merely indicates that the system is working, while lack of variation over many years strongly suggests that the reserves are, in fact, unnecessary.

- **Operating Reserve** – An operating reserve, or working capital reserve, provides a minimum unrestricted fund balance needed to accommodate the short-term cycles of revenues and expenses within a given fiscal year. These reserves are intended to address both anticipated and unanticipated changes in revenues and expenses. Anticipated changes may include billing and receipt cycles, payroll cycles, and other payables. Operating reserves can be used to meet short-term cash deficiencies due to the timing of actual revenues and expenditures.

  Generally, utilities target a certain number of days of working capital as a year-end cash balance to provide the liquidity needed to allow regular management of payables and payment cycles. Consistent with current City policy, this forecast assumes a target working capital reserve of between 60 to 90 days of operating and maintenance (O&M) expenses. Over the life of this forecast, the target operating reserve ranges from $330,000 to $450,000.

- **Capital Contingency Reserve** – A capital contingency reserve is an amount of cash set aside in case of an emergency should a part of the utility's infrastructure fail unexpectedly. Stormwater infrastructure is by definition exposed to the potential destructive effects of severe weather events, and it is important to have resources available to deal with sudden demands for capital replacement. In addition, this reserve can be used for other unanticipated capital needs including capital project cost overruns. There are various approaches to identifying an appropriate level for this reserve, such as using a given percentage of utility system fixed asset costs, or setting the reserve at the cost of replacing certain critical assets.

  As an industry standard, the target capital contingency reserve is typically set at 1 to 2 percent of original asset value or 100% of average annual CIP spending. For purposes of this analysis, the target contingency fund balance is set at 1 percent of original plant cost. Over the life of this forecast, this is equivalent to about $600,000.

- **Bond Reserve** – Bond covenants often establish reserve requirements as a means of protecting bondholders against the risk of nonpayment. This reserve is usually funded by adding it to the bond principal at the time of borrowing. This reserve requirement can also be met by using a surety bond. Since the utility does not have any outstanding debt, the City currently does not maintain a restricted bond reserve. However, our forecast anticipates two bond sales within the 6-year forecast horizon—one at the end of 2013 or early 2014, and one in 2018. For those bond issues, we project a required reserve equal to one year's debt service.

#### 6.4.1.2 System Reinvestment Policies

The purpose of system reinvestment funding is to provide regular rate funding for the replacement of aging system facilities. As we have noted above, developers build stormwater facilities and transfer them to the City; from that point on, the City is responsible for future capital re-investment in those facilities. Annual depreciation is a way to account financially for the gradual deterioration of the City's capital assets; as they are depreciated over time, they are moving toward the eventual need for replacement. While depreciation expense is based on the original cost of the asset, the replacement of that asset will likely cost much more, factoring in inflation and construction conditions. Therefore, the added annual replacement liability is even greater than the annual depreciation expense.

How much should be set aside each year for system reinvestment? There are several reasonable ways to create a target system reinvestment amount. The most aggressive funding method would be to estimate the future replacement cost of assets and set aside an annual amount that, when combined with interest earnings until the date of replacement, is sufficient to entirely pay for the replacement. This method is often used for assets with relatively short lives, such as vehicles or equipment. However, for in-ground facilities such as stormwater, water, or sewer assets, funding full replacement cost is considered to be unnecessarily burdensome to today's ratepayers, because of extreme uncertainty about how long the asset will be useful and what its eventual replacement cost will be. Besides, debt is still an option for future capital replacement needs. The value of a system reinvestment policy is to help the utility constrain its reliance on debt, but not necessarily to eliminate debt altogether.

Stormwater utilities (and water and sewer utilities as well) often base their annual system reinvestment commitment on annual depreciation expense. It is usually not necessary to fund 100 percent of annual depreciation from rates. Experience has shown that unless assets become prematurely obsolete due to growth or regulatory changes, they tend to last longer than the useful lives assumed in the calculation of annual depreciation expense. Instead, a strong system reinvestment policy will typically base the reinvestment target on either a certain percentage of full depreciation (such as 50 percent or 75 percent) or else a certain percentage of "net depreciation" (i.e., annual depreciation net of annual debt principal payments). In practice, we generally look at the utility's existing policy commitment to rate-funded capital, its existing outstanding indebtedness, and the percentage rate increases that would be needed even without any change in system reinvestment. If it can be done without creating too much disruption to ratepayers, we usually recommend gradually increasing the system reinvestment to either 50 to 75 percent of full depreciation or 75 to 100 percent of net depreciation. However, this can vary depending on whether there is reason to be concerned about future reliance on debt.

