CITY OF LACEY

Wastewater Comprehensive Plan Update

April 2015

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LACEY

Acknowledgments

Wastewater Comprehensive Plan Update

April 2015

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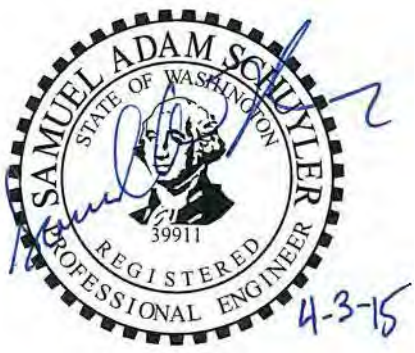

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List of Abbreviations

AFSCME	American Federation of State, County and Municipal Employees
AMMS	Automated Maintenance Management System
BITP	Budd Inlet Treatment Plant
CCTV	Closed Circuit Television
CERB	Community Economic Revitalization Board
CIP	Capital Improvement Plan
City	City of Lacey
CMOM	Capacity Management, Operation, and Maintenance
DOE	Department of Ecology
DOH	Department of Health
DWF	Dry Weather Flow
EM	Emergency Maintenance
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
FOG	Fats, Oils, and Grease
FSM	Full Service Maintenance
FTE	Full Time Employee
GFC	General Facilities Charge
GIS	Graphical Information Systems
GMA	Growth Management Act
GO	General Obligation
gpcd	Gallons Per Capita Per Day
gpd	Gallons Per Day
gped	Gallons Per Employee Per Day
gpsd	Gallons Per Student Per Day
GSP	General Sewer Plan
HTE	
idm	Inch-Diameter Mile
I/I	Infiltration and Inflow
JBLM	Joint Base Lewis-McChord
LAMIRD	Limited Area of More Intense Rural Development
LCA	Latecomer's Agreement
L&I	Labor and Industries
LID	Local Improvement District
LOSS	Large On-Site Septic System
LOTT	Lacey-Olympia-Tumwater-Thurston County Clean Water Alliance
LS	Lift Station
mgd	Million Gallons per Day
MWPS	Martin Way Pump Station
MWRWP	Martin Way Reclaimed Water Plant
NEPA	National Environmental Protection Act
NPDES	National Pollutant Discharge Elimination System
OC	Odor Control
OCC	Operations Control Center
OCF	Odor Control Facilities
O&M	Operation and Maintenance

PACP	Pipeline Assessment and Certification Program
Plan	Wastewater Comprehensive Plan Update
PM	Preventative Maintenance
POTW	Publicly Owned Treatment Works
PUD	Public Utility District
PVC	Polyvinyl Chloride
PWB	Public Works Board
RAC	Regional Athletic Complex
RCW	Revised Code of Washington
RDII	Rain-Dependent Infiltration/Inflow
RM	Routine Maintenance
SCADA	Supervisory Control and Data Acquisition
SEPA	State Environmental Policy Act
SOERP	Sewer Overflow Emergency Response Plan
SP	Special Projects
SRF	System Reinvestment Funding
STEP	Septic Tank Effluent Pump
TCWRC	Thurston County Waste and Recovery Center
TDH	Total Dynamic Head
TRPC	Thurston Region Planning Council
UGA	Urban Growth Area
UGMA	Urban Growth Management Area
ULCA	Updated Land Capacity Analysis
ULID	Utility Local Improvement District
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WEF	Water Environment Federation
WO	Work Order
WOW	Washington Operator Workshop
WWTP	Wastewater Treatment Plant

Executive Summary

E.1 Introduction (Chapter 1)

The City of Lacey's (City) Wastewater Comprehensive Plan Update (Plan) reviews the City's current sewage capacities, analyzes the impact of projected growth on the City's sewage collection and conveyance system, an proposes a Capital Improvement Program to alleviate system deficiencies. It also documents the utility's policies, operation and maintenance practices, and financial condition.

The City is located in north-central Thurston County directly east of the City of Olympia and approximately six miles west of Joint Base Lewis-McChord (JBLM). The location is shown on Figure 1-1. The City is bounded to the east by the Nisqually National Wildlife Refuge and unincorporated Thurston County. The northernmost portion of the City abuts the Puget Sound. The surrounding area is a combination of rural, suburban, and agricultural lands.

The City was incorporated in 1966 and is primarily residential with some commercial areas and industrial activity. The wastewater service area includes the City Limits and Urban Growth Area boundaries.

The City owns, operates and maintains existing wastewater collection and conveyance facilities that provide sewer service to the City's current service area of approximately 13,800 acres. The collection system consists of gravity sewers, pump stations, force mains, septic tank effluent pump (STEP) systems, and grinder pump systems; all of these facilities collect and convey wastewater to the Budd Inlet Treatment Plant (BITP) and the Martin Way Reclaimed Water Plant (MWRWP), which are owned and operated by the Lacey-Olympia-Tumwater-Thurston County Clean Water Alliance (LOTT). The City does not own any wastewater treatment facilities.

This Plan complies with the Washington State Department of Ecology (DOE) regulations for general sewer plan (Washington Administrative Code [WAC] 173-240-050).

E.2 Service Area Characteristics (Chapter 2)

The City has a number of lakes and creeks within the urban growth area (UGA) boundary. Of these, Woodland Creek appears on the Washington Department of Ecology's Water Quality Assessment list [303(d)] for impaired water bodies for fecal coliform, dissolved oxygen, instream flow, pH, and temperature.

The soils in the City consist primarily of glacial outwash and glacial till.

There are critical areas throughout the City which will limit development. Most of these areas are wetlands, floodplains, protected habitat for bald eagle and woodland duck, geologically sensitive areas, and aquifer protection areas. Several species of fish are also present, of which Chinook and Steelhead are federally listed as threatened. Chinook is also listed by Washington State as a candidate.

A majority of the City's water supply comes from 20 active wells. There is also a supply intertie with the City of Olympia and nine emergency interties with Olympia, Thurston County PUD, Pattison, and Meadows water systems.

E.3 Existing and Future Population Forecasts (Chapter 3)

The projected population for the City over the planning horizon of this Plan is presented in Table E-1. Employment and population data were provided by the Thurston Region Planning Council (TRPC). Student population was provided by school districts and individual private schools. Build-out projections are for modeling purposes only and were calculated assuming the highest density possible based on current zoning.

Table E-1 Population Forecasts for the City of Lacey and its Municipal UGA

Year	Population	Employment	Students
2010	75,611	29,073	17,503
2018	85,098	33,509	24,182
2032	104,064	41,271	39,026
Build-out	116,150	45,300	41,962

E.4 Regulations and Policies (Chapter 4)

The City manages its wastewater utility in accordance with established wastewater system policies. The policies provide a consistent framework for the design, operation, maintenance, and service of the wastewater system for appropriately implementing programs, designing new infrastructure, and serving additional customers. The policies defined in this plan pertain solely to the wastewater system; the City has additional land use, development, and finance policies that may specify additional requirements for development or extension of a wastewater service. The City's policies and criteria are summarized in Chapter 4, and include the following major categories:

- Compliance with Regulations and Contractual Agreements
- Utility Planning
- Stormwater Separation
- Fats, Oils, Grease and Pretreatment
- Community Septic Systems – Ownership and Maintenance
- Individual and Community Septic Systems – Connection to City Sewer System
- Reclaimed Water - Priority Uses
- Design Standards
- Construction standards
- Ownership and Maintenance – Gravity
- Ownership and Maintenance – STEP
- Ownership and Maintenance – Grinder Pumps
- Sewer Extensions

E.5 Existing Wastewater Facilities (Chapter 5)

There are approximately 743,000 feet of gravity sewers in the collection systems.

There are 47 lift stations within the City's sewer system; 20 are STEP stations and 27 are conventional lift stations. 18 lift stations have been built since the adoption of the 2005 Plan. The City owns approximately 80,000 feet of sewer force mains for conveying wastewater to the treatment plant or to downstream gravity conveyance piping.

The City has approximately 3,900 customers served by septic tank effluent pump (STEP) systems. The City owns approximately 275,000 feet of STEP main, and there is an additional 2,500 feet of privately owned STEP main.

The City's sewer system has been analyzed by a computer model in three main basins and 124 mini-basins. The Martin Way basin consists of all areas tributary to the LOTT owned Martin Way Pump Station. The Sleater Kinney North basin includes all areas downstream of the Martin Way Pump Station and upstream of the discharge point to the LOTT conveyance system, which corresponds to LOTT flow monitoring station L6. The Sleater Kinney South basin includes all areas tributary to LOTT flow monitoring station L7. These three basins account for the entire Urban Growth Area (UGA) boundary, and are further subdivided into mini-basins as shown on Figure C-1.

E.6 Wastewater Flow Characteristics (Chapter 6)

The unit flows used to model the City's collection system are presented in Table E-2.

Table E-2 Unit Flows

Year	Annual Average Residential Flow (gpcd)	Annual Average Commercial Flow (gped)	Average Annual Student Flow (gpsd)	Martin Way Peak Hour I/I (gpd/idm)	Sleater-Kinney Peak Hour I/I (gpd/idm)	Peak Day Factor	Peak Hour Factor
2012	65	24	10	953	5,106	1.52	2.22
2018	65	24	10	993	5,320	1.52	2.22
2032	65	24	10	1,086	5,821	1.52	2.22
Buildout	65	24	10	1,220	6,536	1.52	2.22

Abbreviations: gallons per capita per day (gpcd), gallons per employee per day (gped), gallons per student per day (gpsd), gallons per day (gpd), inch-diameter mile (idm)

E.7 Wastewater Conveyance Analysis (Chapter 7)

The existing wastewater conveyance system was analyzed using the InfoSWMM modeling platform. The projected populations and their distributions are the basis for establishing future system requirements. The model was developed using information from the City's GIS database, supplemented by selected as-built drawings, pump records, flow monitoring data, and LOTT flow monitoring and infiltration/inflow reports. The model was calibrated using flow monitoring data from the City and from LOTT for dry weather, average annual, peak day, and peak hour flow conditions.

The design capacity of the gravity mains is considered to be 80 percent depth (0.80 d/D ratio), which is equivalent to 87 percent of the hydraulic capacity. The maximum design capacity of STEP mains and force mains are exceeded when flow velocities are greater than 8 feet per second. The firm capacity of a lift station is defined as the capacity of the lift station with the largest pump out of service. When model simulation results exceed these design capacities in piping or in lift stations, they are identified as deficient and system improvements are identified to resolve them.

Where pipe sections were identified as requiring an upgrade, the proposed upgrade was sized to provide capacity equal to or greater than the estimated build-out flows according to the design criteria above.

At lift stations where the estimated peak hour flows were shown to exceed the current firm capacity, a suitable build out upgrade flow capacity was estimated and incorporated into the model for the improved system model runs. This enabled the impact of the increased flow on the downstream sewer network to be investigated. It is unlikely that the mechanical and electrical improvements to the lift stations will be sized for the build-out conditions.

Projected wastewater flows for the major basins are presented in Tables E-3 and E-4. Peaking factors were calculated from model output, and differ from those in Table E-2 which were calculated based on measured flow from the entire City sewer system. Changes in different model runs differ based on projected changes in population and infiltration and inflow.

Table E-3 Projected Wastewater Flows, Sleater Kinney South Basin

Year	Sewered Population	Average Annual Flow (mgd)	Peak Day		Peak Hour	
			Peaking Factor	Flow (mgd)	Peaking Factor	Flow (mgd)
2012	6,845	0.88	2.32	2.04	3.375	2.97
2018	7,204	0.97	2.26	2.19	3.26	3.16
2032	7,817	1.15	2.16	2.48	3.04	3.50
Build-Out	8,045	1.20	2.23	2.68	3.19	3.83

Abbreviation: million gallons per day (mgd)

Table E-4 Projected Wastewater Flows, Martin Way/Sleater Kinney North Basin

Year	Sewered Population	Average Annual Flow (mgd)	Peak Day		Peak Hour	
			Peaking Factor	Flow (mgd)	Peaking Factor	Flow (mgd)
2012	35,228	2.93	1.49	4.36	2.36	6.91
2018	48,559	3.72	1.40	5.22	2.17	8.06
2032	72,149	5.19	1.41	7.34	2.04	10.58
Build-Out	108,105	8.36	1.22	10.24	1.76	14.69

Abbreviation: million gallons per day (mgd)

E.8 Collection Facilities Improvements (Chapter 8)

The 6-year capital improvement projects as determined by model results and the City desired improvements are presented in Table E-5.

Table E-5 Opinion of Probable Project Costs, 6-Year CIP (2014-2019)

CIP No.	Project	Opinion of Probable Project Cost
1	Wastewater Comprehensive Plan Update (recurring)	$45,000
2	LS-25 and LS-31 Retrofit	$1,023,000
3	Steilacoom Road Lift Station	$3,650,000
4	Tanglewilde East ULID	$3,764,000(2)
5	College Street and Martin Way ULID	$750,000
6	STEP Main Air/Vac's	$224,000
7	LS-18	$690,000(1)
8	Lakeview Drive Gravity Main Phase 1	$500,000
9	LS-15 Generator/Flow Meter	$350,000
10	Avonlea Odor Control	$100,000
11	Train Depot	$62,000
12	Carpenter Road STEP Upgrades	$50,000
13	Lift Station 2 - Lift Station, Gravity, and Force Main Replacement	$1,610,000
14	Rumac St STEP Main	$1,000,000
15	Mullen Road Force Main	$500,000
16	College Street Repair	$100,000
17	Annual Sewer Line Replacement	$300,000
18	FOG/Fibrous Wipes Pilot Program	$50,000
19	Generator/Flow Meter LS-22, LS-23, LS-17, LS-20	$800,000
20	LS-49 Land Purchase	$120,000
21	LS-12 Abandonment	$200,000(3)
22	Sleater Kinney Gravity Main Improvements	$1,300,000
23	Lift Station Rehab (Phase 1)	$1,900,000
24	Lift Station Rehab (Phase 2)	$2,850,000
25	Lift Station and STEP System Flow Meters	$690,000(4)
26	Sewer Main Replacement (50th Ave)	$210,000
27	Chemical Storage Tank Replacement	$150,000
28	Sewer Main Replacement (34th Ave)	$60,000
	Total Opinion of Probable Project Cost	**$23,048,000**

Notes:
1) Costs for LS-18 only include construction costs. Other project costs were previously expended.
2) Tanglewilde East is expected to be financed using bonds, to be repaid with funds from the ULID.
3) LS-12 Abandonment includes land acquisition and allied costs. Construction will occur in 2020 and is not included in the 6-year CIP.
4) Lift Station and STEP System Flow Meters construction will continue into 2020. The 2020 construction costs are not included in the 6-year CIP.

E.9 Wastewater Reuse (Chapter 9)

LOTT treats and disposes of all of the City's sewage and produces reclaimed water at two treatment plants. The Class A reclaimed water produced by LOTT is available to the City and other partner jurisdictions, who then distribute the water to the end-user. This water may be used for irrigation, dual-plumbed buildings, environmental enhancement projects, and other non-potable uses.

The City will be diverting some of the reclaimed water to infiltrate at Woodland Creek Community Park off of Pacific Avenue to preserve stream flows in Woodland Creek and to serve as mitigation for additional water rights. The City has also planned to construct a reclaimed water distribution system, including a booster pump station and reservoir, which is tentatively planned to begin construction in 2021. This will provide access to reclaimed water along the City's Britton Parkway and future Main Street corridors.

The City has also installed reclaimed water piping in Marvin Road SE between I-5 and Union Mills Road SE. The pipe will eventually serve the Regional Athletic Complex (RAC), but is currently not in service. The pipe may be connected to the reclaimed water piping leaving the MWRWP, or to the City's future reclaimed water distribution system, when it becomes economically feasible to do so.

LOTT has long-range plans to build a reclaimed water satellite plant on Mullen Road near College Street. A 12-inch diameter reclaimed water main owned by LOTT has already been installed in Mullen Road between College Street SE and Forest Glen Drive SE.

E.10 Operations and Maintenance (Chapter 10)

The following recommendations are made in Chapter 10:

- Odor control costs are currently funded through the STEP budget; this cost should be shared between the STEP budget and the lift station budget.
- Single-wall odor control chemical storage tanks should be replaced.
- A second FOG pilot program should be conducted to confirm the preliminary findings of the first pilot program.
- An educational outreach program discouraging the flushing of fibrous wipes should be implemented.
- City Operations and Maintenance Department should implement the ability to develop non-standard reports with SunGard HTE software.
- Cross training of water and wastewater staff for common O&M activities.
- Internal performance measurement should be increased to help determine whether the utility's performance is improving or diminishing in areas of interest.

E.11 Financial Plan (Chapter 11)

The objective of the financial plan is to identify the total cost of providing wastewater service and to present a financial program that allows the wastewater utility to remain financially viable during the study period. The analysis considers the historical financial condition of the utility, the financial impact of executing the capital improvement plan (CIP), the sufficiency of utility revenues to meet current and future financial and policy obligations, and the affordability of rates.

A variety of potential capital funding resources are also described within this chapter. Local resources may include General Facilities Charges, Local Facilities Charges, and utility cash

reserves. External resources may include Department of Ecology grants and loans, Community Economic Revitalization Board grants and loans, Public Works Board loans, general obligation bonds and revenue bonds.

The results of the analysis indicate that rate increases are necessary to fund ongoing operating needs and the identified capital program. The Baseline scenario in Section 11.7 shows increases of 3.75 percent per year starting in 2015 going through 2019. Additional scenarios in Section 11.11 show rate increases ranging from 2.75 percent to 4.25 percent per year. The City has selected scenario #2 as its preferred alternative (4.25 percent per year) to ensure adequate funding for system reinvestment and to allow for an additional operation and maintenance FTE as the system expands over time. Annual rate adjustments of 4.25 percent would increase the current local sewer rate of $17.30 per month to $21.30 per month by 2019.

Table E-6 Local Sewer Rate Impacts

	2014	2015	2016	2017	2018	2019
Annual Increase (%)		4.25	4.25	4.25	4.25	4.25
Local Rate	$17.30	$18.04	$18.80	$19.60	$20.43	$21.30

Chapter 1 Introduction

The City of Lacey (City) is located in north-central Thurston County directly east of the City of Olympia and approximately six miles west of Joint Base Lewis-McChord (JBLM). The location is shown on Figure 1-1. The City is bounded to the east by the Nisqually National Wildlife Refuge and by unincorporated Thurston County. The northernmost portion of the City abuts the Puget Sound. The surrounding area is a combination of rural, suburban, and some agricultural lands.

The City was incorporated in 1966. The City is primarily residential with some commercial areas and industrial activity. The current population was estimated by the Washington State Office of Financial Management to be 42,393 in 2010.