The City does not have a formal system reinvestment policy for its stormwater utility. However, for the last several years, amounts ranging from $200,000 to $250,000 have been transferred from operating (i.e., rate) revenues to the utility capital fund. Since the City has historically paid for its stormwater capital investments on a pay-as-you-go basis, lack of a system reinvestment policy has clearly not led to an over-reliance on debt in the past. However, future capital needs are expected to be greater than past capital needs in the stormwater system, and two debt issues are included in this forecast. As a result, there would be value in formalizing and increasing the City's commitment to regular rate-funded capital.

An annual capital fund transfer of $250,000 is roughly equal to 16 percent of the 2013 annual depreciation expense. For this financial forecast, we assumed that the utility will gradually increase its system reinvestment funding to 25 percent of annual depreciation expense by the year 2017. That is equivalent to about $425,000 per year.

In the first 2 years of the forecast period (2014 and 2015), rather than transfer a certain percentage of depreciation expense to the capital fund, the forecast assumes rate funding for a 50 percent share of the Hicks Lake to Pattison Lake Conveyance Replacement project, which is a $677,000 commitment in inflated dollars. (The inclusion of this project in the CIP is subject to the City reaching agreement with Thurston County for the other 50 percent cost share prior to beginning construction.) In 2016, the forecast assumes 20 percent of depreciation expense as a system reinvestment transfer, and after that, the transfer reaches the 25 percent level.

#### *6.4.1.3 Debt Policies*

Debt financing is one appropriate tool for capital funding. Even more than cash reserves, debt smoothes out the rate impact of a capital program by spreading costs over time. It also creates intergenerational equity—it is sometimes called "pay-as-you-use" because future customers who use the assets are the ones paying for them. However, debt cannot be relied on too much because it carries the risk of default. Debt also reduces budget flexibility: cash-funded capital projects can be delayed if there is a revenue shortfall, but once the utility has sold debt, the debt service needs to be paid in good times or bad. So while debt is a useful

part of the toolbox, it needs to be monitored to ensure that the system does not become too heavily dependent on it. As the City begins to sell debt for stormwater purposes, it is worth considering two measurements of debt burden: debt service coverage and capital structure.

Debt service coverage is most easily understood by focusing on its reciprocal: the amount of debt service as a percentage of the utility's net revenue. "Net revenue" is analogous to the operating profit of a private business; it refers to the total operating income minus operating expenses. For example, if net revenue were $200,000 and debt service were $100,000, then debt service as a percentage of net revenue would be 50 percent (or $100,000 divided by $200,000). The reciprocal of that percentage (in other words, $200,000 divided by $100,000) is 2.0. This is "coverage," as the term is used in debt agreements. Occasionally, State loans will have coverage requirements, but usually this requirement comes from the sale of revenue bonds, in which case the calculation only includes bonded debt service. A typical coverage requirement for utility revenue bonds (including any past bonds) is 1.25. In the simple illustration above, if annual bonded debt service were $100,000, then net revenue each year would have to be at least $125,000 in order to comply with bond covenants. A bond coverage requirement of 1.25 is equivalent to saying that bonded debt service can be no higher than 80% of net revenue. Appendix F summarizes the forecast over 10 years, from 2014-2023.

Because of the coverage requirement, when it sells bonds, the City agrees to collect enough revenue to meet operating expenses and not only pay debt service, but collect an additional 25 percent increment above debt service. The extra revenue is a cushion that makes bondholders more confident that debt service will be paid on time. The extra revenue can be used for capital expenditures, to build system reinvestment reserves, or for debt service on subordinate debt (if any) that does not require coverage. For the purposes of this financial plan, we assume that the stormwater utility will meet the 1.25 coverage test independently, without relying on the cross-pledging of revenue from the City's water and sewer utilities.

Another measurement often used in assessing the debt burden of a utility is the capital structure: outstanding debt as a percentage of net capital assets. ("Net capital assets" are the value of total capital assets net of depreciation.) Stormwater utilities have a relatively stable revenue stream, and as long as outstanding debt is not more than 60 percent of net capital assets, there is no cause for concern about the overall debt load of the utility.

### 6.4.2 Capital Funding Strategy

The capital improvement program (CIP) developed for this plan totals $11.4 million in 2013 constant dollars, $14.1 million in inflated dollars. Just over half of this amount ($6.0 million in 2013 dollars, $6.7 million inflated) is scheduled to be implemented in the first 6 years, from 2014-2019. Capital project costs are estimated in 2013 dollars and then escalated to the year of planned expenditure assuming an annual inflation rate of 4 percent. Table 6-3 summarizes annual CIP expenditures in 2013 constant dollars and inflated dollars.

A capital funding strategy was developed to provide for these CIP costs. The 2013 beginning fund balance in the capital fund was $926,994. The capital funding strategy for 2014-2019 is summarized in Table 6-4 below. Appendix F shows this strategy through 2023.

The costs shown in Table 6-4 are inflated to the year of spending. This strategy assumes grant funding for two projects—the Vactor Decant Facility (total grant of $354,000, $320,000 in

2014) and the Chambers Lake Stormwater Facility (total grant of $1 million, $857,000 in 2014). Total grant revenue in 2014 is about $1.2 million, or 17 percent of 2014-19 capital costs.

**Table 6-3. Stormwater Utility Capital Improvement Program ($1,000).**

| Year | 2013 Dollars | Inflated Dollars |
|---|---|---|
| 2013 | $ 273 | $ 273 |
| 2014 | 2,682 | 2,789 |
| 2015 | 1,210 | 1,308 |
| 2016 | 264 | 297 |
| 2017 | 166 | 194 |
| 2018 | 734 | 893 |
| 2019 | 986 | 1,248 |
| 2020 | 57 | 1,259 |
| 2021 | 1,783 | 2,439 |
| 2022 | 1,870 | 2,661 |
| 2023 | 518 | 767 |
| **TOTAL** | **$ 11,441** | **$ 14,128** |

**Table 6-4. Capital Funding Strategy ($1,000).**

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| **Total Capital Projects** | | | | | | |
| 2013 Dollars | $ 2,682 | $ 1,210 | $ 264 | $ 166 | $ 734 | $ 986 |
| Inflated Dollars | 2,789 | 1,308 | 297 | 194 | 893 | 1,248 |
| **Funding Sources** | | | | | | |
| Grants | $ 1,177 | $ - | $ - | $ - | $ - | $ - |
| Rates and Capital Fund Balance * | 228 | 1,308 | 297 | 194 | (407) | 1,248 |
| Revenue Bond Proceeds | 1,384 | - | - | - | 1,300 | - |
| **Total** | **$ 2,789** | **$ 1,308** | **$ 297** | **$ 194** | **$ 893** | **$ 1,248** |
| Outstanding Debt as % of Net Capital Assets | 2.9% | 2.6% | 2.5% | 2.3% | 4.5% | 4.1% |

***** Includes system reinvestment transfers as well as draws from/(additions to) capital fund balance.

About 43 percent of the 2014-2019 capital funding, or $2.9 million, is projected to come from rate revenue, either current-year revenue or reserves accumulated from past years. This includes regular system re-investment funding as well as current-year rate revenue used in 2015 for the Hicks Lake to Pattison Lake Conveyance Replacement project (discussed more below). Additions to or draws from the capital fund balance are also shown in this category. A drawdown of fund balance is an available resource for capital project spending, while adding to the balance requires resources and is shown as a negative number above.

Finally, about $2.7 million, or 40 percent of the total capital funding, is projected to come from revenue bond proceeds. The first bond issue of $1,384,000 is actually occurring in the last quarter of 2013, but the proceeds are shown in 2014 so they can be visible in the financial plan, since its proceeds are funding a 2014 project: the City's share of the $2.5 million Chambers Lake project. A second bond issue of $1.3 million is projected to be needed in 2018. Along with rate revenue committed as part of the system reinvestment policy, the 2018 bond issue would provide funding for several major projects planned for 2018 and 2019.

The capital project strategy beyond 2019 (shown in Appendix F) includes two more bond issues: a $2.8 million issue in 2020 and a $2.1 million issue in 2022. During the extended forecast period through 2023, outstanding debt of the stormwater utility remains below 10 percent of net capital assets. This is well within the suggested policy limit of 60 percent.

## 6.5 Annual Financial Forecast

The annual financial forecast, or revenue requirement analysis, projects the amount of annual rate revenue needed to meet utility's financial obligations. The analysis incorporates the capital funding strategy discussed above. It takes into account projected operating and maintenance (O&M) expenses, debt service payments, rate-funded capital needs (including the system reinvestment target), and reserve policies. It then subtracts any offsetting non-rate revenues to yield a rate revenue requirement, which is compared with rate revenue at current rates. The adequacy of current rates is tested against two criteria. First, does revenue projected under current rates meet the cash needs of the utility? Second, does it meet revenue bond coverage requirements? In order to be considered financially viable over the forecast period, both tests of revenue sufficiency must be met. If one of the two tests indicate a deficiency under current rates, then a rate increase is needed. In order to moderate the impact on customers, rate increases are "smoothed" over several years.