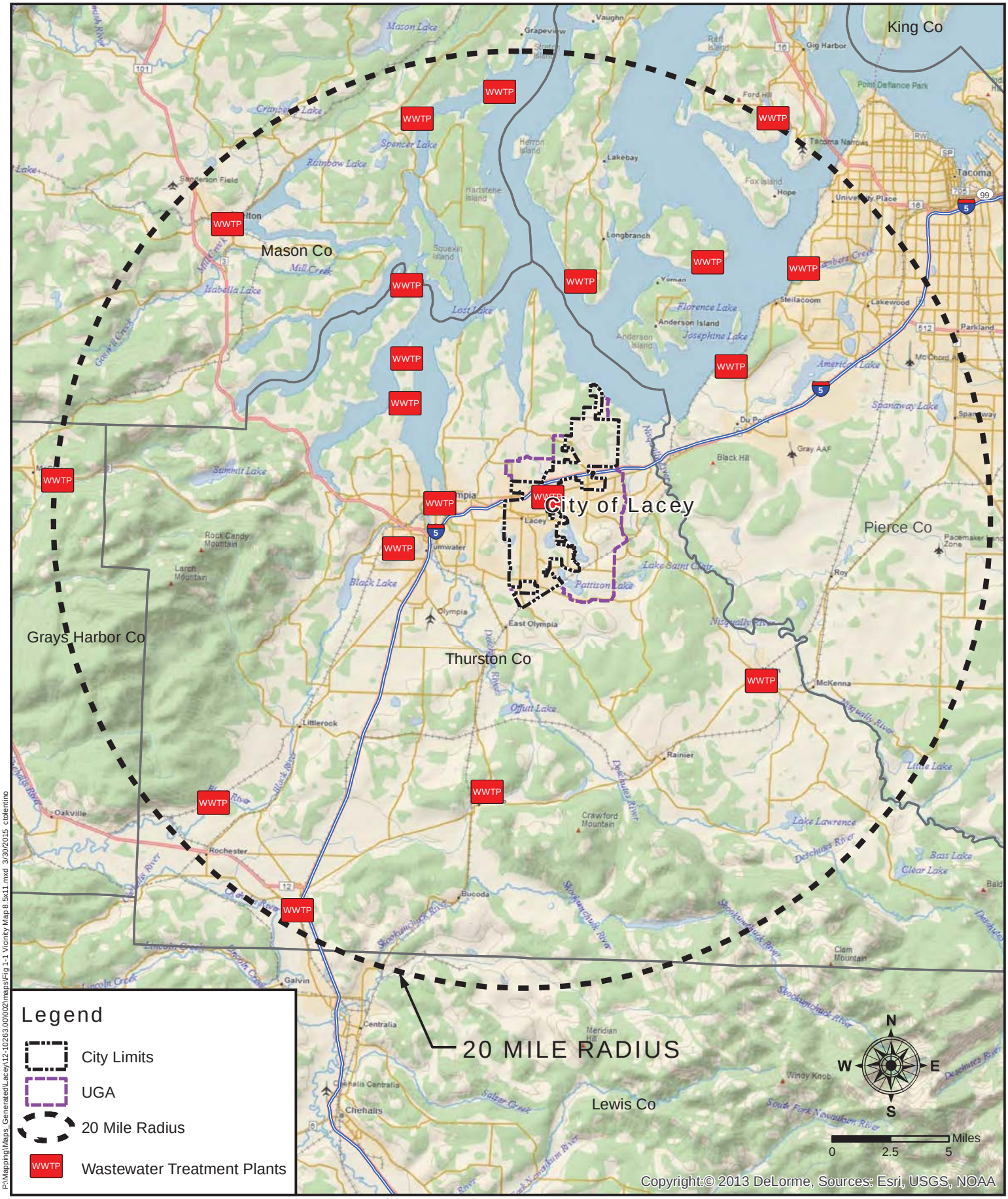
The City owns, operates and maintains existing wastewater collection and conveyance facilities that provide sewer service to the City's current service area of approximately 13,800 acres. The collection system consists of gravity sewers, pump stations, force mains, STEP systems, and grinder pump systems that convey wastewater to the Budd Inlet Treatment Plant (BITP) and the Martin Way Reclaimed Water Plant (MWRWP), which are owned and operated by the Lacey-Olympia-Tumwater-Thurston County Clean Water Alliance (LOTT). The City does not own any wastewater treatment facilities.

Over the next twenty years the population within the UGA is expected to grow to over 104,000 people. The City's sewer service area is expected to grow to approximately 21,200 acres. This Plan evaluates future facilities required to accommodate both existing and future wastewater collection and treatment needs.

1.1 Background

Recent documents reflecting planning efforts and projects related to the City's wastewater collection system include:

- *City of Lacey 2005 Wastewater Comprehensive Plan Update*, EarthTech, December 2005
- *Sanitary Sewer Study East Side of Woodland Creek Valley and Lacey Gateway*, Huitt-Zollars, May 2008
- *2009 Inflow and Infiltration and Flow Monitoring*, LOTT Clean Water Alliance, 2009
- *2010 Annual Capacity Reports*, LOTT Clean Water Alliance, October 2010
- *2011 Infiltration & Inflow and Flow Monitoring Report*, LOTT Clean Water Alliance, February 2012
- *Lift Station 9 Preliminary Design Report*, HDR, June 2010
- *Wastewater STEP Main Evaluation and System Plan*, AECOM, June 2011
- *Draft Woodland Creek Pollutant Reduction Plan*, Pacific Groundwater Group, December 2007
- *Current Conditions Report Woodland Creek Pollutant Load Reduction Project*, Pacific Groundwater Group, February 2007



P:\Mapping\Maps_Generated\Lacey\12-10263.001\002\maps\Fig 1-1 Vicinity Map 8.5x11.mxd 3/30/2015 ctolentino

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

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VICINITY MAP

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey
April 2015

Figure 1-1

1.2 Purpose and Scope

This Wastewater Comprehensive Plan Update (Plan) is prepared for the City to fulfill the requirements of Chapter 173-240-050 of the Washington Administrative Code (WAC), Chapter 90.48 of the Revised Code of Washington (RCW), and RCW 36.70A (Growth Management Act). The Plan provides the City with a comprehensive guide for managing and operating the sewer system and coordinating expansions and upgrades to the infrastructure through buildout. The Plan serves as a guide for policy development and decision making processes for the City. The WAC requirements are outlined in Table 1-1.

Table 1-1 Comprehensive Sewer Plan Requirements per WAC 173-240-050

WAC 173-240-050 Reference Paragraph	Description of Requirement	Location in Document
3a	Purpose and need for proposed plan	Section 1.2
3b	Who owns, operates, and maintains system	Section 1.3
3c	Existing and proposed service boundaries	Figure 2-1
3d	Layout map showing boundaries; existing sewer facilities; proposed sewers; topography and elevations; streams, lakes; and other water bodies; water systems	Figure 2-1, Appendix C, Figure 8-1
3e	Population trends	Chapter 3
3f	Existing domestic and/or industrial wastewater facilities within 20 miles	Figure 1-1
3g	Infiltration and inflow problems	Section 6.3
3h	Treatment systems and adequacy of such treatment	Chapter 5
3i	Identify industrial wastewater sources	Chapter 6
3j	Discussion of public and private wells	Chapter 2
3k	Discussion of collection alternatives	Chapter 8
3l	Define construction cost and O&M costs	Chapters 8, 10, and Appendix H
3m	Compliance with water quality management plan	Section 2.2.3
3n	SEPA compliance	Appendix K

The Plan provides the public and regulatory agencies with information on the City's plans for sewer system extensions to areas designated as urban and provisions for reducing future water requirements by using reclaimed water for irrigation. This approach allows the City to continue providing high quality service to its customers while protecting environmental quality.

The Plan is based on projections for a six year period to 2018, a twenty year period to 2032, and a full buildout capacity scenario.

The existing and future capacities of the sewer system were evaluated based on current and anticipated future wastewater flow rates. Future wastewater flow rates are estimated from

existing flow data and population growth projected within the sewer service area by the Thurston Regional Planning Council (TRPC).

A capital improvement plan is provided that prioritizes improvements, estimates project costs, and outlines a plan for financing the capital improvements, as well as reviewing the existing sewer service rates and connection fee structure.

1.3 Ownership and Management

The City's wastewater utility is funded through wastewater rates and general facility charges. These revenues must provide for future capital improvements, and cover current operating expenses, maintenance of the system, replacement, and/or emergency repairs. Resources and staff are shared between the water and wastewater utilities.

Management and administration of the wastewater utility is provided by the Public Works Department through the Operations & Maintenance, Engineering, and Water Resources Divisions, and the City's Finance Department. This support includes repair and maintenance of the collection system, major improvements and development, engineering design and construction, administrative support, accounting and financial services, billing and collection. In addition, the Stormwater Operations Division provides spill response, which includes hazardous waste and other potential pollutants, when necessary.

The City has an interlocal agreement with LOTT to treat the City's sewage. LOTT is a non-profit organization with appointed elected officials representing the Cities of Lacey, Olympia, Tumwater, and Thurston County. LOTT owns and operates the BITP and the MWRWP, which provide treatment of all sewage in the City, except for on-site septic systems. A copy of the interlocal agreement between the City and LOTT is included in Appendix A.

1.4 Sewer History

Construction of the wastewater collection system began in the late 1960's. This system included a network of gravity pipes feeding the Sleater-Kinney Trunk and flowed by gravity to the LOTT interceptor. Lift Stations 2 and 3 were brought on line in 1970. They discharge into the Sleater-Kinney Trunk and serve the areas around Chambers Lake.

Seven other Lift Stations (1 and 4 through 9) and the Ruddell Road Trunk were constructed during the 1970's. They serve most areas south of Interstate Five (I-5) and west of the Lakes Area. Lift Stations 10 through 15 and the Martin Way Trunk were constructed during the 1980's. They serve the areas east of the Central Area and south of I-5. Lift Stations 16 through 23 were constructed between 1988 and 1999. Lift Station 52 replaced Lift Station 10 in 2012. Ownership of Lift Station 16 was transferred to LOTT in 1999, at the same time that LOTT became an independent entity. It is now known as the Martin Way Lift Station.

The *1989 Comprehensive Sanitary Sewer Plan* recommended the installation of septic tank effluent pumping (STEP) systems. This was a significant change to the collection system. Two major STEP transmission mains have been installed. One of the STEP mains is located along Carpenter Road, serving the areas between Hicks and Long Lakes, and one is located along Union Mills Road serving the areas east of Long Lake. In addition, several smaller developments in the southern portion of the City (the Lakepointe development being the largest) and in the Hawks Prairie Area (at the east end of 31st Avenue), are served by STEP systems.

Some of the newer developments discharging to these STEP mains include gravity sewers draining to a lift station with a shared STEP tank.

The BITP has historically been treating wastewater from the City. The original primary treatment facility was built by Olympia in 1951. Tumwater and the City then contracted with Olympia for treatment services in 1954 and 1969, respectively. Major improvements have included a secondary treatment upgrade in 1983 and a nitrogen removal and disinfection upgrade in 1994. Current planning policy states that the City will continue to send its wastewater to LOTT. LOTT was officially formed in 1999 by an interlocal agreement.

LOTT has constructed a satellite reclaimed water treatment facility on Martin Way. An additional future satellite reclaimed water facility is also being planned by LOTT near the intersection of College Street and Mullen Road.

More detailed information about the existing sewer system and reclaimed water system can be found in Chapters 5 and 9, respectively.

Chapter 2 Service Area Characteristics

This section describes the characteristics of the City's UGA that are used to assess existing wastewater services as well as future service needs.

2.1 Study Area

The City limits and Urban Growth Area (UGA) boundaries are presented in Figure 2-1. The City is bounded on the east by a large bluff which descends to the Nisqually National Wildlife Refuge, the northernmost tip of the City is on the Puget Sound, and Olympia lies to the west. The undeveloped areas within the UGA boundary include forested areas and some farmland, and there are several lakes in the southern half of the City.

2.2 Surrounding Vicinity Characteristics

2.2.1 Topography

The topography of the City may be characterized as moderately hilly and sloping generally to the north.

2.2.2 Water Resources

The primary water resources in the City are Long Lake, Hicks Lake, Pattison Lake, Woodland Creek, and groundwater. Some portions of the City drain toward McAllister Creek to the east and Chambers Lake to the west.

Woodland Creek appears on the Washington Department of Ecology's Water Quality Assessment list [303(d)] for impaired water bodies for fecal coliform, dissolved oxygen, instream flow, pH, and temperature.

2.2.3 Puget Sound Water Quality Management Plan

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, RCW 90.71 established the need of a Puget Sound Water Quality Management Plan. The stated objectives of this governance are to recover the health of the Puget Sound waters by the year 2020. This Comprehensive Sewer Plan is consistent with the intended goals of the Water Quality Management Plan.

2.2.4 Geology

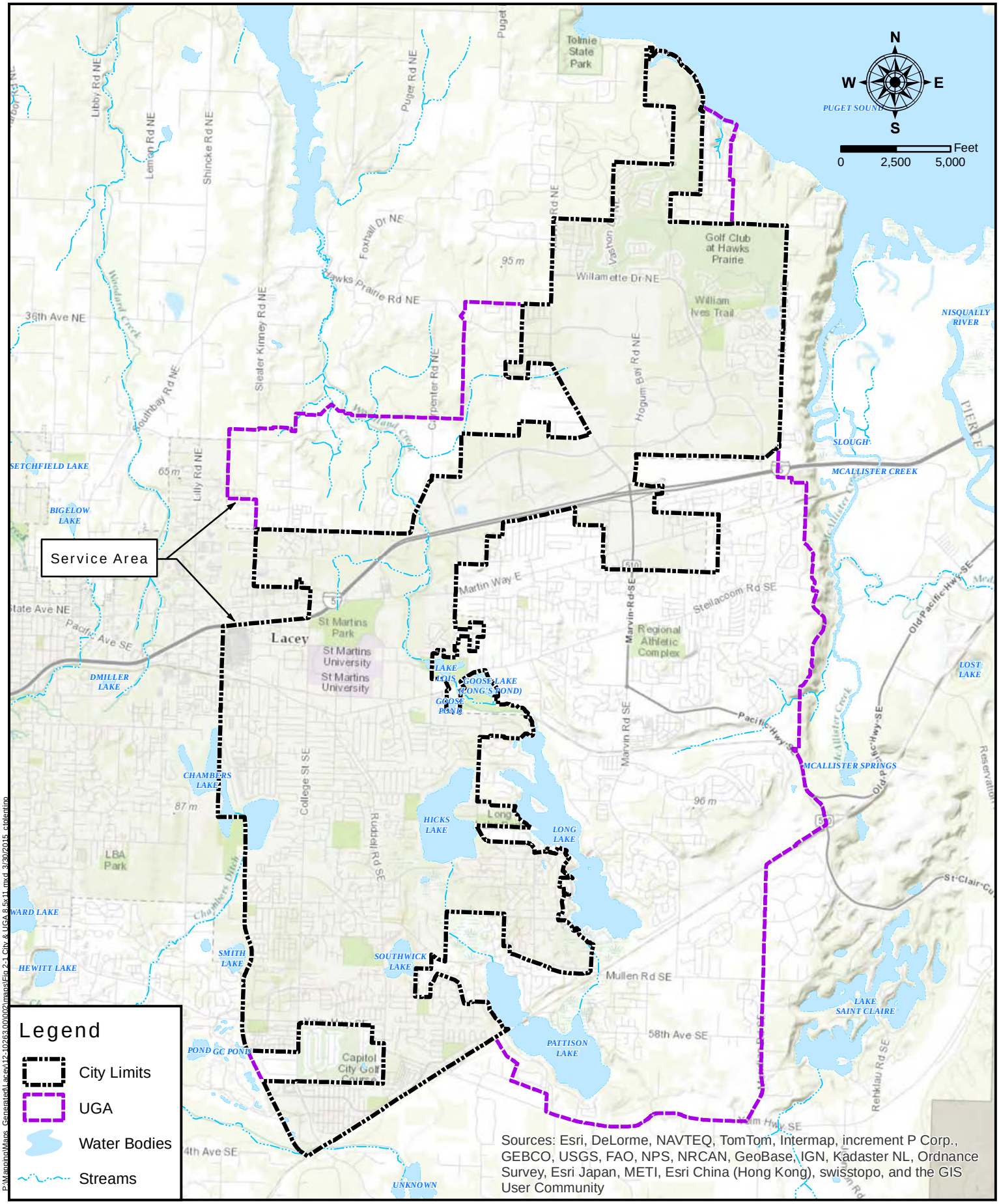
The soils in the City consist primarily of glacial outwash and glacial till.

The Everett Series is the most prevalent soil type in the City. It forms the soils located on outwash plains, terraces, and fans and occur on slopes ranging from 0 to 65 percent. These soils are glacial outwash, characterized as somewhat excessively drained, gravelly, gently undulating soil underlain by sand and gravel and found on terraces.

The Alderwood Series is the second most prevalent soil type in the City. The soil is moderately well drained and has a weakly consolidated to strongly consolidated substratum at a depth of 24 to 40 inches. Permeability is moderately rapid in the upper horizons but very slow in the consolidated substratum. These moderately well drained acidic forested soils formed in loamy glacial till and occur on rolling till plains and moraines.

2.2.5 Critical Areas

There are critical areas throughout the City which will limit development, as shown on Figure 2-2. Most of these areas are wetlands, floodplains, protected habitat for bald eagle and woodland duck, geologically sensitive areas, and aquifer protection areas.



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

P:\Mapping\Maps_Generated\Lacey\12-102630000\2\mxds\Fig 2-1 City & UGA 8.5x11.mxd 3/30/2015 ctolentino

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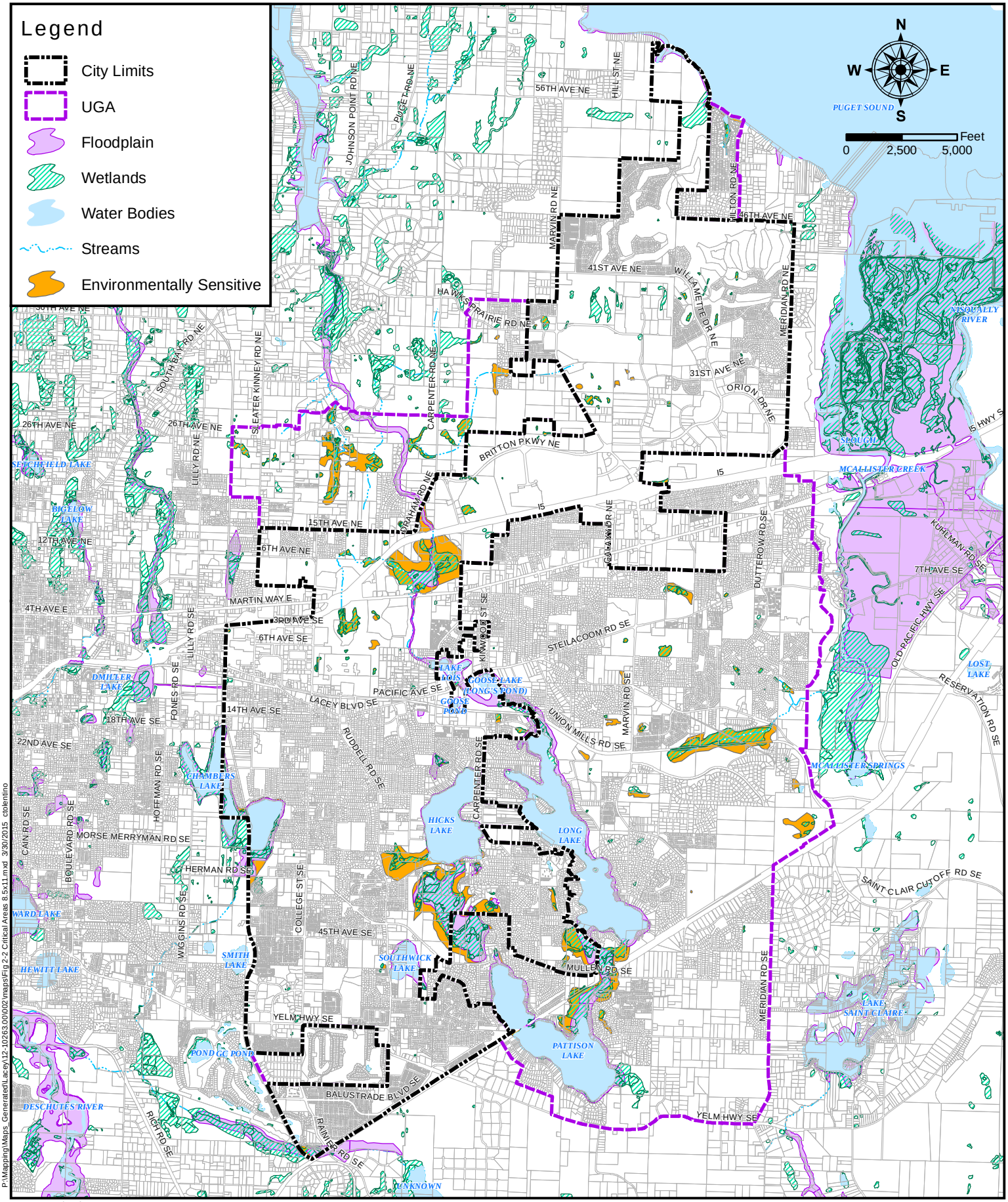
CITY & UGA MAP

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey
April 2015

Figure 2-1



P:\Mapping\Maps_Generated\Lacey\12-10263.000002\maps\Fig 2-2 Critical Areas 8.5x11.mxd 3/30/2015 ctolentino

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CRITICAL AREAS
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City of Lacey
April 2015

Figure 2-2

2.2.6 Endangered Species Habitat

Several fish species are present in Woodland Creek and McAllister Creek. Known species and their endangered species status are listed in Table 2-1. Additionally, bald eagles and woodland ducks are listed species in the area, and they have protected habitat areas along Woodland Creek and adjacent to Hicks Lake, Long Lake, Southwick Lake, and Pattison Lake.

Table 2-1 Species Present

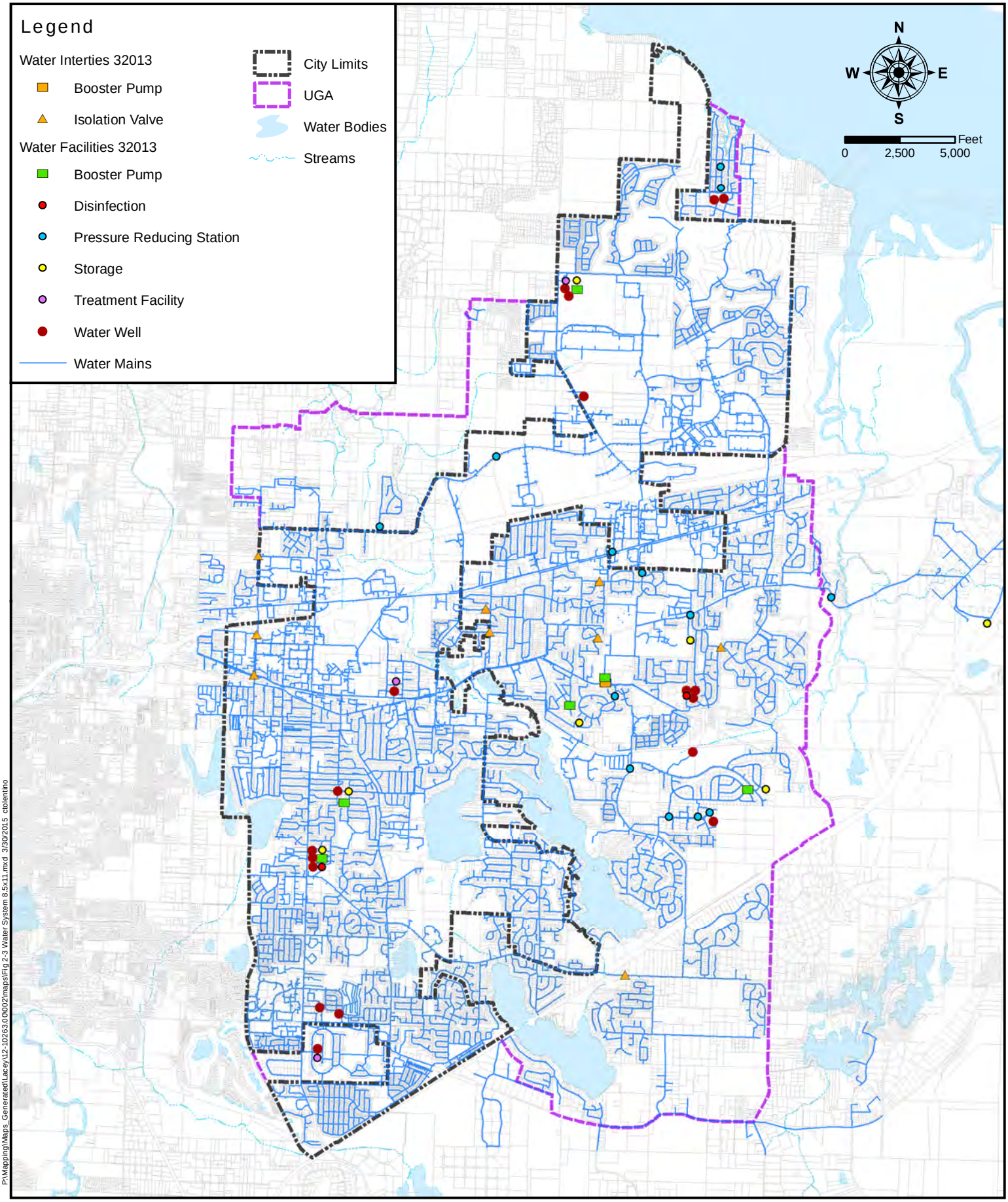
Species	Woodland Creek	McAllister Creek	State Status	Federal Status
Chinook	Yes	Yes	Candidate	Threatened
Coho	Yes	Yes	None	None
Chum	Yes	Yes	None	None
Pink	-	Yes	None	None
Sockeye	-	Yes	None	None
Steelhead	Yes	Yes	None	Threatened

2.3 Water Supply System

Information regarding the City's water system was taken from the *Draft City of Lacey Comprehensive Water Plan*, dated June 2011.

A majority of the City's water supply comes from 20 active wells. The location of wells, reservoirs, and main transmission lines are shown on Figure 2-3. The City also maintains a supply intertie with the City of Olympia and nine emergency interties with the Olympia, Thurston County PUD, Pattison, and Meadows water systems; however, the City would like to obtain new sources of water and phase out use of the Olympia intertie. The City currently operates seven storage facilities with a combined storage of 13.1 million gallons.

The water system consists of the following pressure zones: 188, 211, 224, 275, 337, 375, 400, 422, and 460.



P:\Mapping\Maps_Generated\Lacey\12-10263.00002\maps\Fig 2-3 Water System 8.5x11.mxd 3/30/2015 ctolentino

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WATER SYSTEM MAP

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey
April 2015

Figure 2-3

2.4 Growth Management Act

The State of Washington adopted the Growth Management Act with the intent of concentrating most new development and population gains within the urban areas of the more populous and rapidly growing counties. State and local governments are required to define an urban growth area boundary within which urban services like sewers are provided, and any new parcels created outside that boundary must be at a very low density with sufficient acreage to support on-site sewage disposal systems conforming to Department of Health regulations.

Only two exceptions to the prohibitions of sewers outside the UGA are recognized under state law (per RCW 36.70A.110(4) and WAC 365-196-320(1)(c)):

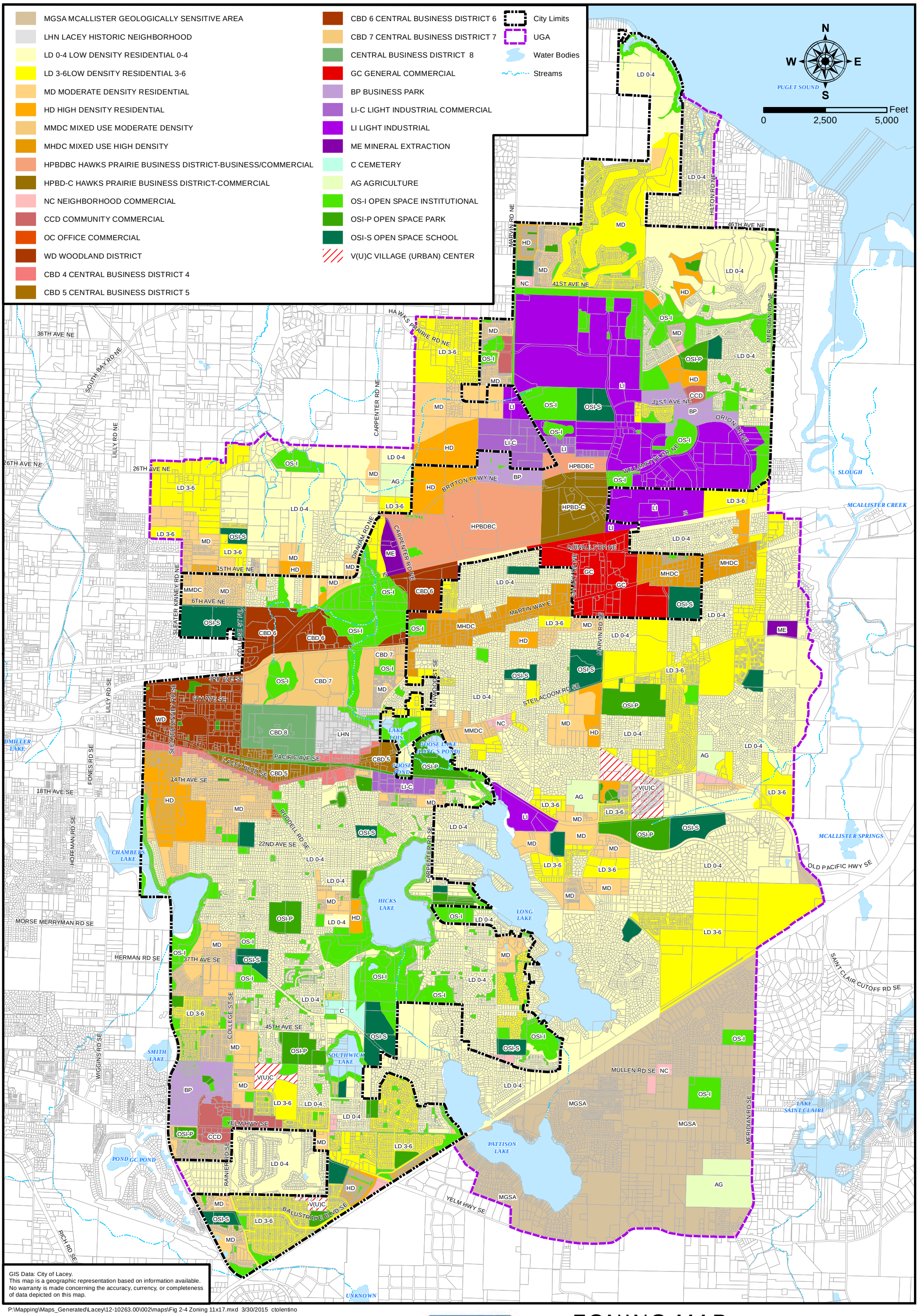
- Public schools outside the UGA can be served by sewers, but are not required to be served.
- Areas of existing development outside the UGA where sufficient on-site sewage disposal systems have failed as to create a “severe public health hazard” can be served by sewers.

Sewers provided in either of these cases can be satellite systems limited to serving just the qualified and defined parcels, or a sewer extension can be ‘tight-lined’ to convey wastewater from the qualified and defined parcels into the UGA for connection to an existing sewer system.

2.5 Land Use and Zoning

The City boundaries and the boundary of the UGA are currently established as described in the *2003 City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area*.

Zoning in the City is shown on Figure 2-4.



P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 2-4 Zoning 11x17.mxd 3/30/2015 ctolentino

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ZONING MAP

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey

April 2015

Figure 2-4

Chapter 3 Existing & Future Population Forecasts

3.1 General

Population and employment forecasts for the City's service area have been independently developed by the Thurston Regional Planning Council (TRPC) for each mini-basin through 2035. TRPC is a regional council of governments in Thurston County, Washington, which carries out regionally focused plans and studies. TRPC provides regional statistics, trends, maps, and analyses such as population and employment forecasts. These forecasts are to be used for planning efforts that impact both regional and local growth.

TRPC population baseline estimates and forecasts are based on a dwelling unit database; this allows for parcel-level estimates that can easily be aggregated to mini-basin geographies. TRPC also maintains a database of total employment parcel-level estimates; while these data are confidential and suppressed at small-scale geographies, TRPC can release them if they are aggregated to larger geographies such as mini-basins.

3.2 Residential Population

Small Area Estimates, provided in TRPC's 2011 Profile, show that population in the City and Urban Growth Area (UGA) has grown an annual average of 2.7 percent since 1995. According to TRPC estimates, the 2010 population for the City and the UGA was 75,611. TRPC updated their population forecasts in Fall 2012 and provided draft forecasts in five-year increments, both for the total service area and for each mini-basin. Forecasts for target years 2018 and 2032 were calculated based on linear interpolation between the increments. Based on these data, the City and its surrounding UGA will increase by an average of 1,300 new residents per year through 2035.

A build-out population capacity was estimated; however, these numbers were calculated only for the purposes of modeling maximum sewer infrastructure capacity and are not intended to depict a maximum allowable population. TRPC calculates total capacity according to number of dwellings. A person per dwelling ratio, extracted from the 2035 population forecast, was applied to the capacity as expressed in dwellings to arrive at the build-out population capacity.

Table 3-1 provides a summary of the population forecasts for the City and its UGA through the planning horizon. Table B-1 in Appendix B provides current and forecast population for each mini-basin.

Table 3-1 Population Forecasts for the City of Lacey and its Municipal UGA

Year	Population	Source
2010	75,611	TRPC 2010 Estimates
2015	79,727	TRPC 2012 Draft Forecast to 2035
2018	85,098	Linear interpolation of between 2015 and 2020 data points from the TRPC 2012 Draft Forecast to 2035
2020	88,679	TRPC 2012 Draft Forecast to 2035
2030	101,582	TRPC 2012 Draft Forecast to 2035
2032	104,064	Linear interpolation of between 2030 and 2035 data points from the TRPC 2012 Draft Forecast to 2035
2035	107,788	TRPC 2012 Draft Forecast to 2035
Build-out	116,150	Theoretical estimate for modeling purposes only

3.3 Employment

Employment must be considered to accurately gauge the wastewater production from non-residential areas. According to TRPC estimates, the 2010 total employment for the City and the UGA was 29,073.

In 2007, TRPC forecast total employment out to the year 2030. TRPC advised delaying the 2030 employment forecast to 2035 to reflect current delays in employment growth due to the recent recession. TRPC's employment data include all sectors of employment, and thus are referred to as total employment. Forecasts for target years 2018 and 2032 were calculated based on a linear interpolation between reported employment in 2010 and the 2035 forecast. Based on these data, the City and its surrounding UGA will gain approximately 550 new jobs per year through 2035.

Build-out total employment capacity was estimated for the entire service area by applying the percentage of employment to population (40 percent, according to the 2035 forecast) to the build-out population capacity. The resultant percentage increase between the 2032 forecast total employment and build-out total employment capacity, approximately 27 percent, was applied to each mini-basin to estimate a theoretical build-out total employment capacity in each mini-basin. These numbers were calculated only for the purposes of modeling maximum sewer infrastructure capacity and are not intended to depict maximum allowable employment, either for the entire service area or for each mini-basin.

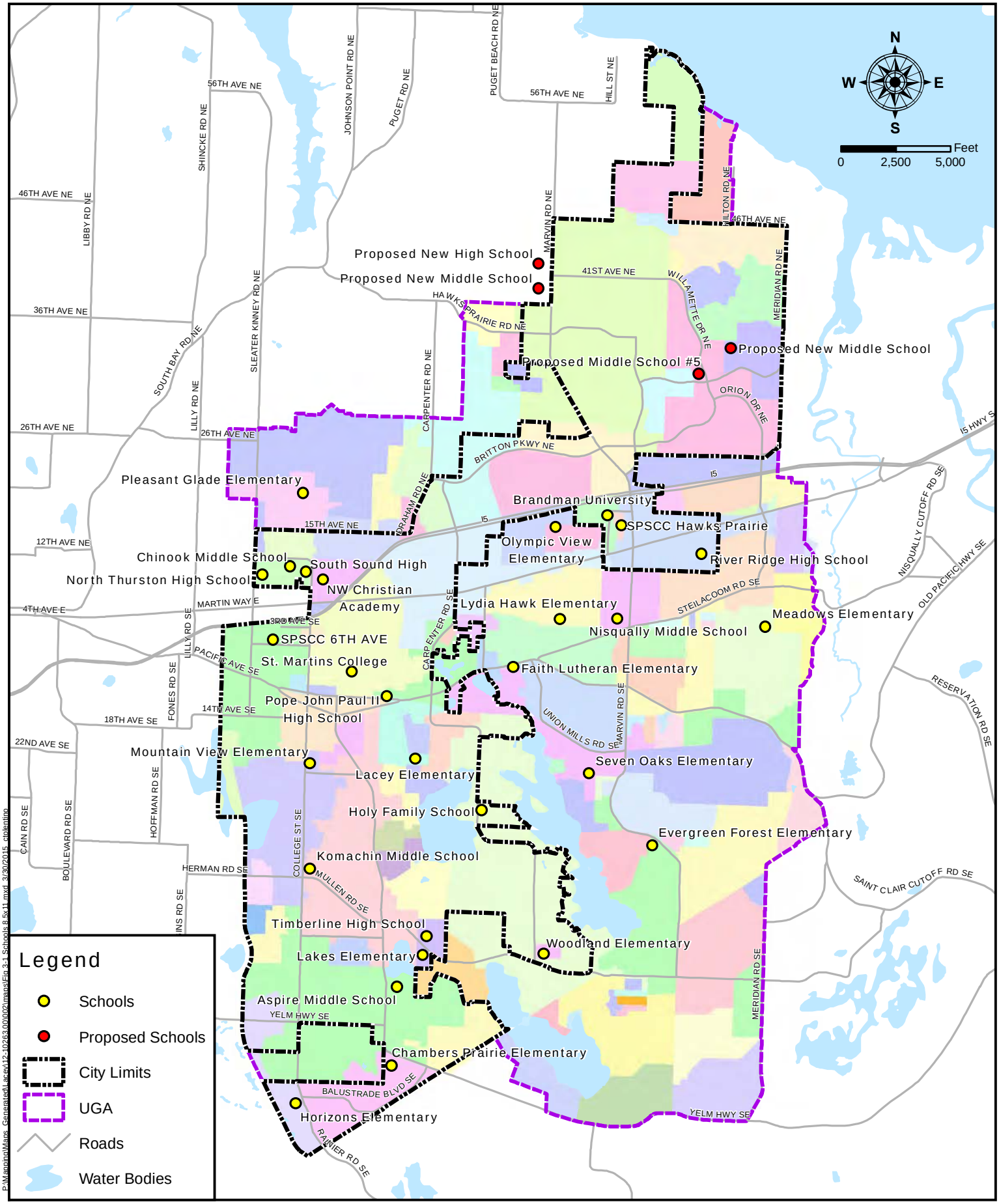
Table 3-2 provides a summary of the employment forecasts for the City and its UGA through the planning horizon. Table B-1 in Appendix B provides current and forecast employment for each mini-basin.

Table 3-2 Total Employment Forecasts for the City of Lacy and its Municipal UGA		
Year	**Total Employment**	**Source**
2010	29,073	TRPC 2010 Estimates
2018	33,509	Linear interpolation of TRPC 2007 Forecast to 2030 (adjusted to 2035)
2032	41,271	Linear interpolation of TRPC 2007 Forecast to 2030 (adjusted to 2035)
2035	42,935	TRPC 2007 Forecast to 2030, adjusted to 2035
Build-out	45,300	Theoretical estimate for modeling purposes only

3.4 Schools

The public and private schools within the City's service boundary represent concentrated locations of wastewater production. The locations of schools in relationship to the mini-basins are shown in Figure 3-1. Schools and school districts were contacted individually to discuss current enrollment figures and plans for growth. Public school districts are required to expand capacity to keep pace with population forecasts; their plans for expansion are based on a 25 year student forecast analysis and capital facilities plan. A large portion of the anticipated student growth in the City is also due to South Puget Sound Community College's plans to significantly expand the Lacey campus, growing from a current enrollment of around 2,200 students to over 10,000 by 2035. Summarized student enrollment and forecasts are shown in Table 3-3, and student forecasts for each mini-basin are shown in Table B-1 in Appendix B.

Table 3-3 Student Enrollment Forecasts for the City of Lacy and its Municipal UGA		
Year	**Students**	**Source**
2010	17,503	Conversations with individual schools and school districts.
2018	24,182	
2032	39,026	
Build-out	41,962	



P:\Mapping\Maps_Generated\Lacey\12-102630000\2\mxds\Fig 3-1 Schools 8.5x11.mxd 3/30/2015 ctolentino

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LACEY SCHOOLS
WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure 3-1

3.5 Summary

Historical and projected population, employment, and student growth is presented in Figure 3-2.