### *6.5.1 Sources and Assumptions*

The revenue requirement analysis is based on the following sources and assumptions.

- The 2013 budget is used as the basis of the analysis.
- Rate revenues under existing rates are calculated to increase with customer growth. Customer growth assumptions are based on population projections provided by City staff, which assume a long-term average growth rate of 1.25 percent per year.
- Labor costs (i.e., salaries and wages) are escalated annually at 3 percent.
- Benefits costs are escalated annually at 6 percent for assumed benefits cost inflation.
- Other operating and maintenance expenses are escalated annually at 3 percent.
- The City's annual fund interest earnings rate is assumed to be 0.40 percent in 2013. From this level, it is assumed to increase by 25 basis points (i.e., 0.25 percent) each year, reaching 1 percent in 2016, and remain at that level for the rest of the analysis period.

- Per City staff's direction and consistent with the result of the staffing needs evaluation, the following additional O&M expenses are included in the 2013 baseline budget:
    - Starting in 2013, $50,000 per year (in 2013 dollars) is added for rehabilitation of existing ponds and stormwater facilities.
    - Starting in 2015, 0.5 full time employee (FTE) is assumed to be added at an annual cost of $57,000 for stormwater program management.
    - Starting in 2015, 2.5 full-time employees (FTEs) are assumed for operations and maintenance at an annual cost of $239,000.
- Annual construction cost inflation is assumed to be 4 percent per year starting in 2014.
- The 2013 beginning operating fund balance was $1,104,856.
- In addition to maintenance and operating costs, revenue requirements include capital costs for new debt service incurred to fund the CIP.
- The forecast assumes a revenue bond interest rate of 5 percent, a repayment term of 20 years, issuance cost of 1 percent, and required coverage of 1.25 times debt service.

Table 6-5 summarizes the projected financial performance and rate revenue requirement of the stormwater utility for 2014 through 2019 based upon the above assumptions. Appendix F summarizes this forecast over a 10-year time frame, through 2023.

As shown in Table 6-5, revenues under the existing rates are not sufficient to fund the projected revenue requirement. The projected revenue deficiency is primarily due to inflation, additional O&M expenses, new debt service, and rate funding of capital projects.

The annual financial forecast shows that rates will need to increase by 9 percent annually in years 2014 through 2016 and by 6 percent per year from 2017-2023. The forecast assumes January 1 implementation of rate increases.

Table 6-5 also shows rate revenue, net cash flow, and debt service coverage after rate increases. In the forecast, debt service coverage is 2.39 in 2014 but drops to 1.43 in 2015, as a result of the planned addition of 3 FTEs in that year. While the 1.43 projected coverage is adequate to comply with bond covenants, the City will definitely need to wait until 2015 to add the positions; if the positions were added earlier than shown here, debt service coverage would drop below 1.25 in 2014. In 2016 and beyond (including the extended forecast horizon through 2023), the City's cumulative rate increases have a strong enough effect to provide a safer margin of error. Even with large bond issues planned for 2020 and 2022, the projected debt service coverage after the rate increases never drops below 1.95.

Table 6-6 below shows projected year-end cash balances for the operating, capital, and debt reserve funds) for the stormwater utility, after implementation of the planned rate increases.

| Table 6-5. Summary of Revenue Requirements ($1,000). | | | | | | |
|---|---|---|---|---|---|---|
| | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
| ***Assuming Existing Rates:*** | | | | | | |
| Revenue: | | | | | | |
| Rate Revenue | $ 2,160 | $ 2,187 | $ 2,215 | $ 2,242 | $ 2,270 | $ 2,299 |
| Non-Rate Revenue | 17 | 21 | 16 | 16 | 16 | 15 |
| **Total Revenue** | **$ 2,177** | **$ 2,208** | **$ 2,231** | **$ 2,259** | **$ 2,286** | **$ 2,314** |
| Expenses: | | | | | | |
| Cash Operating Expenses | $ 2,087 | $ 2,452 | $ 2,533 | $ 2,617 | $ 2,704 | $ 2,794 |
| New Debt Service | 122 | 122 | 122 | 122 | 237 | 237 |
| Rate-Funded Capital Costs | - | 494 | 337 | 424 | 424 | 428 |
| **Total Expenses** | **$ 2,209** | **$ 3,069** | **$ 2,993** | **$ 3,164** | **$ 3,365** | **$ 3,459** |
| **Annual Surplus/(Deficiency)** | **$ (31)** | **$ (860)** | **$ (762)** | **$ (905)** | **$ (1,079)** | **$ (1,145)** |
| **Annual Rate Adjustment** | **9.00%** | **9.00%** | **9.00%** | **6.00%** | **6.00%** | **6.00%** |
| Cumulative Rate Adjustment | 9.00% | 18.81% | 29.50% | 37.27% | 45.51% | 54.24% |
| ***After Rate Increase:*** | | | | | | |
| Rate Revenue | $ 2,355 | $ 2,599 | $ 2,868 | $ 3,078 | $ 3,304 | $ 3,546 |
| Net Cash Flow | $ 160 | $ (455) | $ 219 | $ (82) | $ (61) | $ 83 |
| Debt Service Coverage<br>*Target >1.25* | 2.39 | 1.43 | 2.89 | 3.94 | 2.63 | 3.30 |