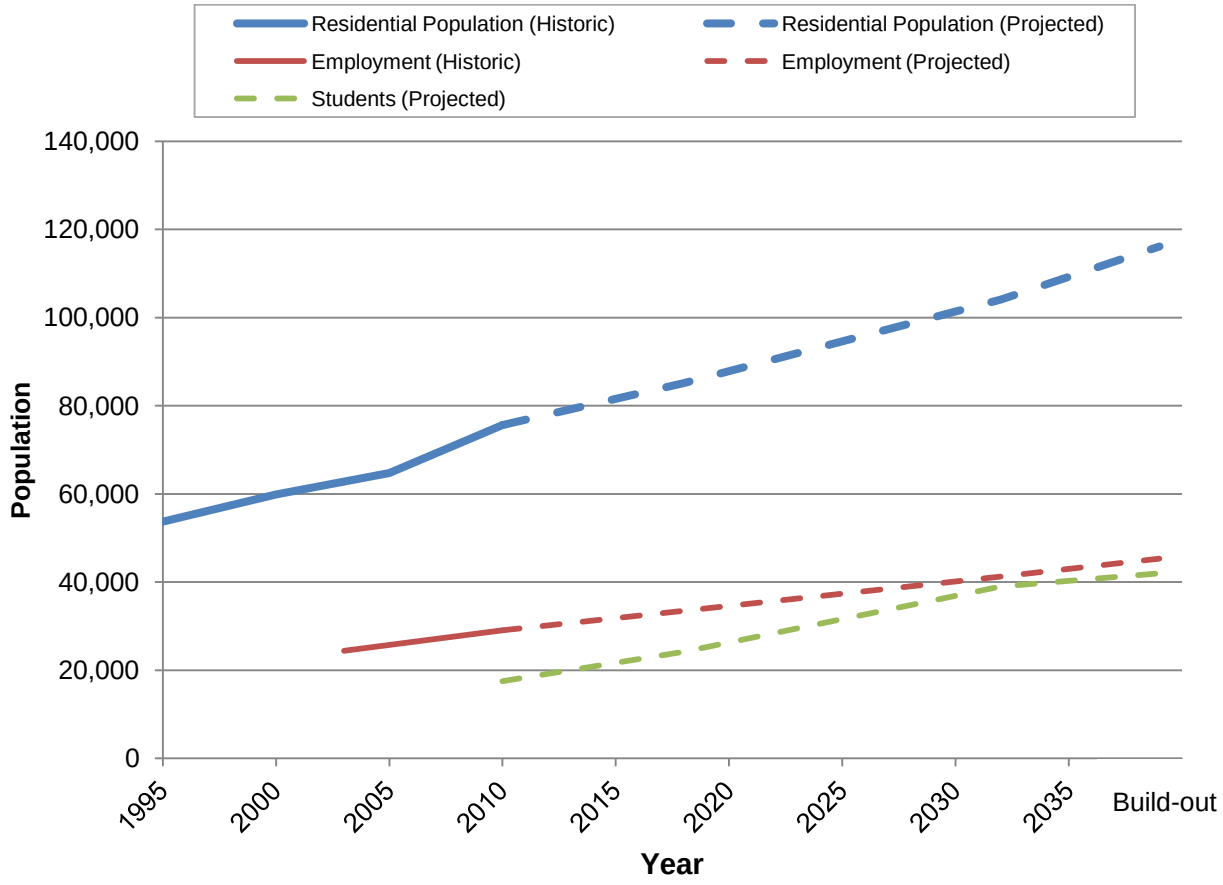

Figure 3-2 Historical and Projected Population, Employment, and Student Growth

Chapter 4 Regulations & Policies

4.1 Introduction

The City of Lacey manages its wastewater utility in accordance with established wastewater system policies. The policies provide a consistent framework for the design, operation, maintenance, and service of the wastewater system for appropriately implementing programs, designing new infrastructure, and serving additional customers. The policies defined in this plan pertain solely to the wastewater system; the City has additional land use, development, and finance policies that may specify additional requirements for development or extension of a wastewater service.

4.2 Policies

The City of Lacey follows the guidelines and standards required in the Department of Ecology's Criteria for Sewage Works Design, which is also often referred as the "Orange Book". These criteria are intended to ensure that the design of sewage collection and conveyance is consistent with public health and water quality objectives of the State of Washington. It should be noted that the Orange Book establishes minimum requirements and limiting factors used by DOE and the Department of Health in determining the approvals of these facilities.

Though the Orange Book establishes a baseline, it does not, nor was it intended to, capture all policies for a municipality.

This section addresses those other non-technical policies that the City now wishes to formalize. The following 12 policies will help guide wastewater governance for the City. These policies include:

1. Compliance with Regulations and Contractual Agreements
2. Utility Planning
3. Stormwater Separation
4. Fats, Oils, Grease and Pretreatment
5. Community Septic Systems – Ownership and Maintenance
6. Individual and Community Septic Systems – Connection to City Sewer System
7. Reclaimed Water - Priority Uses
8. Design and Construction Standards
9. Ownership and Maintenance – Gravity
10. Ownership and Maintenance – STEP
11. Ownership and Maintenance – Grinder Pumps
12. Sewer Extensions

As new circumstances arise, it may be necessary to expand or modify these policies, which may be done as an addendum to this document. Additional financial policies are included in Chapter 11.

POLICY NO. 1 – COMPLIANCE WITH REGULATIONS AND CONTRACTUAL AGREEMENTS

ISSUE

Many regulations impact the design, construction, ownership, and maintenance of a Publicly Owned Treatment Works (POTW). This includes those system facilities under the direct control of the City of Lacey and those facilities for which the City of Lacey has entered into a contractual obligation with LOTT. This includes, but is not necessarily limited to, the collection system, conveyance facilities such as interceptors and pump stations, force mains, metering facilities, odor control facilities, treatment plants, and the disposal of sanitary wastewater.

POLICY

The City of Lacey shall comply with all applicable federal, state and local regulations and honor their contractual obligation with LOTT as related to the ownership and maintenance of a sanitary wastewater system.

ADDITIONAL DETAILS AND EXPLANATIONS

Compliance with the following regulations and contracts shall include, but not be limited to, the following:

- State Environmental Protection Act (SEPA) – WAC 197-11
- National Environmental Protection Act (NEPA)
- Growth Management Act (GMA)
- Clean Water Act
- LOTT Interlocal Agreement – dated November 5, 1999 and RCW 39.34
- Clean Air Act
- Department of Ecology – RCW 173-240
- Department of Health

POTENTIAL CITY OF LACEY IMPACTS

- The City of Lacey is statutorily required to adhere to local, state, and federal regulations.
- Failure to comply could result in a financial fine or penalty and a court-mandated compliance schedule
- Cost of statutory compliance

POTENTIAL RATEPAYER IMPACTS

- No direct impacts to ratepayers

POLICY NO. 2 – UTILITY PLANNING

ISSUE

As a partner in LOTT, the City of Lacey has an obligation to provide to LOTT the expected building activity within its jurisdiction for the following calendar year. These values will be based on the Thurston County Regional Planning Council's forecast of population and employment (See Article IV, Section 4.3.b). The forecasted population and employment and the resulting wastewater flows is to be submitted to LOTT for review and comment. The frequency of the planning documents (General Sewer Plan - GSP) is not stipulated in the LOTT agreement.

POLICY

The City of Lacey shall plan for and provide service to the City of Lacey and the City of Lacey Urban Growth Area consistent with the local land use designations and population forecasts.

ADDITIONAL DETAILS AND EXPLANATIONS

- The Growth Management Act initially passed in 1990, stipulates that urban type services (such as sanitary sewers) cannot be extended into areas outside the Urban Growth Area boundaries, except under certain circumstances such as:
  - Documented Health Hazards in existing development areas
  - Protection of basic health and safety and the environment (Thurston County Comprehensive Plan, VII. Goals, Objectives and Policies, goal 1, objective A, policy 11)
  - Services are financially supportable at rural densities and do not encourage urban development (Thurston County Comprehensive Plan, VII. Goals, Objectives and Policies, goal 1, objective B, policy 7)
- The Growth Management Board assigns population and employment projections for each UGA. The City of Lacey will use these values in determining expected growth within their UGA
- These population and employment values will be included in a General Sewer Plan (WAC 173-240-050)
- Development occurring in unincorporated urban growth areas shall conform to City of Lacey design and construction standards
- The City of Lacey scheduled updates to the GSP every 8 years to coincide with mandated updates to the Comprehensive Plan
- The GSP will be prepared and submitted to the Department of Ecology and to LOTT for review and comment
- The GSP will also be submitted to neighboring cities and stakeholders for comment

POTENTIAL CITY OF LACEY IMPACTS

- Solicit and contract for planning services to prepare the GSP
- Review and distribution of the GSP to neighboring cities
- Distribution to LOTT and Department of Ecology
- Identify City of Lacey employee who is fully familiar with the assumptions, methodology and conclusions reached in the GSP. This person should be familiar with the hydraulic model and should be able to evaluate new development proposals and their impact on the collection, conveyance and treatment elements of the system

POTENTIAL RATEPAYER IMPACTS

- The costs of GSP updates would be borne by the ratepayers
- New development will be responsible for capital improvements associated with increased flows and Facility Charges

POLICY NO. 3 – STORMWATER SEPARATION

ISSUE
Direct connection of stormwater collection systems to the sanitary sewer system reduces the capacity of the sewer system and increases surcharging potential of the pipe, which can contribute to sewer deterioration and increase the potential for pipeline collapse. Some agencies allow surface water runoff collected from areas subject to high pollutant loading to discharge to the sanitary sewer. Numerous connections of this type can overload the City of Lacey sanitary sewer collection system.

POLICY
No storm drainage connections shall be made to the sanitary sewer system unless approved by the City of Lacey, and only under special and unusual circumstances. The discharges shall be defined by discharge permit, contract or other such document.

ADDITIONAL DETAILS AND EXPLANATIONS

- Stormwater shall be defined as any flow occurring during or following any form of natural precipitation, and resulting from such precipitation, including snowmelt
- The discharge of stormwater into a POTW system consumes capacity, dilutes the influent concentrations and potentially jeopardizes the integrity of the system
- The LOTT agreement addresses the prohibition against discharging stormwater into the LOTT system. This language states:
  - Stormwater, groundwater, rainwater, street drainage, subsurface drainage, yard drainage, roof drainage or unpolluted water, including, but not limited to, non-contact cooling water, or blow-down from cooling towers or evaporation coolers, shall not be discharges through direct or indirect connection to any sanitary sewer
  - With the approval of the LOTT Plant Manager, the Participant may, but shall not be required to, permit such discharge when no reasonable alternative method of disposal is available
  - If a permit is granted for the discharge of such water into a sanitary sewer, the user shall pay the applicable charges and fees and meet such other conditions from time to time by the Participant

POTENTIAL CITY OF LACEY IMPACTS

- Provisions will need to be addressed for water quality treatment from surface water collection areas subject to high pollutant loading that the City of Lacey may have previously connected to the sanitary sewer system
- Requests to connect storm water collection areas to the sanitary sewer system will have to be reviewed for conformance with the special circumstances developed by the City of Lacey
- Special fee structures may be adopted for connection of storm drainage sources to the sanitary sewer system

POTENTIAL RATEPAYER IMPACTS

- No impact
- Development required to make provisions to handle all stormwater

POLICY NO. 4 – FATS, OILS, GREASE (FOG) AND PRETREATMENT

ISSUE

As a partner in LOTT, the City of Lacey has an obligation to meet certain FOG and pretreatment standards. The intent of these limitations is to protect the ability of the POTW to properly treat the wastewater entering the plant. The objective is to prevent the introduction of pollutants to the plant that would interfere with its operations or may cause the wastewater to be inadequately treated. The purpose of the FOG and pretreatment standards is also to ensure the quality of the produced sludge and to protect the POTW personnel who may be affected by the wastewater and sludge.

POLICY

The City of Lacey shall discharge wastewater to LOTT that complies with the LOTT/City of Lacey agreement dated November 1999 and in accordance with 40 CFR, Part 403. Grease interceptors and traps shall be designed and installed in accordance with the City of Lacey's FOG policy and shall apply to all commercial wastewater customers that have food handling and preparation services or otherwise generate fats, oils and grease. The City of Lacey's Pretreatment Regulations were adopted by Resolution No. 1306 in 2008.

ADDITIONAL DETAILS AND EXPLANATIONS

Compliance with the following pretreatment standards (refer to the November 5, 1999 LOTT agreement and LMC 13.10.010) shall include, but not be limited to, the following:

- Fats, Oils and Grease, < 300 mg/l
- Hydrocarbon Based Oils and Grease, <50 mg/l
- pH must be between 6.0 and 9.0
- Concentrations of dissolved solids limitations
- Concentrations of inert suspended solids limitations
- Heavy metal discharge limitations
- Excess Strength limits, > 300 mg/l BOD, > 300 mg/l TSS
- Temperature limitations
- Prohibited discharges
  - Explosive substances
  - Solid or viscous substances
  - Noxious or malodorous liquids
  - Objectionable color such as dyes, tanning solutions
  - Pesticides
  - Infectious wastes
  - Radioactive wastes
- Compliance reporting per 40 CFR 403.6 (c).

POTENTIAL CITY OF LACEY IMPACTS

- Review of quarterly inspection reports
- Though the City of Lacey has the provision to levy fines against those that do not comply with the provisions of the FOG policy, the City of Lacey's stance is to encourage compliance rather than imposing fines
- City of Lacey employee or contractor to support the FOG program and to work with commercial users on an as needed basis

POTENTIAL RATEPAYER IMPACTS

- Costs associated with the installation and maintenance of the grease interceptor are borne by the customer
- Disposal costs of collected grease

POLICY NO. 5 – COMMUNITY SEPTIC SYSTEMS – OWNERSHIP AND MAINTENANCE

ISSUE

Community septic systems have been installed to provide temporary sewer service within the UGA of the City of Lacey. These systems may serve dozens or hundreds of single family units. Typically the ownership and maintenance requirements for these systems rest with the Homeowners Associations. Installation of new community on-site systems within the City of Lacey's UGA is discouraged.

POLICY

The City of Lacey will not approve or otherwise accept ownership/responsibility for any new large on-site or community septic systems.

ADDITIONAL DETAILS AND EXPLANATIONS

- Review and approval authority for on-site sewage systems is divided between the local health jurisdiction, Department of Health (DOH) and the Department of Ecology (DOE), based on the design flow capacities and method of treatment
- Local health jurisdictions have responsibility for the review and approval of on-site systems up to a maximum design capacity of 3,500 gpd
- Review and approval for systems with flows between 3,500 and 14,500 gpd (excluding mechanical treatment systems) is the responsibility of DOH
- Mechanical treatment systems that exceed 3,500 gpd and systems with a design flow greater than 14,500 gpd are the responsibility of DOE
- Where possible, the City of Lacey should encourage the extension of and connection to the public sewer service to any existing community on-site system for the protection of the aquifer and receiving waters
- The City of Lacey and Thurston County should work towards a joint resolution to prohibit the installation of new systems within city limits and the UGA

POTENTIAL CITY OF LACEY IMPACTS

- If the public sewer system is extended to serve the community systems, the City of Lacey may incur costs associated with upgrading existing infrastructure
- Such General Facilities might be over sized lines and pump stations to accommodate a service area larger than the community on-site parcels
- If no over sizing of the General Facilities is necessary to serve the community on-site parcels, the proponent should be financially responsible for all costs and connection charges
- The City of Lacey may be asked to facilitate and administer a late-comers agreement for those parcels that benefit from and connect to the sewer extension if done by a single party. If there are multiple parties involved in a sewer extension, a ULID is the preferred funding mechanism.

POTENTIAL RATEPAYER IMPACTS

- No impact
- Development required to make provisions to manage all community on-site systems

POLICY NO. 6 – INDIVIDUAL AND COMMUNITY SEPTIC SYSTEMS – CONNECTION TO CITY OF LACEY SEWER SYSTEM

ISSUE

Functioning individual and community septic systems exist within the UGA of the City of Lacey. These systems may serve single family and dozens or hundreds of single family units. The operation and maintenance of these systems is the responsibility of the homeowner or Homeowner's Associations. Inadequately designed and/or functioning septic systems may not be properly treating the wastewater and consequently, may be contaminating groundwater or receiving waters. What incentives can and should the City of Lacey offer to encourage abandonment of the septic system and connection to the City of Lacey's public sewer system? Should the City of Lacey offer financial assistance to help facilitate connection?

POLICY

The City of Lacey will consider the following measures to help facilitate abandonment of septic systems and connection to the City of Lacey's sewer system.

- Assist in and administer the formation of a LID/ULID
- Administer Latecomer's Agreement for those parcels benefiting from the sewer extension when only one party is involved
- Make a financial contribution to oversized General Facilities when the oversizing benefits the sewer system in excess of the required extension
- Consider extending the sewers as a City of Lacey project with assessments due at certain triggering events

ADDITIONAL DETAILS AND EXPLANATIONS

- Triggering events that would require payment of the assessment may include:
  - Sale of property
  - Application for a building permit
  - Mortgage refinance
  - Zoning change
  - Failure of the existing septic system that prompts repair or modification of the septic system
  - Customer initiated request
- The construction costs to extend the side sewers from the edge of R/W to the house connection could be included in the financing incentive package
- New structures on parcels where the property line is within 200 feet of the City of Lacey's sewer system shall be mandated to connect. This connection requirement shall apply to both the new structure and any existing structures on the parcel.

POTENTIAL CITY OF LACEY IMPACTS

- City of Lacey's credit is extended to private benefit
- Regional improvement to the water quality
- Increase in customer basis
- Delayed cash flow
- Additional administrative costs to facilitate and administer a late-comers agreement for those parcels that benefit from and connect to the sewer extension when only one party is involved

POTENTIAL RATEPAYER IMPACTS

- No impact
- Development required to make provisions to manage all community on-site systems

POLICY NO. 7 – RECLAIMED WATER – PRIORITY USES

ISSUE

The regulations governing General Sewer Plans require that a feasibility evaluation be conducted for the use of reclaimed water. Using reclaimed water can minimize water rights impacts, significantly reduce the irrigational demands on the water supply system and avert the need of more potable water infrastructure, production, and transmission. The City of Lacey is committed to promoting the use of reclaimed water. How should the City of Lacey best promote the use of reclaimed water?

POLICY

The City of Lacey will define a reclaimed water service area and establish the following conditions for implementation of a reclaimed water utility:

- All new construction in the reclaimed water service area will be required to install/extend reclaimed water lines through the project site
- New construction in the reclaimed water service area is required to connect irrigation services to the reclaimed water line, these lines will be charged with potable water if reclaimed water is not immediately available
- Reclaimed water line extensions shall be installed in accordance with City of Lacey design and construction standards
- The City of Lacey's available reclaimed water will first be used for water rights mitigation, second for irrigational demands and thirdly, for other non-potable uses as approved by the City of Lacey and LOTT's NPDES permit
- The cost of using reclaimed water shall be 30 percent lower than potable water on a per unit basis

ADDITIONAL DETAILS AND EXPLANATIONS

- Triggering events that would require the installation of a reclaimed water system might include:
  - Application for a building permit for new construction or division of land
  - Application for a building permit of an addition or modification to an existing structure on a case by case basis
  - The extension of a sewer or water line to serve a parcel(s). This would apply to both gravity and pressure line extensions
  - As mandated by future City of Lacey policy
- Invoicing for reclaimed water usage will be done by the City of Lacey and may be included with the potable water invoice

POTENTIAL CITY OF LACEY IMPACTS

- Reduction in potable water consumption
- Added administrative costs to read reclaimed water meters and create a billing for said use
- Positive mitigate water rights limitations
- Provide cash flow for this utility
- Using reclaimed water is viewed as an environmentally conscientious stewardship
- Prepare a Comprehensive Reclaimed Water Plan

POTENTIAL RATEPAYER IMPACTS

- No direct impact
- Development required to make provisions to accommodate reclaimed water usage

POLICY NO. 8 – DESIGN AND CONSTRUCTION STANDARDS

ISSUE

The City of Lacey wishes to achieve maximum uniformity in planning, engineering, and construction practices within the City of Lacey. By establishing these standards, the City of Lacey is setting the minimum acceptable standard, but these standards are not a substitute for good engineering judgment. More stringent designs may be required to address special conditions or environmental constraints. Deviation from these minimum standards will be evaluated by the City of Lacey.

POLICY

The City of Lacey has defined design and construction standards for utilities and infrastructure in the City of Lacey. These standards are included in *City of Lacey Development Guidelines and Public Works Standards,* dated September 2009*.* Chapter 7 in that document addresses the standards for the wastewater utility. This chapter is included in Appendix

ADDITIONAL DETAILS AND EXPLANATIONS

- Design and construction standards are to adhere to the Department of Ecology's orange book: *Criteria for Sewage Works Design*
- Design and Construction standards will follow provisions in the latest edition of the *Washington State Department of Transportation, Standard Specifications for Road, Bridge, and Municipal Construction*

POTENTIAL CITY OF LACEY IMPACTS

- Modifications to the City of Lacey's Design and Construction Standards will need to be updated periodically to reflect changes or additions to these standards

POTENTIAL RATEPAYER IMPACTS

- No direct impact
- Development required to incorporate the City of Lacey's Development Standards

POLICY NO. 9 – OWNERSHIP AND MAINTENANCE - GRAVITY

ISSUE
Various cities and special service districts delineate the ownership and maintenance requirements differently. Some entities assume ownership of all infrastructure that is within the rights-of-way or easements. Other agencies retain ownership that only includes the main and perhaps the tee fitting.

POLICY
The City of Lacey shall own and maintain all sanitary sewer mains located within the public right-of-way. Customers are responsible for the sewers from the structure to the main including the portion in a right-of-way or easement.

ADDITIONAL DETAILS AND EXPLANATIONS

- For all new construction a clean out or manhole shall be installed at the right-of-way or easement line
- Property owners will be encouraged to contact the City of Lacey in the event of a blockage. If the blockage is found to be in that portion of the sewer that is publicly owned, the City of Lacey will assume responsibility to clear the blockage. If the blockage is found to be in the private lateral or sewer, the responsibilities will be the property owners
- All laterals shall be a minimum of 6-inches in diameter from the main to the edge of the right-of-way or easement and shall include a clean-out

POTENTIAL CITY OF LACEY IMPACTS

- No impacts

POTENTIAL RATEPAYER IMPACTS

- No direct impact
- Property owners will be required to maintain the side sewer
- New development will be required to install a clean out or manhole at every service

POLICY NO. 10 – OWNERSHIP AND MAINTENANCE - STEP

ISSUE
Various cities and special service districts delineate the ownership and maintenance requirements differently. Some entities assume ownership of all infrastructure that is within the rights-of-way or easements. Other agencies retain ownership that only includes the main and perhaps the tee fitting. Similarly, ownership and maintenance of a STEP system has an added element associated with the STEP pump, tank, and force main.

POLICY
The City of Lacey shall own and maintain the force main, pressure service line, STEP tank, pumping equipment and control panel. This policy of ownership and maintenance is applicable for all STEP customers. The property owner is responsible for ownership and maintenance of the sewer lateral from the structure to the STEP tank.

ADDITIONAL DETAILS AND EXPLANATIONS

- Scheduling and pumping out of the septic tank, whether in a community-wide STEP system or an individual STEP assembly, shall be the responsibility of the City of Lacey
- If modifications to the electrical system of the home or dwellings from which sewage is being pumped need to be made to accommodate the pumping equipment, the cost of that modification will be borne by the property owner
- Right-of-entry to service the pumping equipment will be granted by the property owner to the City of Lacey in perpetuity or until an alternative service scheme is implemented
- Isolation valving is to be installed at the edge of right-of-way (or easement)
- The customer has a duty to notify the City of Lacey of any alarms or system failures.

POTENTIAL CITY OF LACEY IMPACTS

- No impacts

POTENTIAL RATEPAYER IMPACTS

- No direct impact

POLICY NO. 11 – OWNERSHIP AND MAINTENANCE – GRINDER PUMPS

ISSUE

Various cities and special service districts delineate the ownership and maintenance requirements differently. The ownership and maintenance of a grinder pump system has some unique requirements that merit a specific policy.

POLICY

The City of Lacey shall own and maintain the force main, pressure service line, grinder pump and sump, and control panel. This policy of ownership and maintenance is applicable for all new installations beginning January 1, 2015. Existing installations must meet certain equipment requirements, grant a maintenance easement to the City of Lacey and agree to a waiver of liability prior to the City of Lacey's acceptance of ownership and maintenance responsibilities.

ADDITIONAL DETAILS AND EXPLANATIONS

- Customer has a duty to report any alarms or system failures to the City of Lacey
- Customer is responsible for ownership and maintenance of the lateral from the structure to the grinder pump
- City of Lacey ownership and maintenance obligation is conditional on the execution of maintenance easement (right-of-entry) and a hold harmless agreement
- If the right-of-entry and hold harmless agreements have not been executed, then City of Lacey ownership and maintenance obligations will end at the service connection valve box which is typically located at the edge of the right-of-way
- If modifications to the electrical system of the home or dwellings from which sewage is being pumped need to be made to accommodate the pumping equipment, the cost of that modification will be borne by the property owner
- Isolation valving is to be installed in a service connection valve box located at the edge of right-of-way (or easement)

POTENTIAL CITY OF LACEY IMPACTS

- City of Lacey must carry an inventory of spare parts
- City of Lacey must respond to service calls

POTENTIAL RATEPAYER IMPACTS

- No direct impact

POLICY NO. 12 – SEWER EXTENSIONS

ISSUE

As new development is anticipated, a critical element is the availability of sanitary sewers. The protocol of implementing the extension of the sewer system should be clearly delineated. The type of collection system and the routing and sizing of the piping system are unique to each of the sewer basins.

POLICY

The City of Lacey will delineate the sewer basin(s) in which the development will be located and define the method by which the development will be served. The developer will configure the proposed piping systems to be consistent with the City of Lacey's delineation and method of sewering the area. A letter of sewer availability will be issued by the City of Lacey at the time of application by the developer which will identify the routing and the type of sewer extension and the fees and charges associated with the extension. Any requested deviation from the direction given by the City of Lacey shall be made in writing to the Public Works Department with an explanation and substantiation of the request.

ADDITIONAL DETAILS AND EXPLANATIONS

- Basin Delineation
  - Delineations are based on topography, existing infrastructure, zoning, and an area's ability to drain or discharge to a common location
  - Where a proposed project boarders or falls within more than one basin, the basin boundaries may be reviewed along with the specific project proposal
  - Basins are identified as either STEP or Gravity and should utilize the corresponding type of sewer collection system
- STEP Systems Extensions
  - STEP sewer extensions will only be allowed in basins that have been identified as STEP basins
  - Similarly, sewer systems other than STEP will not be allowed in STEP basins
  - Deviations from the sewer service scheme presented in the Wastewater Comprehensive Plan Update may require an evaluation using the City of Lacey's hydraulic model, the cost of which will be borne by the developer
  - High volume users may require multiple tanks
  - Tanks larger than 8,000 gallons will not be permitted except for industrial users and as approved by the Public Works Director
  - The point of discharge of a STEP system shall be evaluated for odor and corrosion potential. Appropriate measures shall be taken to control or abate any such impacts
  - The minimum size for a STEP main is 2-inch diameter
  - Pressure mains shall be designed to not exceed a maximum flow velocity of 8 feet per second
- Gravity System Extensions
  - Gravity system sewer extensions will only be allowed in basins that have been identified as gravity basins
  - Similarly, sewer systems other than gravity will not be allowed in a gravity basins to the maximum extent possible
  - Grinder pump systems may be permitted on a case by case basis where gravity service is not feasible and where the utilization of a grinder pump system will not impede the extension of the gravity system
  - Gravity collection and local pump stations serving 150 ERUs or more will be allowed in a gravity basin
  - Grinder systems may be allowed into areas serving fewer than 150 ERUs or where multiple lift stations would be required to serve fewer than 150 ERUs

  - The minimum size for a gravity main is 8 inches
  - The maximum flow depth in a gravity main shall not exceed 80% of the pipe diameter
- Sewer extensions shall be sized to accommodate maximum wastewater flows anticipated over the life of the facilities, including upstream tributary flows
- When the installation of facilities benefits the development and other properties, the developer may enter into a Latecomer's Agreement (LCA) to recoup costs from the other benefitting properties
- When the City of Lacey requires oversizing of the facilities beyond that which is necessary to serve the proposal and which does not benefit surrounding or adjacent parcels, then the City of Lacey may enter into an agreement with the developer for reimbursement through GFC credits
- Temporary wastewater facilities will only be allowed as part of a phased development plan and only when accompanied by a formal development agreement that clearly identifies the phasing and sequencing, a timeline when the phases will be constructed, the infrastructure associated with each phase and identification of the proponent who has responsibility to complete all phases
- All temporary facilities shall be constructed in conformance to the City of Lacey's current standards. The Public Works Director shall have full discretion in the decision to allow temporary facilities and may require a financial surety for the completion of the phased infrastructure

POTENTIAL CITY OF LACEY IMPACTS

- City of Lacey will administer the LCA
- City of Lacey may potentially make a contribution toward the General Facilities

POTENTIAL RATEPAYER IMPACTS

- No direct impact
- Developers will be financially impacted to install the comprehensive infrastructure

4.3 Operation and Maintenance Costs

In developing the comprehensive plan for sewers in the City, a comparison of the cost of the various service schemes was developed and which is presented in Table 4-1.

Table 4-1 Cost of Service

Type of Service	Number of ERU's					Cost/ERU (Annual)	Average Monthly Cost per ERU
	2009	2010	2011	2012	4-Year Average		
Gravity Only	6,755	6,824	6,854	6,910	6,836	$103.39	$8.62
Gravity, One LS	6,194	6,376	6,505	6,725	6,450	$151.70	$12.64
Gravity, Two LS	2,384	2,497	2,543	2,558	2,496	$200.01	$16.67
Individual STEP	2,301	2,317	2,373	2,401	2,348	$220.61	$18.38
Individual STEP, One LS	658	658	658	658	658	$268.92	$22.41
Individual STEP, Two LS	67	68	68	68	68	$317.23	$26.44
Community STEP	756	866	1,012	1,051	921	$386.79	$32.23
Total	19,115	19,606	20,013	20,371	19,776	$164.69	$13.72

The intent of this comparison was to quantify the cost of service. Not surprising the least expensive service is gravity and the most expensive is an individual STEP / Lift Station combined system. This comparative ranking of service schemes was instructive and helped define the type of service each basin was to follow.

A present worth lifecycle analysis was performed to compare the relative lifecycle costs of lift stations, grinder pumps, and STEP systems. The analysis is presented graphically in Figures 4-1 through 4-4. The costs are relative and are therefore not shown. The results of this analysis were used in developing Policy 12.

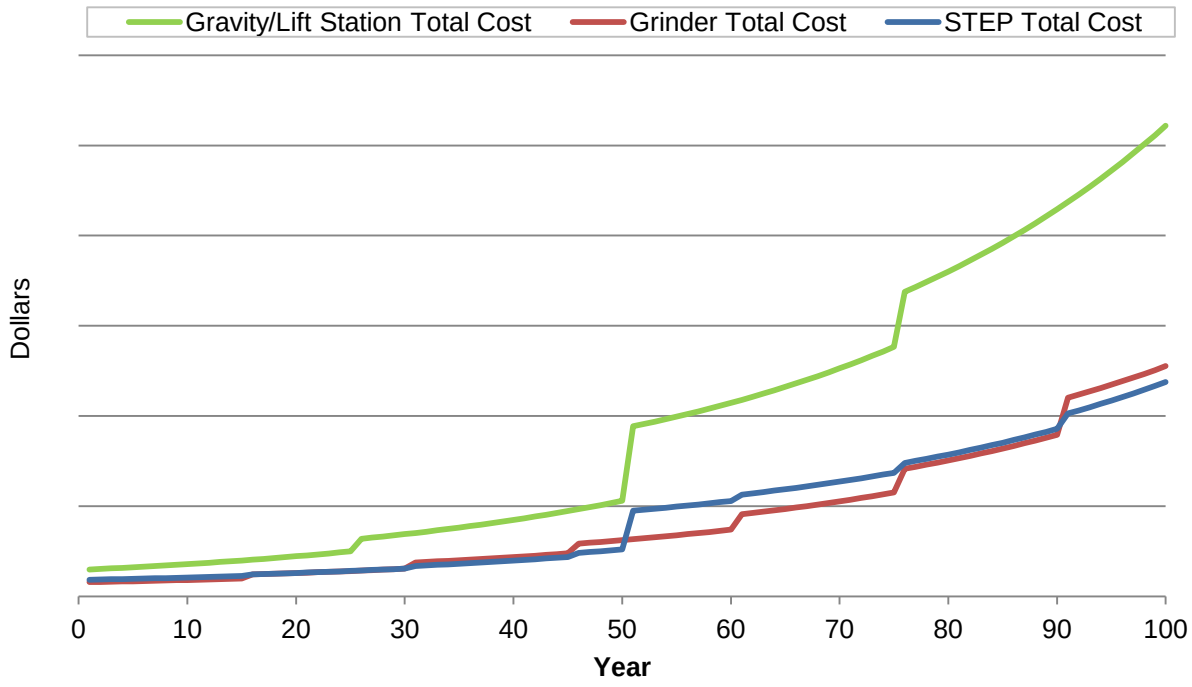

Figure 4-1 Service Cost Comparison, 50 Connections

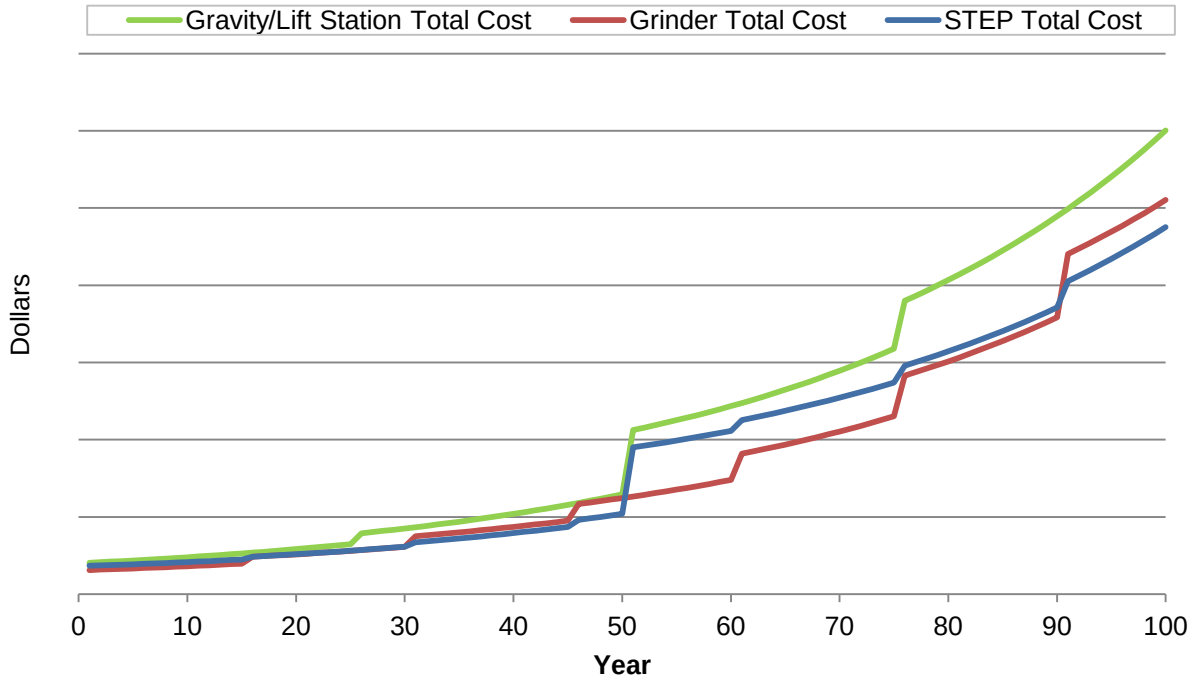

Figure 4-2 Service Cost Comparison, 100 Connections

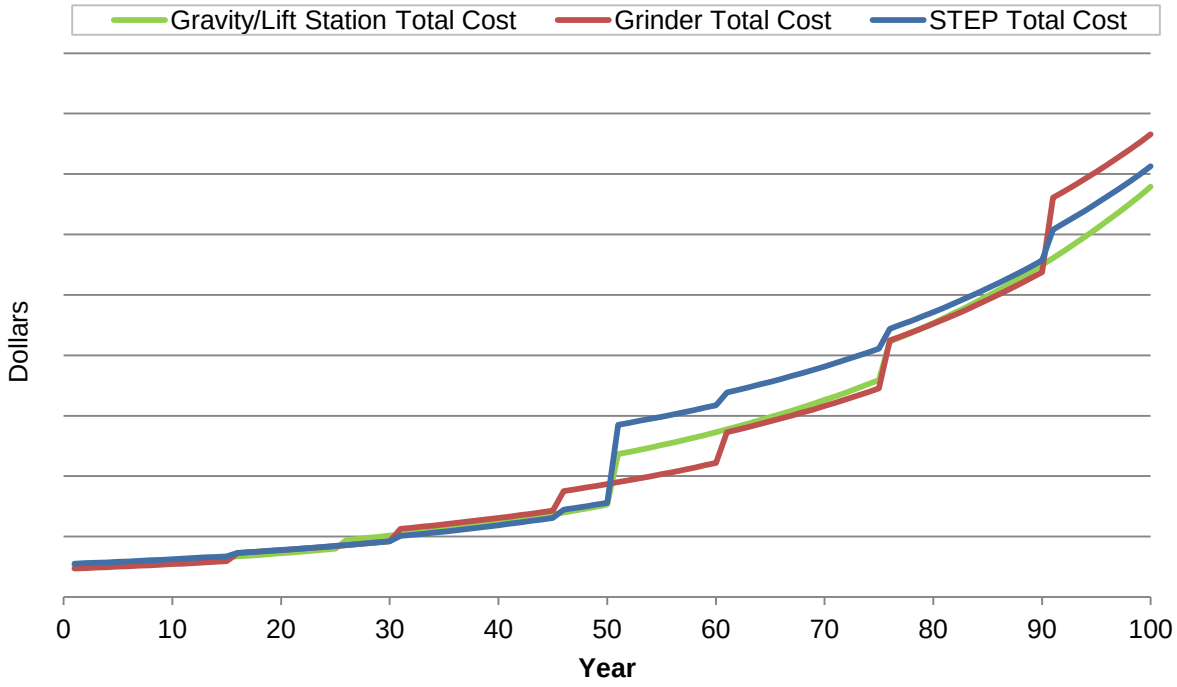

Figure 4-3 Service Cost Comparison, 150 Connections

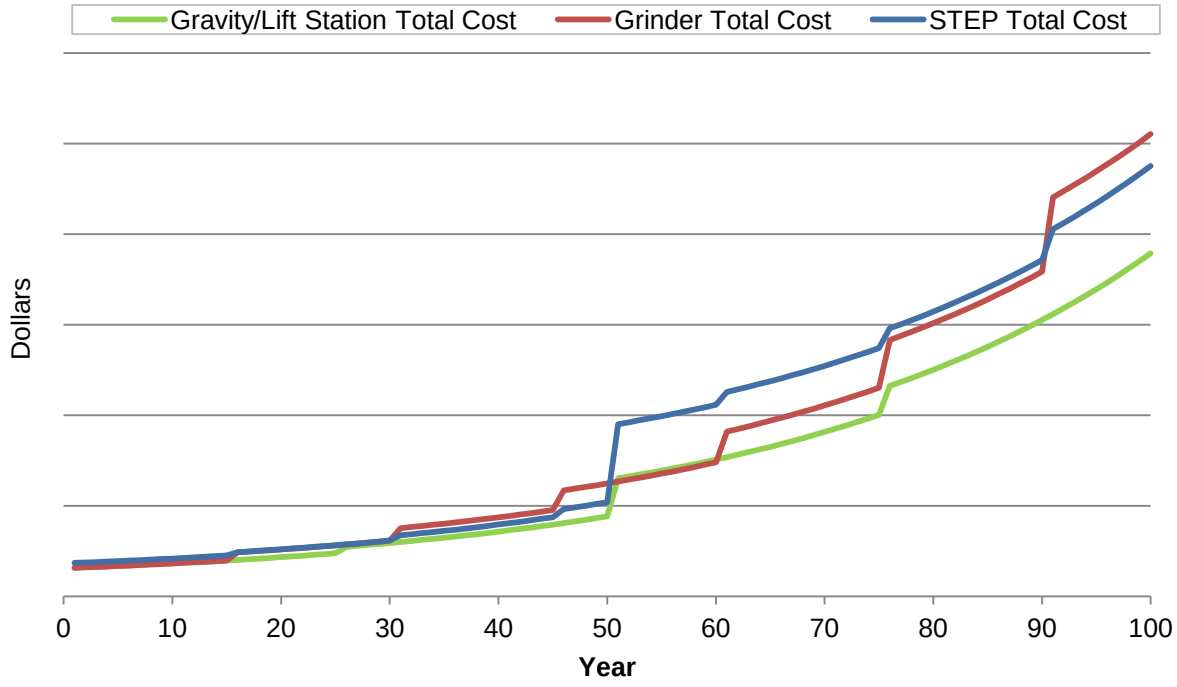

Figure 4-4 Service Cost Comparison, 200 Connections

Chapter 5 Existing Wastewater Facilities

5.1 Introduction

The City's sewer system was first installed in the late 1960's. It now serves 33 square miles of residential, commercial, and industrial customers within the UGA boundary. The sewer system is separate from the stormwater system, and consists of gravity sewers, lift stations, septic tank effluent pump systems (STEP), grinder pump systems, and on-site septic systems. The collection system conveys sewage to the Budd Inlet Treatment Plant (BITP) and the Martin Way Reclaimed Water Plant (MWRWP), both owned and operated by LOTT.