| Table 6-6. Projected Cash Balances at Year-end ($1,000). | | | | | | |
|---|---|---|---|---|---|---|
| | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
| Operating Fund | $ 1,191 | $ 591 | $ 609 | $ 528 | $ 466 | $ 550 |
| Capital Fund | $ 814 | $ 152 | $ 395 | $ 629 | $ 1,467 | $ 662 |
| Debt Reserve | $ 122 | $ 122 | $ 122 | $ 122 | $ 237 | $ 237 |
| **Total** | **$ 2,127** | **$ 865** | **$ 1,126** | **$ 1,279** | **$ 2,170** | **$ 1,449** |
| Operating Reserve<br>*Target 60-90 days of O&M expense* | 214 days | 90 days | 90 days | 75 days | 64 days | 73 days |
| Target capital contingency | $ 593 | $ 606 | $ 609 | $ 611 | $ 620 | $ 632 |
| Capital contingency deficit | $ - | $ (454) | $ (214) | $ - | $ - | $ - |

During 2015 and 2016, projected ending cash balance in the capital fund drops below the target capital contingency of about $600,000. This is due to the funding strategy for the Hicks Lake to Pattison Lake Conveyance Replacement Project. Though the CIP shows this project in 2014-15, there is uncertainty about its actual timing, because moving ahead requires agreement from Thurston County. For that reason, it would not have made sense to include its funding in the planned bond issue at the end of 2013. However, if there is flooding in the affected neighborhood, there will be pressure on all parties to do the project quickly. This is a situation where drawing down and then replenishing the capital contingency makes sense.

As we mentioned earlier, fluctuation in reserve levels is not a negative indicator; it simply means that the reserves are being used.

## 6.6 Current and Projected Rates

The City charges its single family and duplex residential customers a flat fee per parcel per month. All other customers receive a monthly charge per gross acre, with the per-acre rate falling into one of seven tiers, depending on the percentage of impervious surface area for the parcel. The City's 2013 stormwater rate categories and their associated rates are shown in Table 6-7.

**Table 6-7. Existing Stormwater Rates (2013).**

| Rate Category | % Impervious Surface | Monthly Rate |
|---|---|---|
| *Single Family and Duplex(per parcel):* | | |
| Single Family Residential | N/A | $ 7.36 |
| Duplex Family Residential | N/A | $ 14.73 |
| *Multi-family and Commercial (per gross acre):* | | |
| Very Light | 0% to 10% | $ 3.38 |
| Moderate Light | >10% to 25% | $ 12.22 |
| Light | >25% to 40% | $ 23.65 |
| Moderate | >40% to 55% | $ 36.05 |
| Moderately Heavy | >55% to 70% | $ 49.08 |
| Heavy | >70% to 85% | $ 63.31 |
| Very Heavy | >85% to 100% | $ 78.33 |

Non-residential rates can be adjusted by a reduction of one rate category if a property provides stormwater retention and treatment facilities that sufficiently mitigate water quality and quantity impacts. In addition to on-site facility rate credits, properties located within the Chambers Lake Drainage District are granted a reduction in charges equal to the fees charged by the District. Low-income senior citizens and low-income disabled citizens in single family homes and duplexes are given a 50 percent rate discount.

Table 6-8 presents the City's projected stormwater rates for the first 6 years of the forecast period, incorporating the rate adjustments shown in the annual financial forecast.