5.2 Sewer Drainage Basins and Mini-Basins

Primary basins are divided based on their ultimate discharge point to LOTT. The Martin Way basin consists of the area upstream of the Martin Way Pump Station (MWPS). The Sleater Kinney North basin consists of the area downstream of the MWPS and upstream of the connection to the LOTT sewer system. The Sleater Kinney South basin consists of the western portion of the City south of I-5.

A mini-basin is defined as an area from which the collection system drains to a specified discharge point. Delineations of mini-basins are based on existing sewer service and topography. Each portion of the system contributing to a pump station is delineated as a separate mini-basin for this analysis. Mini-basins were subdivided with assistance from the City.

The sewer system is presented as a schematic on Figure 5-1, and is shown as a map on Figures 5-2 and 5-3. A large basin map is included in Appendix C.

5.3 Wastewater Treatment

The City does not operate and maintain a wastewater treatment plant. All of the City's sewage is conveyed to the BITP and MWRWP for treatment and disposal. The agreement between the City and LOTT is included as Appendix A.

5.4 Collection and Conveyance Facilities

5.4.1 Gravity Sewer

Gravity sewer pipes in the City's collection system range in size up to 30-inch in diameter. The City owns over 743,000 feet of gravity pipe in the collection system, 74 percent of which is 8-inch diameter. Most of the sewer pipe is PVC and has a low infiltration and inflow (I/I) rate. There are a few sections of pipe with an adverse slope. The sections with adverse slopes should be replaced to reduce deposition of solids and to reduce cleaning requirements.

The sewer pipe inventory is summarized in Table 5-1; pipe lengths are approximated from GIS data provided by the City. Appendix D includes the slope, diameter, and capacity of the hydraulically modeled trunk sewer segments.

In addition to the City owned gravity sewer pipes, there are also LOTT owned and privately owned gravity pipes within the UGA boundary. These pipes are maintained by the owners, with the exception of the Martin Way gravity main, which is owned by LOTT and maintained by the City. The City currently provides line cleaning and televising services for the Martin Way line at

LOTT's request (see Interlocal Agreement included in Appendix A). These pipes are summarized in Tables 5-2 and 5-3 respectively.

FILE NAME (UPDATED BY)	PLOT DATE & TIME
S:\CAD\LACEY\12-10263 COMP PLAN\DWGS\F12-102630_FIG 5-1_EXIST.DWG (PLS)	MAR 30 2015 15:31:40

XREFS: NONE

LEGEND

- City of Lacey Gravity Main
- City of Lacey Force Main
- City of Lacey STEP Main
- LS No. — City of Lacey Lift Station
- LS No. — Mini-Basin
- LOTT Gravity Main
- LOTT Force Main
- LS No. — LOTT Lift Station

LS 43 → LS 43
LS 51 → LS 51
B, G, H, C, F, 19C, 19B, 19A
LS 19
J → K
LANDFILL → LANDFILL
GALAXY
LS 15 → LS 15
LS 49 → LS 49
MARTIN WAY
LS 32 → LS 32
MARTIN WAY EAST
LS 35 → LS 35
LS 50 → LS 50
LS 42 → LS 42
LS 34 → LS 34
LS 29, LS 26, LS 28
LS 36 → LS 36
LS 47 → LS 47
LS 48 → LS 48
LS 31 → LS 31
LS 38 → LS 38
X
LS 25 → LS 25
McALLISTER PARK
MARTIN WAY LS
TO MARTIN WAY RECLAIMED WATER PLANT
DESMOND
LS 11 → LS 11
LS 52 → LS 52
LS 12 → LS 12
U
UNION MILLS
LS 24 → LS 24
CLEARBROOK
HOMANN
LANCASTER
LS 14 → LS 14
LS 44 → LS 44
CARPENTER
LS 45 → LS 45
LS 33 → LS 33
LS 41 → LS 41
LS 40 → LS 40
LS 46 → LS 46
LS 30 → LS 30

LS 23 → LS 23
LS 27 → LS 27
WOODLAND CREEK
OLYMPIA
N
TO BUDD INLET TP (LOTT)
LS 17 → LS 17

SLEATER-KINNEY NORTH BASIN

TO BUDD INLET TP (LOTT)
R
LS 8 → LS 8
LS 2 → LS 2
LS 21 → LS 21
LS 3
PACIFIC
LS 39 → LS 39
AVONLEA

SLEATER-KINNEY SOUTH BASIN

LACEY
ALDER
RUDDELL
LS 4 → LS 4
LS 22 → LS 22
LS 18 → LS 18
LS 9
LS 20 → LS 20
LS 5 → LS 5
LS 6 → LS 6
LS 37 → LS 37
LAKE POINTE
NT PS

MARTIN WAY BASIN

BHC Consultants, LLC
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Existing Sewer Schematic
Wastewater Comprehensive Plan Update
City of Lacey
April 2015

Figure
5-1

Legend

Lift Stations
- City of Lacey LS
- LOTT LS
- Private LS

Force Main
- City of Lacey FM
- LOTT FM
- Private FM

Sewer Main
- City of Lacey Sewer Main
- LOTT Sewer Main
- Private Sewer Main

STEP System
- City of Lacey STEP System
- Private STEP System
- WWTP

Base Layers
- City Limits
- UGA
- Basins
- Parcels

N W E S

0 2,500 5,000 Feet

MARTIN WAY BASIN

SLEATER KINNEY NORTH BASIN

SLEATER KINNEY SOUTH BASIN

PUGET BEACH RD NE
PUGET RD NE
HILL ST NE
56TH AVE NE
MARVIN RD NE
HILTON RD NE
46TH AVE NE
41ST AVE NE
WILLAMETTE DR NE
MERIDIAN RD NE
HAWKS PRAIRIE RD NE
36TH AVE NE
BAY RD NE
CARPENTER RD NE
31ST AVE NE
ORION DR NE
LILLY RD NE
26TH AVE NE
BRITTON PKWY NE
15TH AVE NE
SLEATER KINNEY RD NE
6TH AVE NE
COLLEGE ST NE
MARTIN WAY E
GALAXY DR NE
3RD AVE SE
6TH AVE SE
STEILACOOM RD SE
LILLY RD SE
FONES RD SE
PACIFIC AVE SE
LACEY BLVD SE
14TH AVE SE
18TH AVE SE
UNION MILLS RD SE
HOFFMAN RD SE
RUDDELL RD SE
22ND AVE SE
OLD PACIFIC HWY SE
MORSE MERRYMAN RD SE
37TH AVE SE
SAINT CLAIR CUTOFF RD SE
WIGGINS RD SE
45TH AVE SE
MULLEN RD SE
YELM HWY SE
RAINIER RD SE
BALUSTRADE BLVD SE
RICH RD SE

LS-43 LS-19 (B) LS-19 (C) LS-19 (A) LS-51 LS-49 LS-23 LS-27 LS-17 LS-8 LS-21 LS-52 LS-11 LS-12 LS-26 LS-29 LS-28 LS-36 LS-38 LS-25 LS-47 LS-31 LS-48 LS-24 LS-44 LS-14 LS-4 LS-2 LS-3 LS-6 LS-5 LS-39 LS-22 LS-20 LS-45 LS-33 LS-40 LS-46 LS-41 LS-30 LS-9 LS-37 LS-18 LS-15 LS-32 LS-35 LS-42 LS-50

WWTP

A B C D E F G H I J K L M N P Q S T U V W X Y Z AA BB CC BC DD EE FF GG HH II JJ KK LL MM NN OO PP QQ RR SS TT UU VV WW XX ZZ

MC North Future LS-C Woodland Creek Olympia Drayam 15th Ave Galaxy Tanglewilde East Martin Way-East Ridgeview Martin Way Nisqually Bluff Desmond Pacific Clearbrook Lacey Alder Homann Union Mills McAllister Park Shady Lane Lancaster Ruddell Carpenter Avonlea Alder Glen Lake Pointe Landfill

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 5-2 Basins & Minibasins 11x17.mxd 3/30/2015 ctolentino

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BASINS & MINI-BASINS

WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure 5-2

Legend

Lift Stations
- City of Lacey LS
- LOTT LS
- Private LS

Force Main
- City of Lacey FM
- LOTT FM
- Private FM

Sewer Main
- City of Lacey Sewer Main
- LOTT Sewer Main
- Private Sewer Main

STEP System
- City of Lacey STEP System
- Private STEP System

Base Layers
- City Limits
- UGA
- Basins
- Parcels
- Water Bodies

Service Type Basin
- Gravity Sewer (Gravity/Lift Station/Grinder)
- STEP Sewer
- Gravity & STEP Sewer
- Future Gravity Sewer (Gravity/Lift Station/Grinder)
- Future STEP Sewer

N W E S

PUGET SOUND

0 2,500 5,000 Feet

MARTIN WAY BASIN

SLEATER KINNEY NORTH BASIN

SLEATER KINNEY SOUTH BASIN

56TH AVE NE
HILL ST NE
46TH AVE NE
HILTON RD NE
LS-43
BC
A
C
MC North
41ST AVE NE
LS-19 (B)
LS-19 (C)
WILLAMETTE DR NE
HAWKS PRAIRIE RD NE
36TH AVE NE
ZZ
B
D
MARVIN RD NE
E
LS-51
CARPENTER RD NE
31ST AVE NE
MERIDIAN RD NE
H
G
LS-19 (A)
ORION DR NE
HOGUM BAY RD NE
26TH AVE NE
LS-49
BRITTON PKWY NE
K
Landfill
Future LS-C
Woodland Creek
LS-23
Olympia
15TH AVE NE
Dragam
DRAHAM RD NE
J
I5
Galaxy
Tanglewilde East
LS-32
LS-35
M
L
LS-15
GALAXY DR NE
Martin Way-East
Ridgeview
LS-34
LILLY RD NE
LS-27
6TH AVE NE
15th Ave
P
Q
N
LS-17
Martin Way
MARTIN WAY E
AA
DUTTEROW RD SE
WWTP
S
T
STEILACOOM RD SE
Nisqually Bluff
LS-29
LS-26
LS-36
LS-38
LS-12
LS-11
KINWOOD ST SE
6TH AVE SE
LS-8
Desmond
V
Y
LS-52
PACIFIC AVE SE
W
X
LS-21
Pacific
R
SLEATER KINNEY RD NE
LACEY BLVD SE
Clearbrook
14TH AVE SE
Z
UNION MILLS RD SE
LS-25
LS-47
LS-31
LS-48
BB
CC
18TH AVE SE
FONES RD SE
Lacey
Alder
Homann
LS-14
Union Mills
McAllister Park
LS-24
22ND AVE SE
CHAMBERS LAKE
LS-4
Shady Lane
LS-44
COLLEGE ST SE
HOFFMAN RD SE
LS-2
EE
Lancaster
FF
HH
LONG LAKE
LS-3
LS-6
HICKS LAKE
LS-42
LS-50
GG
MORSE MERRYMAN RD SE
Ruddell
DD
Carpenter
II
37TH AVE SE
LS-39
RUDDELL RD SE
LS-5
KK
SAINT CLAIR CUTOFF RD SE
JJ
WIGGINS RD SE
Yonfea
LS-22
45TH AVE SE
NTPS
LS-45
MM
SMITH LAKE
LS-20
Alder Glen
MULLEN RD SE
LS-33
LS-40
LS-46
LS-41
LS-30
MERIDIAN RD SE
PP
LS-9
UU
OO
Lake Pointe
PATTISON LAKE
NN
LAKE SAINT CLAIRE
QQ
SS
RICH RD SE
LS-37
BALUSTRADE BLVD SE
RR
LS-18
RAINIER RD SE
YELM HWY SE
OLD PACIFIC HWY SE

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 5-3 Sewer Srvc Type 11x17.mxd 3/30/2015 ctolentino

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SEWER SERVICE TYPE
WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure 5-3

Table 5-1 City Owned Gravity Pipe Inventory	
Pipe Diameter (inches)	**Total Length (feet)**
Unknown	700
4	1,800
6	11,800
8	551,900
10	56,000
12	53,700
15	21,300
18	10,300
21	6,600
24	16,200
27	10,600
30	1,800
Total Length	**743,100**

Table 5-2 LOTT Owned Gravity Pipe Inventory	
Pipe Diameter (inches)	**Total Length (feet)**
8	300
15	1,900
18	3,200
20	800
24	3,900
27	100
Total Length	**10,200**

Table 5-3 Privately Owned Gravity Pipe Inventory	
Pipe Diameter (inches)	**Total Length (feet)**
Unknown	3,200
4	1,700
6	13,300
8	46,600
10	1,700
12	600
Total Length	**67,100**

5.4.2 Lift Stations

There were 47 lift stations within the City's sewer system at the end of 2012. 20 are STEP stations and 27 are conventional lift stations. Of these, 13 are stations that have been built since the adoption of the 2005 Plan. Table 5-4 shows general lift station information. More detailed data is included in Appendix E.

On-site emergency generators have been installed at all but 14 of the lift stations. The remaining 14 lift stations that do not have on-site emergency generators are provided with pig tails to attach portable generators. The City's goal is to replace the pig tails with on-site generators at all of the remaining lift stations.

All lift stations and the water system are connected to the City's supervisory control and data acquisition (SCADA). The City's entire SCADA system was historically handled through a single repeater located on the Union Mills reservoir until 2013. Poor communication sometimes occured due to obstructed lines of sight between the lift stations and the repeater. The repeater also had difficulty handling all of the lift stations and communication was slowed and/or interrupted due to the volume of traffic. The City has just recently completed the process of increasing the reliability of the SCADA system by installing multiple radio repeater sites. This will prevent overloading of a single facility, and improve communication lines of sight throughout the City. This work removed the existing Union Mills repeater and replaced it with three repeaters located at the Hawks Prairie, Judd Hill, and McAllister reservoirs. The City's SCADA system collects and stores operational information that is used by engineering and operations staff. Operations staff are able to receive and respond to various alarms from their mobile devices.

Vacuum Prime stations were prevalent for a short time in the late 70's to early 80's. Wet pit/dry pit stations were common from the late 60's to early 90's. Submersible stations have been the City's preference since the mid 90's and the City has made efforts to retrofit several of its vacuum prime stations with submersible pumps due to the poor reliability and unavailability of parts for many of the vacuum prime stations.

The City began allowing community STEP stations in the early 2000's as STEP sewer was extended to the east. Some of these stations were designed to eventually be converted to solid-handling submersible pump stations as STEP was viewed as a temporary solution for some areas, particularly along Steilacoom Road. The City has since stopped approving community STEP systems due to maintenance and liability concerns related to the large debris tanks.

Table 5-4 City Owned Lift Stations

Lift Station	Location	Capacity (gpm)	No. of Pumps	Pump HP	Mini-Basins Served	STEP[(1)]	Generator[(1)]
LS-2	2408 Westlake Dr.S.E.	140	2	3.8	LS-2		Yes
LS-3	2404 Golf Club Rd.S.E.	1100	2	25	LS-2, LS-3, LS-39, Avonlea		Yes
LS-4	5900 25th Ave S.E.	175	2	5	LS-4		
LS-5	3607 Ryan St. S.E.	150	2	5	LS-5		
LS-6	5611 32nd Ct. S.E.	210	2	5	LS-6		Yes
LS-8	590 College St.S.E.	100	2	2	LS-8		
LS-9	4901 Ruddell Rd.S.E.	2050	3	35	LS-9, LS-18, LS-22, LS-37, Lake Pointe		Yes
LS-11	6480 Glen Ct.S.E.	100	2	5	LS-11		
LS-12	6617 5th Ct.S.E.	100	2	2	LS-12		
LS-14	1807 Diamond Lp.S.E.	175	2	15	LS-14		Yes
LS-15	1210 Galaxy Dr. N.E.	100-130	2	3	LS-15		
LS-17	480 College St.N.E.	165	2	25	LS-17		
LS-18	4530 Yelm Hwy.S.E.	250	2	5	LS-18		Yes
LS-19	2691 Willamette Dr.S.E.	340	2	15	LS-19A, LS-19B, LS-19C, C, F		Yes
LS-20	5011 47th Ave.S.E.	100	2	5	LS-20		
LS-21	4526 Pacific Ave.S.E.	300	2	5	LS-21		
LS-22	4401 45th Ave.S.E.	360	2	7.5	LS-22		
LS-23	1922 Abernathy N.E.	180	2	23	LS-23		
LS-24	2201 Mayes Rd	56	2	3	LS-24	Yes	
LS-25	1450 Marvin Rd.S.E.	300	2	5	LS-25	Yes	Yes
LS-26	801 Avalon Ct SE	28	2	1	LS-26	Yes	Yes
LS-27	951 College Ln NE	30	2	1.5	LS-27	Yes	
LS-28	800 Pine Crest Dr S.E.	34	2	1.5	LS-28	Yes	Yes
LS-29	8502 8th Ct SE	50	2	1	LS-29	Yes	Yes
LS-30	8500 55th Ct SE	50	2	3	LS-30	Yes	Yes
LS-31	8519 Sweetbrier Lp S.E.	238	2	7.5	LS-31	Yes	Yes

Table 5-4 City Owned Lift Stations

Lift Station	Location	Capacity (gpm)	No. of Pumps	Pump HP	Mini-Basins Served	STEP(1)	Generator(1)
LS-32	9300 Martin Way NE	240	2	5.5	LS-32		Yes
LS-33	4901 Mullen Heights Dr SE	34	2	3	LS-33	Yes	Yes
LS-34	800 Torden Ln S.E.	350	2	15	LS-34		Yes
LS-35	9420 Fagan Ct NE	290	2	5	LS-35		Yes
LS-36	836 Rowland Dr SE	50	2	1	LS-36	Yes	Yes
LS-37	5601 Lintel Ln SE	1249	2	69.7	LS-37		Yes
LS-38	8341 Steilacoom Rd SE	59	2	5	LS-38	Yes	
LS-39	4201 37th Ave SE	300	2	7.5	LS-39		Yes
LS-40	8231 54th Ave SE	50	2	3	LS-40	Yes	Yes
LS-41	8201 55th Ave SE	50	2	3	LS-41	Yes	Yes
LS-42	8524 28th Way SE	63	2	1.5	LS-42	Yes	Yes
LS-43	8320 Vashon Dr NE	550	2	20	LS-43		Yes
LS-44	2414 Pleasanton Ct SE	50	2	3	LS-44	Yes	Yes
LS-45	4630 carpenter Rd. SE	30	3	1.5	LS-45	Yes	Yes
LS-46	5421 Caleb Ct. SE	35	2	3	LS-46	Yes	Yes
LS-47	8514 15th Ave SE	50	2	0.75	LS-47	Yes	Yes
LS-48	1516 Farina Loop SE	50	4	1.5	LS-48	Yes	Yes
LS-49	2365 Shady Glen Ct NE	800	2	60	LS-49		Yes
LS-50	2920 Accalla Dr SE	50	2	1.5	LS-50	Yes	Yes
LS-51	3099 Eagle Lp NE	135	2	7.5	LS-51		Yes
LS-52	6035 7th Ave SE	450	2	14.1	LS-11, LS-12, LS-52		Yes

Notes:
(1) A blank cell indicates 'No'.

5.4.3 Force Mains

The City owns approximately 80,000 feet of sewer force mains for conveying wastewater to the treatment plant or to downstream gravity conveyance piping. Pipe lengths are approximated from GIS data provided by the City. The force mains are summarized in Table 5-5 below, and are shown in the map in Appendix C.

There are also LOTT owned and privately owned force mains located in the City. These are summarized in Tables 5-6 and 5-7 respectively.

Table 5-5 City Owned Force Mains

Diameter (inches)	Length (ft)
1.25	100
1.5	400
2	2,400
3	200
4	16,700
6	20,000
8	13,300
10	13,800
12	6,600
14	2,200
18	4,200
Total Length	**80,000**

Table 5-6 LOTT Force Mains

Diameter (inches)	Length (ft)
4	2,200
12	2,300
18	7,800
Total Length	**12,200**

Table 5-7 Private Force Mains	
Diameter (inches)	**Length (ft)**
2	600
3	700
4	7,600
Total Length	**8,800**

5.4.4 STEP Systems

The City has approximately 3,900 customers served by septic tank effluent pump (STEP) systems. These operate like an on-site septic system by collecting sewage into a septic tank, and settling out solids. However, instead of discharging the effluent to a drain field, it is instead pumped into a force main which ultimately discharges to gravity conveyance piping. The septic tanks do need periodical cleaning to remove grease and accumulated solids.

There are two types of STEP systems in the City. The first type has individual septic tanks located on individual parcels, and the effluent from the tank is pumped into a shared main. The other type has a community tank which collects sewage by gravity from surrounding parcels, with the effluent then being pumped into a force main. The community STEP systems have been installed in areas that are too far from the existing sewer system to be economically feasible to serve via a gravity sewer and in areas where zoning densities made it challenging to accommodate individual STEP systems.

Several of the City's community STEP systems were installed as a temporary method of providing sewer service in areas where the infrastructure needed to provide gravity service had not yet been installed. These systems were designed to easily bypass the community STEP system and to connect directly to a future gravity main. Unfortunately many of these installations have become somewhat permanent. Since the City relies heavily on developer funded projects to expand its collection system, the more of these temporary systems that are built the less likely it is that a gravity system will be extended to these areas without a City funded project. Maintenance crews have also noted that regular cleaning of the large 20,000 - 50,000 gallon debris tanks can be a very difficult task. For these reasons the City has decided to no longer approve community STEP systems unless no other alternative exists. The City would like to look at options for eliminating as many of these stations as feasible.

The STEP mains vary in size from 1-inch to 16-inches. The City owns approximately 275,000 feet of STEP main, and there is an additional 2,500 feet of privately owned STEP main. These mains are summarized in Tables 5-8 and 5-9.

5.4.5 Individual Grinder Pumps

The City has approximately 100 customers served by individual grinder pump systems. These systems consist of a relatively small pump basin where the customer’s waste stream is ground to a slurry and pumped through small diameter force mains to the gravity system. These systems are best used in gravity basins where individual or small groups of customers are unable to discharge directly to the gravity system because of their local topography. Grinder systems do not tend to develop significant odor problems due to the reduced residence time of the waste stream, provided that force main lengths are relatively short and properly sized.

However, the deposition of solids is a concern if scouring velocities are not reached on a regular basis. Grinder systems fill a similar role to that of STEP systems, where grinder systems tend to be better suited to smaller basin sizes with shorter distances to a gravity out fall, and STEP systems are better suited to larger basins that have a longer distance to the gravity out fall, require more flexibility in the sizing of force mains, and can take advantage of centralized odor control facilities. Historically, the City has chosen to limit the use of grinder systems and has only approved their use on a case by case basis. Past practice has been that grinder systems are privately owned and maintained, whereas STEP systems are typically owned and maintained by the City. This stance has led to several cases of poorly performing installations, particularly in custom built commercial applications. The City is considering revising its policies relating to grinder systems, which is discussed in Chapter 4.

Table 5-8 City Owned STEP Mains

Diameter (inches)	Length (ft)
1	1,600
1.15	100
1.25	200
1.5	800
2	129,600
2.5	2,000
3	23,600
4	45,500
6	29,400
8	25,500
10	5,100
14	5,800
16	5,900
Total Length	**275,200**

Table 5-9 Privately Owned STEP Mains

Diameter (inches)	Length (ft)
2	1,100
3	800
4	700
Total Length	**2,500**

5.5 Odor Control Facilities

The City has 8 active odor control facilities to mitigate odor complaints and reduce corrosion associated with sewer gases. Bioxide® is injected directly into STEP force mains at 5 locations. There are 3 active soil biofilter air-scrubbing/aeration systems. There are also 6 inactive odor control facilities. A summary of the odor control facilities is listed in Table 5-10.

Table 5-10 Odor Control Facilities

Facility Number	Address	Type	Active/Inactive
1	6620 Carpenter Road SE	Chemical Injection	Active
2	9165 31st Avenue NE	Chemical Injection	Active
3	6100 Stockton Street SE	Chemical Injection	Active
4	5800 Rumac Street SE	Chemical Injection	Active
6	4905 Ruddell Road SE	Soil Filter Bed	Active
8	6120 Thornbury Court SE	Aeration/Soil Filter Bed	Active
10	4031 Campus Green Drive NE	Aeration/Soil Filter Bed	Active
12	4119 Ingleside Loop SE	Chemical Injection	Active
5	Nelson Street SE	Soil Filter Bed	Inactive
7	3065 Hogum Bay Road NE	Soil Filter Bed	Inactive
9	6200 61st Avenue SE	Soil Filter Bed	Inactive
11	800 Torden Lane SE	Chemical Injection	Inactive
13	8320 Vashon Drive NE	Chemical Injection	Inactive
14	2365 Shady Glen Court SE	Chemical Injection	Inactive

Historically residents in areas where sewer force mains discharge into manholes have registered more frequent odor complaints. City staff takes all complaints very seriously and strive to respond and address all odor issues. The odor complaints are concentrated near manholes where STEP effluent is discharged into downstream gravity systems. Odors are typically caused by the formation of hydrogen sulfide in sewers. Hydrogen sulfide is formed when wastewater is deprived of oxygen for an extended period of time. This is especially prevalent with STEP systems. Maintenance crews monitor hydrogen sulfide levels at force main outfalls to gage the effectiveness of the City's odor control facilities. When released into the atmosphere in manholes and partially full sewer lines, the hydrogen sulfide combines with water vapor to form sulfuric acid, which is corrosive to concrete.

Hydrogen sulfide is a colorless, inflammable compound with the characteristic odor of rotten eggs. In addition to the odor problems, it can and does cause corrosion problems in the collection system downstream of the STEP system discharges. Concrete facilities and metal appurtenances are primarily impacted. Since most of the newer sewer piping is constructed of PVC, most of the degradation is observed in concrete manhole structures. The 1999 Plan listed a partial inventory of manholes that were evaluated for corrosion problems caused by low dissolved oxygen levels and the formation of hydrogen sulfide. Field investigations of manholes were not conducted for the 2005 Plan Update. Since then, the City has rehabilitated several deteriorated manholes and sections of concrete pipe along the Sleater Kinney corridor. The City televises pipes in suspect areas on a regular basis to monitor for corrosion and other potential issues. The use of Bioxide® has reduced hydrogen sulfide levels and is expected to reduce future corrosion as a result.

5.6 On-Site Septic Systems

There are approximately 10,200 on-site septic systems within the UGA boundary. There are ongoing discussions with LOTT, Olympia, Tumwater, and Thurston County to convert septic systems to sewer to reduce groundwater contamination. In particular, Woodland Creek water quality is suspected to have been negatively impacted by failing septic systems in the area.

In the "Current Conditions Report Woodland Creek Pollutant Load Reduction Project" dated February 2007, the Woodland Creek Estates and Covington septic systems are identified as contributing to high fecal coliform loads to Woodland Creek. These septic systems are in the process of being converted to STEP systems to reduce fecal coliform loading. The STEP piping has already been installed and services are in the process of being connected. Work should be completed by 2014.

Tanglewilde and Thompson Place are also suspected of contributing to poor water quality due to the density of the neighborhoods and soils with high infiltration rates.

Future septic system to sewer conversion is expected to occur at a rate of 2% per year, or approximately 200 septic systems per year on average. All new development, which is estimated to be all future population growth, occurring within the City limits is assumed to connect to the sewer system. Figure 5-4 shows the septic systems within the City.

Existing septic systems that have failed or otherwise require significant upgrades/repairs and have access to a public sewer within 200 feet of the property are required to connect to the public sewer system at that time. If the public sewer is located more than 200 feet away from the property, then the owner may repair the existing septic system, provided there are no other environmental or public health considerations that would prohibit the use of a septic system in that location.

Legend

Lift Stations
- City of Lacey LS
- LOTT LS
- Private LS

Force Main
- City of Lacey FM
- LOTT FM
- Private FM

Sewer Main
- City of Lacey Sewer Main
- LOTT Sewer Main
- Private Sewer Main

STEP System
- City of Lacey STEP System
- Private STEP System
- WWTP

Base Layers
- City Limits
- UGA
- Basins
- Minibasins
- Parcels
- Septic Tank Parcels

N W E S

0 2,500 5,000 Feet

MARTIN WAY BASIN

SLEATER KINNEY NORTH BASIN

SLEATER KINNEY SOUTH BASIN

GIS Data: City of Lacey.
Septic Tank Parcels: Thurston County
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 5-4 Septic Tank Locations 11x17.mxd 3/30/2015 ctolentino

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SEPTIC TANK LOCATIONS
WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure 5-4

Chapter 6 Wastewater Flow Characteristics

Wastewater flow data recorded at various locations in the City's wastewater collection system for the years of 2007 through 2011 are analyzed to determine current wastewater flow characteristics such as unit flows, I/I rates, and peaking factors.

LOTT has developed the following reports used in preparing this chapter:

- *2010 Flows and Loadings Report*, LOTT, October 2010
- *2010 Inflow & Infiltration and Flow Monitoring Report*, LOTT, October 2010
- *2011 Inflow & Infiltration and Flow Monitoring Report*, LOTT, February 2012

6.1 Existing Wastewater Flows

LOTT has eight wastewater flow monitoring stations throughout the City, and the City has two. Flow monitoring station L7 measures flow from the Sleater-Kinney South basin. The Martin Way Pump Station measures flows from the Martin Way basin, and measures the flows diverted to the Martin Way Reclaimed Water Plant. Flow monitoring station L6 measures the flow from the Martin Way and Sleater-Kinney North basins which ultimately discharge to the Budd Inlet Treatment Plant. These flow meters allow for the measuring of all sewer flows in the Lacey sewer system. The flow monitoring stations are shown on Figure 6-1.

6.1.1 Annual Average Day Flow

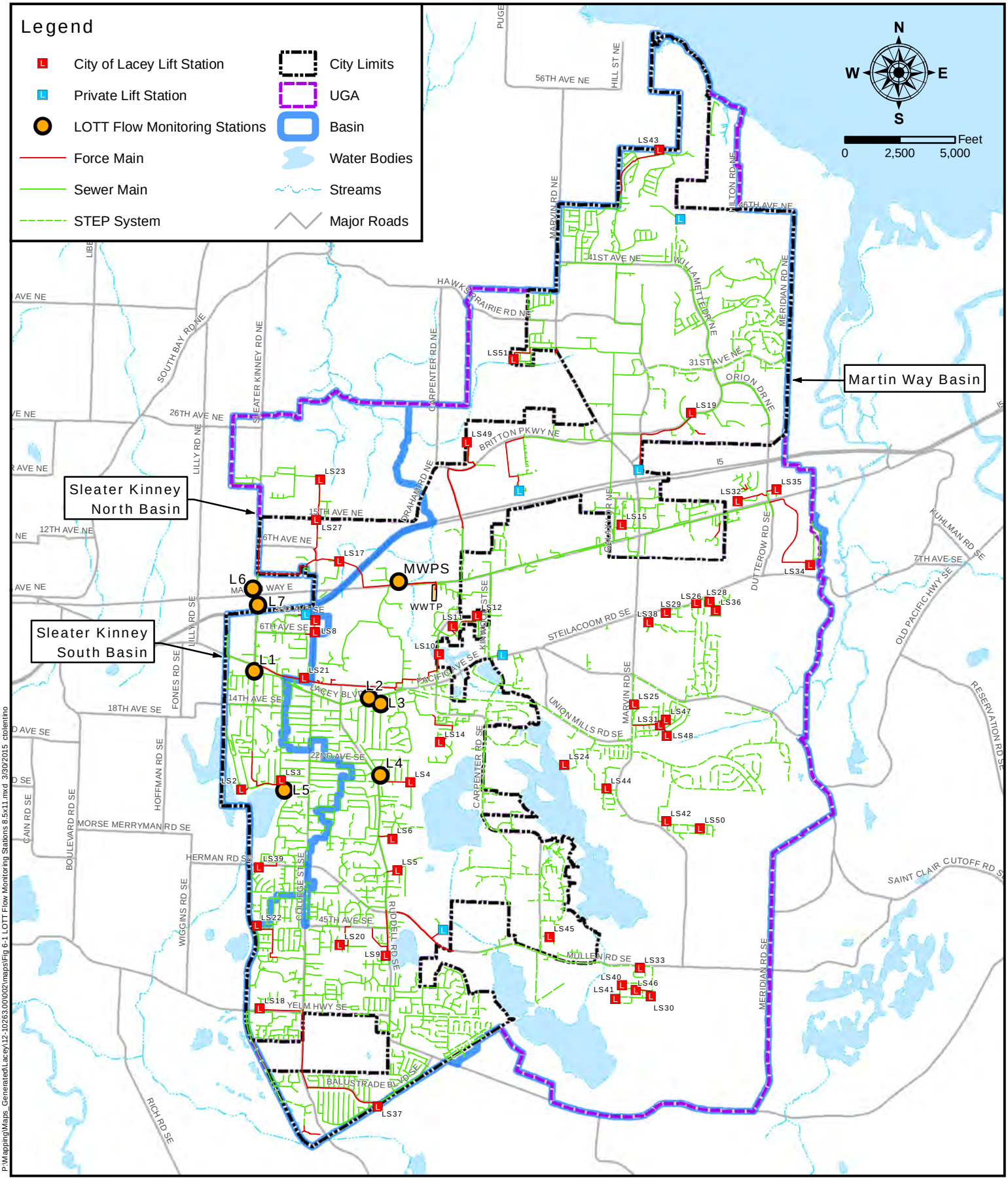
Table 6-1 summarizes annual average wastewater flow characteristics recorded at LOTT's flow monitoring stations L6 and L7 from 2007 through 2011. A population/residential connections ratio of 2.96 was derived from 2009 data from the *2010 Flows and Loadings Report* and included in Table 6-1. The average household size in the City is 2.47 people/unit.

Table 6-1 includes flow from residential, commercial, institutional, and inflow and infiltration. 85 gpcd is comparable to other communities in the Puget Sound region.

Table 6-1 Annual Average Flow Characteristics

Year	L6 Flow (mgd)	L7 Flow (mgd)	MWRWP Flow (mgd)	Total Flow (mgd)	Residential Connections	Sewered Population[1]	Per Capita Flow (gpcd)
2007	1.67	0.91	0.64	3.22	12,690	37,556	86
2008	1.74	0.81	0.61	3.16	13,211	39,098	81
2009	1.70	0.77	0.99	3.46	13,643	40,376	86
2010	1.69	0.85	1.04	3.58	14,039	41,548	86
2011	2.13	0.99	0.65	3.77	14,868	44,001	86
Average	**1.79**	**0.87**	**0.79**	**3.44**	**N/A**	**N/A**	**85**

(1) Sewered population was calculated using number of residential connections and the ratio of 2009 sewered population (obtained from LOTT) to residential connections.



P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 6-1 LOTT Flow Monitoring Stations 8.5x11.mxd 3/30/2015 ctolentino

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

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LOTT FLOW MONITORING STATIONS

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey
April 2015

Figure

6-1

6.1.2 Monthly Average Day Flow

Table 6-2 summarizes the monthly average flow measured at L6 and L7 over the five year period from 2007 through 2011.

Table 6-2 Monthly Average Daily Flow Summary

Month/Year	Flow (mgd)				
	2007	**2008**	**2009**	**2010**	**2011**
January	3.28	3.46	3.83	3.61	4.01
February	3.18	3.34	3.42	3.67	3.84
March	3.12	3.56	3.45	3.68	4.15
April	2.75	3.46	3.47	3.68	4.01
May	2.50	3.29	3.50	3.58	3.82
June	2.57	3.32	3.29	3.61	3.73
July	2.47	3.25	3.30	3.54	3.52
August	2.39	3.13	2.95	3.28	3.41
September	2.44	2.31	3.32	3.57	3.39
October	3.11	2.30	3.17	3.40	3.41
November	3.18	3.14	3.41	3.81	3.53
December	3.60	3.17	3.53	3.95	3.52
Annual Average	**2.88**	**3.14**	**3.39**	**3.62**	**3.69**

6.1.3 Peak Month and Peak Day Flow

Peak month and peak day flows recorded at the LOTT flow monitoring stations L6 and L7 from 2007 through 2011 are summarized in Table 6-3.

Table 6-3 Peak Flows

Year	Peak Month (mgd)	Month	Peak Day (mgd)	Day
2007	3.60	December	6.08	December 2
2008	3.56	March	4.25	July 1
2009	3.83	January	5.70	January 7
2010	3.95	December	5.07	December 12
2011	4.15	March	4.95	January 16
Average	**3.82**		**5.21**	

6.2 Domestic Wastewater

An estimate of the existing domestic wastewater flow component is derived in the following paragraphs.

6.2.1 Water Use Data

An analysis relating water use to wastewater flows was included in Table 10 of the *2010 Flows and Loading Report* in order to develop unit base sewer flows for the City. Basins 1, 2, 3, and 4, shown on Figure 7 of the same report, represent The City. The report is included as Appendix F. Water usage quantities were collected from the City for 2009 for sewered customers only. Baseline sewer flow was calculated using water use during winter months, when irrigation is minimal and most of the water is assumed to enter the sewer system.

Commercial and residential flows were analyzed separately to develop per capita and per employee base flow rates. The base flow was compared to summer sewer records to calibrate the sewer per capita rates. Table 6-4 lists the flows per LOTT's basins. Basins 1, 2, and 3 are approximately the same as the Martin Way basin; Basin 4 is similar to the Sleater-Kinney basin. Table 6-5 lists typical per connection wastewater generation rates

Table 6-4 Wastewater Generation Rates (2009)

LOTT Basin	Population		Drinking Water Consumption			Adjusted WW Generation Rate		Base Flow (gpd)
	Sewered Population	Sewered Employees	Total (gpd)	Residential (gpd)	Employee (gpd)	Residential (gpcd)	Employee (gped)	
1	8,006	7,346	781,111	505,792	275,319	63	38	781,695
2	5,285	729	383,712	364,793	18,919	69	26	383,288
3	19,358	3,622	1,349,432	1,285,784	63,647	66	18	1,349,262
4	5,554	8,368	504,345	372,280	132,064	67	16	504,305
Total	**38,203**	**20,065**	**3,018,600**	**2,528,649**	**489,949**	**66**	**24**	**3,018,550**

Table 6-5 Typical Per Connection Wastewater Generation Rates

Connection Type	Per Capita Sewer Rate (gpcd)	Population/Connection	Flow Rate/Connection (gpd)
Residential	66	2.47	163
Commercial	24	30.79	739

6.2.2 Student Wastewater Flows

Wastewater generated by students will be calculated per the Department of Ecology's *Criteria for Sewage Works Design* (Orange Book). The Orange Book has separate per capita flow rates for schools with showers, schools without showers, and community colleges, ranging from 10-16 gpd/student. For the purposes of this analysis, 10 gpd/student will be used.