The City is currently evaluating equity issues with the current rate structure and possible alternatives to that structure. Based on the results of that evaluation, the City might revise its stormwater rate structure following the completion of this comprehensive plan.

| Table 6-8. Projected Monthly Rates. | | | | | | |
|---|---|---|---|---|---|---|
| **Rate Category** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
| *Single Family and Duplex (per parcel):* | | | | | | |
| Single Family Residential | $ 8.03 | $ 8.75 | $ 9.54 | $10.11 | $10.72 | $11.36 |
| Duplex Family Residential | $16.05 | $17.48 | $19.06 | $20.20 | $21.42 | $28.70 |
| *Multi-family and Commercial (per gross acre):* | | | | | | |
| Very Light | $ 3.68 | $ 4.01 | $ 4.37 | $ 4.63 | $ 4.91 | $ 5.20 |
| Moderate Light | $13.32 | $14.52 | $15.83 | $16.78 | $17.79 | $18.86 |
| Light | $25.78 | $28.10 | $30.63 | $32.47 | $34.42 | $36.49 |
| Moderate | $39.29 | $42.83 | $46.68 | $49.48 | $52.45 | $55.60 |
| Moderately Heavy | $53.50 | $58.32 | $63.57 | $67.38 | $71.42 | $75.71 |
| Heavy | $69.01 | $75.22 | $81.99 | $86.91 | $92.12 | $97.65 |
| Very Heavy | $85.38 | $93.06 | $101.44 | $106.53 | $113.98 | $120.82 |

## 6.7 Conclusion

In order to fund the capital improvement program outlined in this Stormwater Comprehensive Plan, bond issues will be required totaling $7,584,000 over the coming ten years, of which $2,684,000 will be needed in the coming 6 years. This level of debt assumes that the City formalizes and increases its commitment to rate-funded system reinvestment by transferring to the capital fund about $425,000 per year, which represents a target of 25 percent of depreciation expense.

In order to pay for debt service on the new debt, O&M expenses, and rate-funded capital, stormwater rates will need to increase by 9 percent per year from 2014-2016 and 6 percent per year thereafter. While the percentage increases are higher than projected inflation, the actual dollar impact to customers is modest, because stormwater charges are such a small component of residents' overall utility bills. The annual increases in the single family rate would be less than $1.00 in any given year. The single family rate would go from $7.36 in 2013 to $11.36 in 2019, an overall increase of $4.00 over a 6-year period.

The City stormwater utility has had conservative financial management in past years, with no debt as of the beginning of 2013. However, as a result of rapid growth over the previous decade, there is been a growing need for increased O&M and capital re-investment in the system. With the rate increases and bond issues shown in this financial plan, the City should be able address these infrastructure needs while continuing to have a financially healthy stormwater utility at a reasonable cost to customers.

# 7.0 REFERENCES


Booth, D.B. and P. Henshaw. 2001. Rates of Channel Erosion in Small Urban Streams. Land Use and Watersheds: Human Influence on Hydrology and Geomorphology in Urban and Forest Areas. Mark Wigmosta and Stephen Burges (eds.). American Geophysical Union, Washington, D.C. pp. 17-38.

Burges, S.J., M.S. Wigmosta, and J.M. Meena. 1998. Hydrologic Effects of Land-Use Change in a Zero-Order Catchment. *Journal of Hydrologic Engineering* 3(2):86-97. April 1998.

Castro, J.M. and P.L. Jackson. 2002. Bankfull Discharge Recurrence Intervals and Hydraulic Geometry Relationships: Patterns in the Pacific Northwest, USA. *Journal of the American Water Resources Association* 37(5):1249-1262.

Deixis. 2010. Survey for Potamopyrgus Antipodarum (New Zealand Mudsnail) within a Five-Mile Radius of Capitol Lake, Thurston County, Washington. Prepared for the Washington Invasive Species Council by Deixis Consultants, SeaTac, Washington. November 8, 2010.

Ecology. 1997. Lakes Monitored from 1989 to 1997, Hicks Lake, provided by Washington Department of Ecology Lake Monitoring Program. http://www.ecy.wa.gov/programs/eap/lakes/wq/docs/lkhicth1.html (accessed April 8, 2012).

Ecology. 2005a. Nisqually Watershed Bacteria and Dissolved Oxygen total Maximum Daily Load (Water Cleanup Plan) Submittal Report. Prepared by Hempleman, Christine and Sargeant, Debra. Water Quality Program and Environmental Assessment Program. Publication 05-10-040. Washington State Department of Ecology, Olympia, Washington. June 2005.

Ecology. 2005b. Stormwater Management Manual for Western Washington. Publications 05-01-029 through 05-10-033. Washington State Department of Ecology, Olympia, Washington. February 2005.

Ecology. 2008. Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study. Publication 06-03-012. Washington State Department of Ecology, Olympia, Washington. May 2008.

Ecology. 2010. The 303(d) List of Impaired and Threatened Waterbodies 2008 List – by Water Resource Inventory Areas (WRIAs). Washington State Department of Ecology, Water Quality Program Home, 303(d) Home. http://www.ecy.wa.gov/programs/wq/303d/ (accessed June 24, 2010).

Ecology. 2012a. The 303(d) List of Impaired and Threatened Waterbodies 2012 List. Washington State Department of Ecology, Water Quality Program. http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html (accessed September 27, 2013).

Ecology. 2012b. Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum daily Load Technical Report. Washington State Department of Ecology, Olympia, Washington. June 2012.

Ecology. 2012c. Stormwater Management Manual for Western Washington. Washington State Department of Ecology, Olympia, Washington. August 2012.

Ecology. 2013. Nonpoint: Pollution from Urban Living. Washington State Department of Ecology, Olympia, Washington. September 2013. http://www.ecy.wa.gov/programs/wq/nonpoint/urban.html (accessed November 5, 2013).

ESA Adolfson. 2008. Lacey, Olympia, and Tumwater: Shoreline Analysis & Characterization Report. Prepared for Thurston Regional Planning Council by ESA Adolfson, Seattle, Washington. December 2008.

Finkenbine, J.K., J.W. Atwater, and D.S. Mavinic. 2000. Stream Health After Urbanization. *Journal of the American Water Resources Association* 36(5).

Hart Crowser, Washington Department of Ecology, U.S. Environmental Protection Agency, and Puget Sound Partnership. 2007. Phase 1: Initial Estimate of Toxic Chemical Loadings to Puget Sound. Ecology Publication Number 07-10-079. Olympia, Washington. October 2007.

Hartley, D.M., C.R. Jackson, and G. Lucchetti. 2001. Stream Health After Urbanization. *Journal of the American Water Resources Association* 37(3).

Konrad, C.P. 2000. The Frequency and Extent of Hydrologic Disturbances in Streams in the Puget Lowland, Washington. Water Resources Series Technical Report No. 164. University of Washington, Seattle, Washington. December 2000.

Lacey and Ecology. 1995. Woodland Creek/Lake Lois Enhancement Project Final Report. Prepared by the City of Lacey and the Washington State Department of Ecology. March 17, 1995.

Lacey and Thurston County. 2008. City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area. Prepared by the City of Lacey and Thurston County.

Lacey. 2007. 2007-2026 Capital Facilities Plan. Prepared by the City of Lacey. May 2007.

Lacey. 2009. Aerial photograph of City Lacey. High-resolution color orthoimage. City of Lacey. Horizontal resolution: 0.5 feet. Date of source image: July 10, 2009. Obtained March 2, 2011, via FTP site.

Lacey. 2009b. City of Lacey 2009 Development Guidelines and Public Works Standards. Prepared by the City of Lacey.

Lacey. 2010a. Stormwater Management Program (SWMP) 2009 Annual Report. City of Lacey, Public Works Department, Water Resources Division, Lacey, Washington. March 2010.

Lacey. 2010b. City of Lacey 2010 Stormwater Design Manual. City of Lacey, Department of Public Works, Water Resources Division. January 2010.

Lacey. 2011a. Storm drain system vector shapefiles. City of Lacey. Data created between August 21, 2009, and August 7, 2010. Obtained March 2, 2011, via FTP site.

Lacey. 2011b. Stormwater Management Program (SWMP) 2010 Annual Report. City of Lacey, Public Works Department, Water Resources Division, Lacey, Washington. March 2011.

Lacey. 2012a. 2011 Comprehensive Annual Financial Report. City of Lacey. Finance Department, Accounting Division, Lacey, Washington. June 2012.

Lacey. 2012b. City of Lacey Stormwater Comprehensive Plan and Stormwater Management Program Update. Prepared by Herrera Environmental Consultants, Inc., Seattle, Washington, for the City of Lacey. February 2012.

Lacey. 2012c. Parks and Recreation, Woodland Creek Park. http://www.ci.lacey.wa.us/city-government/city-departments/parks-and-recreation/parks-and-facilities/municipal-parks/woodland-creek-community-park (accessed April 8, 2012).

Lacey. 2012d. Parks and Recreation, Long Lake Park. http://www.ci.lacey.wa.us/city-government/city-departments/parks-and-recreation/parks-and-facilities/municipal-parks/long-lake-park (accessed April 8, 2012).

Lacey. 2012e. Stormwater Management Program (SWMP) 2012 Annual Report. City of Lacey, Public Works Department, Water Resources Division, Lacey, Washington. March 2013.

Lacey. 2012f. Stormwater Management Program (SWMP) 2011 Annual Report. City of Lacey, Public Works Department, Water Resources Division, Lacey, Washington. March 2012.

Lacey. 2013. City of Lacey Water System Comprehensive Plan Update. Prepared for the City of Lacey by Carollo Engineers. February 2013.

Littell, J.S., M. McGuire Elsner, L.C. Whitely Binder, and A.K. Snover (eds). 2009. The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate. Climate Impacts Group, University of Washington, Seattle, Washington.

LMI. 2005. Low-Impact Development Strategies and Tools for Local Governments. Building a Business Case. Prepared by LMI Government Consulting. September 2005.

Moscrip, A.L. and D.R. Montgomery. 1997. Urbanization, Flood Frequency, and Salmon Abundance in Puget Lowland Streams. *Journal of the American Water Resources Association* 33(6):1289-1297.

Mote, P.W. and E.P. Salathé. 2010. Future climate in the Pacific Northwest. *Climatic Change* 102(1-2):29-50.

PSLC. 2002. Lidar bare earth digital elevation model ground point returns collected by Terrapoint, November 1, 2001, through April 1, 2002. Horizontal resolution: 6 feet. Vertical accuracy: 30 centimeters in flat open surface. Puget Sound Lidar Consortium. Obtained January 15, 2012, from organization website: http://pugetsoundlidar.ess.washington.edu/.

PSP and WSU Extension. 2012. Low Impact Development Technical Guidance Manual for Puget Sound. Prepared by the Puget Sound Partnership, Tacoma, Washington, and Washington State University Extension, Puyallup, Washington. December 2012.

PSP. 2006. Sound Health, Sound Future: Protecting and Restoring Puget Sound. Prepared by the Puget Sound Partnership. December 2006.

PSP. 2009. Action Agenda. Prepared by the Puget Sound Partnership. May 27, 2009.

PSP. 2011. Action Agenda Update Center. Prepared by the Puget Sound Partnership. http://www.psp.wa.gov/action_agenda_2011_update_home.php (accessed April 27, 2012).

Roberts, M. and G. Pelletier. 2007. Interim Results from the Budd Inlet, Capitol Lake, and Deschutes River Dissolved Oxygen and Nutrient Study. Washington State Department of Ecology, Environmental Assessment Program, Olympia, Washington.

Skillings-Connolly and FishPro. 1995. Woodland Creek/Lake Lois Enhancement Project. Prepared for the City of Lacey Water Resources Management and the Washington State Department of Ecology by Skillings-Connolly, Inc. and FishPro, Inc. March 17, 1995.

Thurston County, Lacey, Olympia, Tumwater. 1986. Thurston County, Lacey, Olympia, Tumwater Surface Water Management Utility Development Plan.

Thurston County. 1995a. Chambers Ward Hewitt Comprehensive Drainage Basin Plan. Prepared by Thurston County Storm and Surface Water Program. July 1995.

Thurston County. 1995b. Woodland and Woodard Creek Comprehensive Drainage Basin Plan. Prepared by Thurston County Storm and Surface Water Utility. August 1995.

Thurston County. 2004a. Watershed Planning in Deschutes Water Resource Inventory Area (WRIA 13), Chapter 5: Surface Water Assessment. Table 1, Henderson Inlet: Stream and Watershed Characteristics.

Thurston County. 2004b. McAllister/Eaton Creek Comprehensive Drainage Basin Plan. Adopted March 21, 1994.

Thurston County. 2009. Drainage Design and Erosion Control Manual. Prepared by the Thurston County Water Resources Division, Department of Resource Stewardship. July 2009.

Thurston County. 2010. Thurston County Water Resources Monitoring Report 2007-2008 Water Year, 2008-2009 Water Year. Prepared by Thurston County Public Health and Social Services Department, Environmental Health Division and Thurston County Resource Stewardship Department, Water Resources Division.

Thurston County. 2012. Henderdon-Nisqually Shellfish Protection District. Prepared by Thurston County Planning Department. http://www.co.thurston.wa.us/planning/natural-res/shellfish-home.htm (accessed December 18, 2012).

WADOH. 2012. Henderson Inlet commercial shellfish area gains 100 more acres. Prepared by the Washington State Department of Health. June 13, 2012.

Ward, B., E. MacMullan, and S. Reich, 2008. The Effect of Low-Impact-Development on Property Values. Sustainability Conference Proceedings. Water and Environment Federation.