6.2.3 Peaking Factors

Peaking factors are the ratio of the peak flow to the average annual flow. Peak month, peak day, and peak hour peaking factors are presented in Tables 6-6, 6-7, and 6-8 respectively.

Table 6-6 Peak Month Flow Peaking Factors

Year	Annual Average Flow (mgd)	Peak Month Flow (mgd)	Peak Month Peaking Factor
2007	3.22	3.60	1.12
2008	3.16	3.56	1.13
2009	3.46	3.83	1.11
2010	3.58	3.95	1.10
2011	3.77	4.15	1.10
Average	**3.44**	**3.82**	**1.11**

An average peak month flow peaking factor of 1.11 was derived for total wastewater flow.

Table 6-7 presents the derivation for the peaking factor for peak day flow.

Table 6-7 Peak Day Flow Peaking Factors

Year	Annual Average (mgd)	Peak Day (mgd)	Peak Day Peaking Factor
2007	3.22	6.08	1.89
2008	3.16	4.25	1.34
2009	3.46	5.70	1.65
2010	3.58	5.07	1.42
2011	3.77	4.95	1.31
Average	**3.44**	**5.21**	**1.52**

A peak day peaking factor of 1.52 was derived for total wastewater flow.

Table 6-8 presents the derivation for the peaking factor for peak hour flow on a City-wide scale.

Table 6-8 Peak Hour Flow Peaking Factors

Year	Annual Average (mgd)	Peak Hour (mgd)	Peak Hour Peaking Factor
2007	3.22	8.71	2.70
2008	3.16	6.63	2.10
2009	3.46	7.97	2.30
2010	3.58	7.74	2.16
2011	3.77	6.99	1.85
Average	**3.44**	**7.61**	**2.22**

A peak hour peaking factor of 2.22 was derived for total wastewater flow.

6.2.4 Diurnal Curves

Typically, sewer flows are lowest at night and highest during the morning and evening. This distribution of flow throughout the day is described by a diurnal curve. These curves are used by the computer model to simulate flow variations throughout the time period being modeled. The curves should also be in general agreement with the peaking factors developed above. The maximum factor on the diurnal curve is approximately 1.51. Multiplying this by the peak day peaking factor of 1.52 results in a peak hour peaking factor of 2.30. This is in close agreement with the Table 6-7 Peak Hour Peaking factor of 2.22.

Diurnal curves for the City's two main basins were developed by Brown and Caldwell as part of LOTT's *2010 Inflow & Infiltration and Flow Monitoring Report,* and are shown on Figure 6-2. This curve has been divided by the average daily flow rate to normalize it. The difference between the two diurnal curves likely has to do with higher infiltration rates in the Sleater Kinney basin.

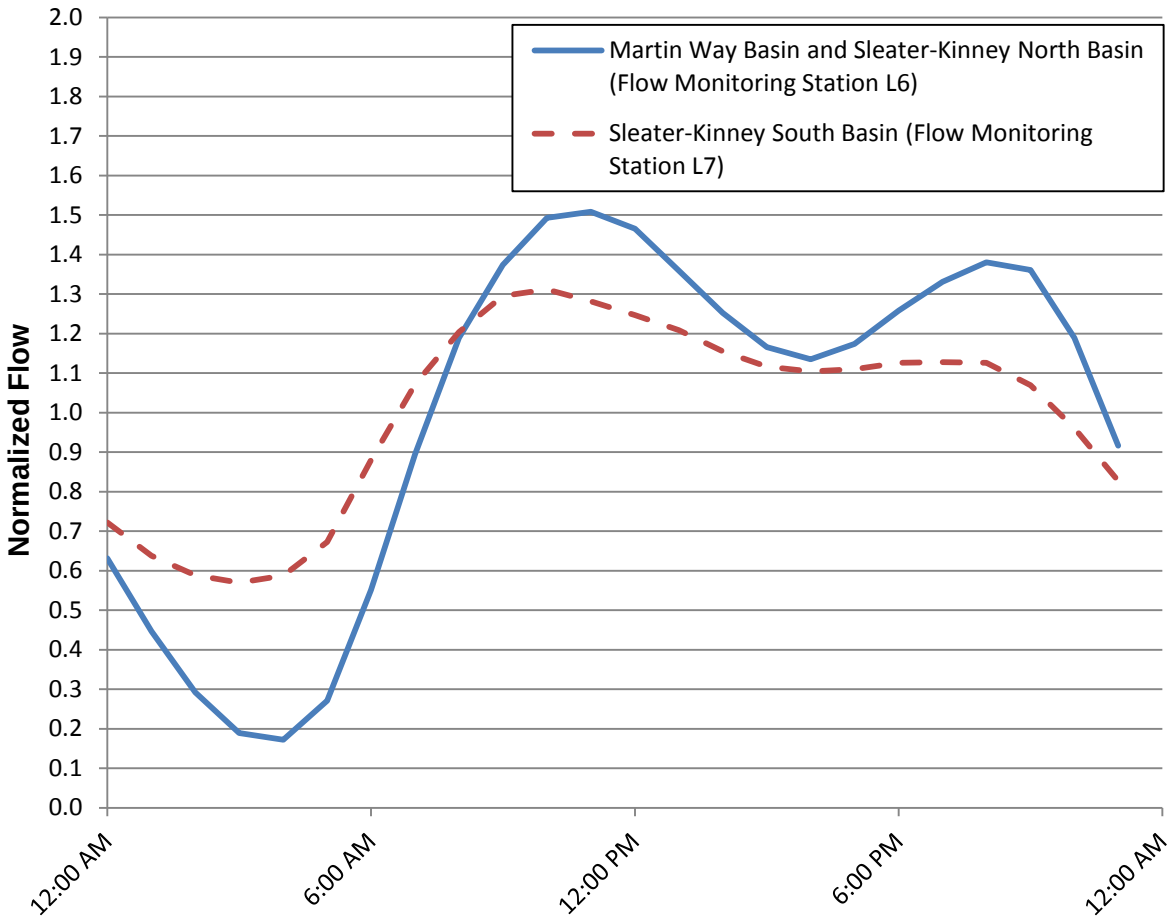

Figure 6-2 Diurnal Curves

6.3 Infiltration and Inflow Analysis

Infiltration and inflow (I/I) is the wastewater component consisting of stormwater surface runoff entering the sewer system and infiltration from storm-saturated ground conditions. Inflow is runoff entering the sewer directly, typically from storm sewer connections, basement sump pumps, roof drains and submerged manholes. Infiltration occurs as groundwater leaks into the sewer system through cracked or broken pipes and manholes, or through loose joints and connections.

The City's sewer system is fairly new in comparison with other systems in the area. As a result, most of the system has a low I/I rate.

6.3.1 LOTT I/I Study

LOTT performs an I/I study on seven year cycles such that at the end of each cycle, its entire service area is analyzed. The most recent report analyzing I/I in the City is the *2011 Inflow & Infiltration and Flow Monitoring Report* (I/I Study) prepared by LOTT and Brown and Caldwell.

The study analyzed seven flow monitoring stations in the City and compared them with population and water use data throughout the year to determine baseline sewer flows and to analyze rates of I/I.

All of the City's wastewater flows through two flow monitoring stations: the Martin Way basin through monitoring station L6, and the Sleater-Kinney basin through monitoring station L7. The difference between the average of monitored flow and water consumption in the Martin Way basin is 1 percent; however, the difference in the Sleater-Kinney basin is 25 percent, implying a high rate of I/I.

The I/I Study calculated the I/I rate in the following ways:

- Per ERU
- Per inch/diameter/mile
- Peak hour flow/base flow ratio

All of these factors were divided by a benchmark value and averaged in the benchmark ratio, so that a value of 1 or lower signifies low I/I and a value higher than 1 signifies high I/I. These parameters for the City are shown on Table 6-9.

Table 6-9 Summary of I/I Statistics

Basin	I/I per ERU (gpd/ERU)			I/I per inch-diameter/mile (gpd/idm)			Peak Hour I/I / Base Flow	Benchmark Ratio
	Average Annual	Peak Day	Peak Hour	Average Annual	Peak Day	Peak Hour		
Martin Way	8	66	103	75	607	953	1.6	0.4
Sleater-Kinney	72	279	383	965	3,715	5,106	3.0	2.5
Benchmark	20	150	250	200	1,500	2,400	2.5	1.0

6.3.2 DOE Infiltration and Inflow Thresholds

The EPA publication 'Infiltration/Inflow – I/I Analysis and Project Certification' dated May 1985 was reissued by the Department of Ecology as Ecology Publication No. 97-03. This publication established the following thresholds for possibly excessive dry weather infiltration and inflow:

- If average dry weather flow is less than 120 gpcd, infiltration is non-excessive.
- If average wet weather flow is less than 275 gpcd, inflow is non-excessive.

LOTT performed an I&I analysis in their 2011 Inflow & Infiltration and Flow Monitoring Report. The average dry weather and wet weather flows are calculated from data in that report and shown in Table 6-10.

Table 6-10 Dry and Wet Weather Flows		
Basin	**Dry Weather Flow (gpcd)**	**Wet Weather Flow (gpcd)**
Martin Way	77	81
Sleater Kinney	127	176
City of Lacey	**85**	**97**
EPA/DOE Excessive I/I Criteria	120	275

The City as a whole has low rates of I/I; however, there is evidence that the Sleater-Kinney basin has high rates of infiltration.

6.3.3 Future Infiltration and Inflow Rates

Based on the *Regional Needs Assessment Report,* (March 1, 2005, prepared by King County), as sewer systems age I/I will increase at a rate of approximately 7 percent per decade up to a maximum of 28 percent.

The purpose of analyzing buildout conditions is to ensure that new pipe installed will have sufficient capacity through the end of its useful life. Therefore, the 28 percent maximum increase of I/I will be used when modeling the buildout conditions to properly size pipes. This assumes that no repairs or upgrades are made to reduce I/I, and so will result in a conservative evaluation of capacity. When specific projects are being considered, a pre-design report should be prepared to more thoroughly analyze pipe sizing criteria for specific project conditions.

6.4 High Strength Sewage Flows

LOTT has an industrial pre-treatment program to prevent the introduction of pollutants that could interfere with treatment plant processes, impact receiving water or biosolids quality, and/or threaten workers' safety. The program is mandated by the Department of Ecology as part of LOTT's National Pollutant Discharge Elimination System (NPDES) Permit.

There are three high strength sewage customers in the City. These customers are:

- Thurston County Waste and Recovery Center (TCWRC, formerly known as the Hawks Prairie Landfill)
- Nutriom
- International Paper

LOTT monitors flows from TCWRC, Nutriom, and International Paper. These flows are summarized in Table 6-11 and were provided by the City.

Table 6-11 High Strength Sewage Flow Producers

Month	Year	TCWRC (gallons/month)	Nutriom (gallons/month)	International Paper (gallons/month)
January	2010	128,678	47,610	51,507
February	2010	116,120	73,117	52,599
March	2010	130,159	44,095	60,334
April	2010	121,931	30,324	56,452
May	2010	130,025	48,485	40,946
June	2010	125,559	89,610	45,172
July	2010	126,113	79,138	25,694
August	2010	117,264	101,646	34,588
September	2010	140,781	108,602	33,675
October	2010	126,786	12,447	40,557
November	2010	250,071	43,145	43,952
December	2010	476,207	40,048	38,612
January	2011	432,441	48,590	56,122
February	2011	213,614	81,218	59,406
March	2011	441,761	103,613	67,447
April	2011	227,953	112,185	71,853
May	2011	93,171	124,632	66,669
June	2011	100,696	124,011	59,683
July	2011	40,968	113,868	66,310
August	2011	13,958	121,692	73,124
September	2011	8,879	38,126	50,325
October	2011	11,684	17,930	51,522
November	2011	264,710	65,248	48,777
December	2011	316,890	15,282	56,826
January	2012	355,801	87,217	57,641
February	2012	256,684	125,245	60,319
March	2012	278,383	126,315	80,283
April	2012	266,423	96,051	37,041
May	2012	264,635	75,840	70,462
June	2012	233,271	81,472	67,327
July	2012	48,874	50,400	74,433
Maximum Month	-	476,207	126,315	80,283

The highest monthly flow at TCWRC during this time period was in December 2010. The TCWRC average daily flow of the maximum month for December 2010 was 15,400 gpd. The leachate is treated in an aerated leachate lagoon prior to discharge to the City's sewer system. Discharge limits can be found in the Wastewater Discharge Permit No. LA-004, located in Appendix G.

The highest monthly flow at Nutriom during this time period was in March 2012. The Nutriom average daily flow of the maximum month for March 2012 was 4,100 gpd. Industrial flow is discharged to the City's sewer system from a high strength storage tank. Discharge limits can be found in the Wastewater Discharge Permit No. MIU-LA-002, located in Appendix G.

The highest monthly flow at International Paper during this time period was in March 2012. The International Paper average daily flow of the maximum month for March 2012 was 2,600 gpd. Industrial flow is discharged to the City's sewer system from a treated water storage tank. Discharge limits can be found in the Wastewater Discharge Permit No. LA-003, located in Appendix G.

6.5 Unit Flows

The unit flows presented in Table 6-12 will be used to model the existing and future system. This assumes that I/I rates will increase as described in Section 6.3.3. This is a conservative assumption, because as sewers in the Sleater-Kinney basin known to have high infiltration are replaced and rehabilitated the I/I rate will likely reduce. New sewers with improved materials and construction methods typically have lower I/I rates. It's important to note that these peaking factors were derived for use on a City-wide scale and may not be appropriate for use when evaluating mini-basins or sub-areas.

Table 6-12 Unit Flows

Year	Annual Average Residential Flow (gpcd)	Annual Average Commercial Flow (gpcd)	Average Annual Student Flow (gpcd)	Martin Way Peak Hour I/I (gpd/idm)	Sleater-Kinney Peak Hour I/I (gpd/idm)	Peak Day Factor	Peak Hour Factor
2012	65	24	10	953	5,106	1.52	2.22
2018	65	24	10	993	5,320	1.52	2.22
2032	65	24	10	1,086	5,821	1.52	2.22
Buildout	65	24	10	1,220	6,536	1.52	2.22

Chapter 7 Wastewater Conveyance Analysis

Analysis of the City's wastewater conveyance system is a critical component in determining the suitability of the existing infrastructure and its ability to accommodate growth in the future. This chapter provides the analysis necessary for strategic, long-term infrastructure planning and development of the Capital Improvement Plan (CIP). The City's conveyance system was analyzed using an "all-pipes" hydraulic model that accurately simulates the entire wastewater collection system. This is in contrast to the City's previous wastewater plans, which only included "skeletonized" models, simulating only trunk and interceptor gravity mains. This allows for a more thorough representation of the conveyance system with more accurate loading of the projected flows developed in Chapter 6, and the simultaneous analysis of both gravity and pressure systems. The system was analyzed for existing conditions (2012), a 6-year planning horizon (2018), a 20-year planning horizon (2032), and the theoretical build-out conditions.

7.1 Study Area

The study area includes the City's entire wastewater collection network and is bounded by the City's Urban Growth Management Area (UGMA). Some LOTT owned and operated facilities have been included in areas where their performance impacts the Lacey system and where they are necessary for model calibration.

Due to the size of the City's collection system, the system was split into two hydraulically separate study areas for modeling based on where flows are discharged to LOTT's system:

- Sleater Kinney: The Sleater Kinney South Basin serves the western portion of the City, south of Martin Way and north of 45th Ave SE, the eastern boundary meanders loosely along the College St corridor. This basin discharges from the south into the LOTT owned interceptor in Martin Way at its intersection with Sleater Kinney Rd.
- Martin Way: This area includes both the Sleater Kinney North and Martin Way Basin Systems that serve the remainder of the City. The Martin Way Basin is the City's largest basin serving the entire eastern half of the city and drains to LOTT's Martin Way Pump Station. The Sleater Kinney North Basin includes the area north of Martin Way and west of Draham Road. Flows not treated at the Martin Way Reclaimed Water Plant combine with the flows from the Sleater Kinney North Basin before discharging to LOTT's system near the intersection of Sleater Kinney Road and Kasey Keller Drive.

The City's existing sewer system and mini-basin delineation is shown on Figure 7-1.

7.2 Model Software

InfoSWMM 12.0 by Innovyze was the hydraulic modeling software selected by the City to model the City sewer system. InfoSWMM 12.0 is a dynamic hydraulic model that utilizes the EPA SWMM 5.0 computer program for the hydraulic analysis calculations. The model is designed specifically for modeling urban sanitary and combined sewer systems. The current version operates within an ArcGIS (ArcMap) platform.

Legend

Lift Stations
- City of Lacey LS
- LOTT LS
- Private LS

Force Main
- City of Lacey FM
- LOTT FM
- Private FM

Sewer Main
- City of Lacey Sewer Main
- LOTT Sewer Main
- Private Sewer Main

STEP System
- City of Lacey STEP System
- Private STEP System
- WWTP

Base Layers
- City Limits
- UGA
- Parcels

Basins
- Martin Way
- Sleater Kinney North
- Sleater Kinney South

N W E S

PUGET SOUND

0 2,500 5,000 Feet

MARTIN WAY BASIN

SLEATER KINNEY NORTH BASIN

SLEATER KINNEY SOUTH BASIN

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 7-1 Basins 11x17.mxd 3/30/2015 ctolentino

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BASINS MAP
WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure 7-1

7.3 Model Development

7.3.1 Existing Sewer System

The following information was used in developing the hydraulic model of the existing sewer collection system:

- GIS information provided by the City, including the following information:
  - Pipe
    - Gravity sewers
    - Force mains
    - STEP mains
  - Manholes
  - Lift stations
- As-built drawings and anecdotal information (e.g. areas with inverse pipe slopes) from the City
- Previously developed hydraulic models representing portions of the collection system (e.g. Pump Station 9, HYDRA and STEP system models)
- Lift station data sheets

Additional detail on the existing sewer system is included in Chapter 5.

7.3.2 Gravity Sewers

Gravity sewers make up the majority of the City's wastewater collection system. The City's entire collection system, including pipes, manholes, and other hydraulically significant features were imported into the model from the GIS database provided by the City. Sewer lines ending in clean-outs or similar features were typically omitted to reduce the size of the model to below the 4,000 pipe limit of the City's current software license, and to increase performance. Flows from these areas were loaded to the next available downstream node. Engineering judgment was used to ensure the accuracy of the model was retained.
All gravity pipes are connected at manholes, which are represented as nodes in the model. Sewer flow is loaded directly to these nodes to simulate service connections, inflow, and infiltration. The resulting model was compared against the City's previous models and inconsistencies where investigated. Record drawings were used to evaluate pipe invert elevations in areas where abnormal or adverse grades were present.

7.3.3 STEP Sewers

Careful consideration was given to determining the best approach to modeling the complex hydraulics of the STEP systems. A standard, representative STEP pump curve and associated storage basin (septic tank) depth-volume relationship were developed, which all modeled STEP pumps could reference during model simulation. A single STEP pump and tank in the model represented clusters of individual houses. The number of individual houses comprising a typical cluster was determined by engineering judgment, validated by performing trial simulations in the model. The goal of identifying an appropriate number of houses for a typical cluster was guided by including enough pumps in a basin to appropriately simulate both the flow and the pressure conditions that occur in the actual system, while avoiding model logistical and performance issues of including too many STEP pumps in the model.

Basin X, located in the east central portion of the sewer system in the Martin Way Basin, is an example of the resulting model representation of a STEP basin. A total of 38 pumps are used in

the model to represent the estimated 453 individual residential STEP pumps in this basin. These 38 pumps represent about 8 percent of the total STEP pumps in that basin. The model is configured such that these 38 pumps pump all of the flow produced in the entire basin. Therefore, the smaller number of pumps in the model operate for longer periods of time, depending on the number of homes each pump represents, and the resulting pressurization and overall system flow is representative of the system. Figure 7-2 illustrates the model's representation of the Basin X STEP system. The ratio of 8 percent of modeled versus actual STEP pumps varies somewhat between STEP basins, but is the general goal for model simulation of STEP basins. This method accurately represents flows and pressures within the sewer pipes, with a smaller number of pumps cycling more frequently. This method also maintains the randomness of pump cycles normally found in STEP systems.

7.3.3.1 Sleater Kinney South Basin

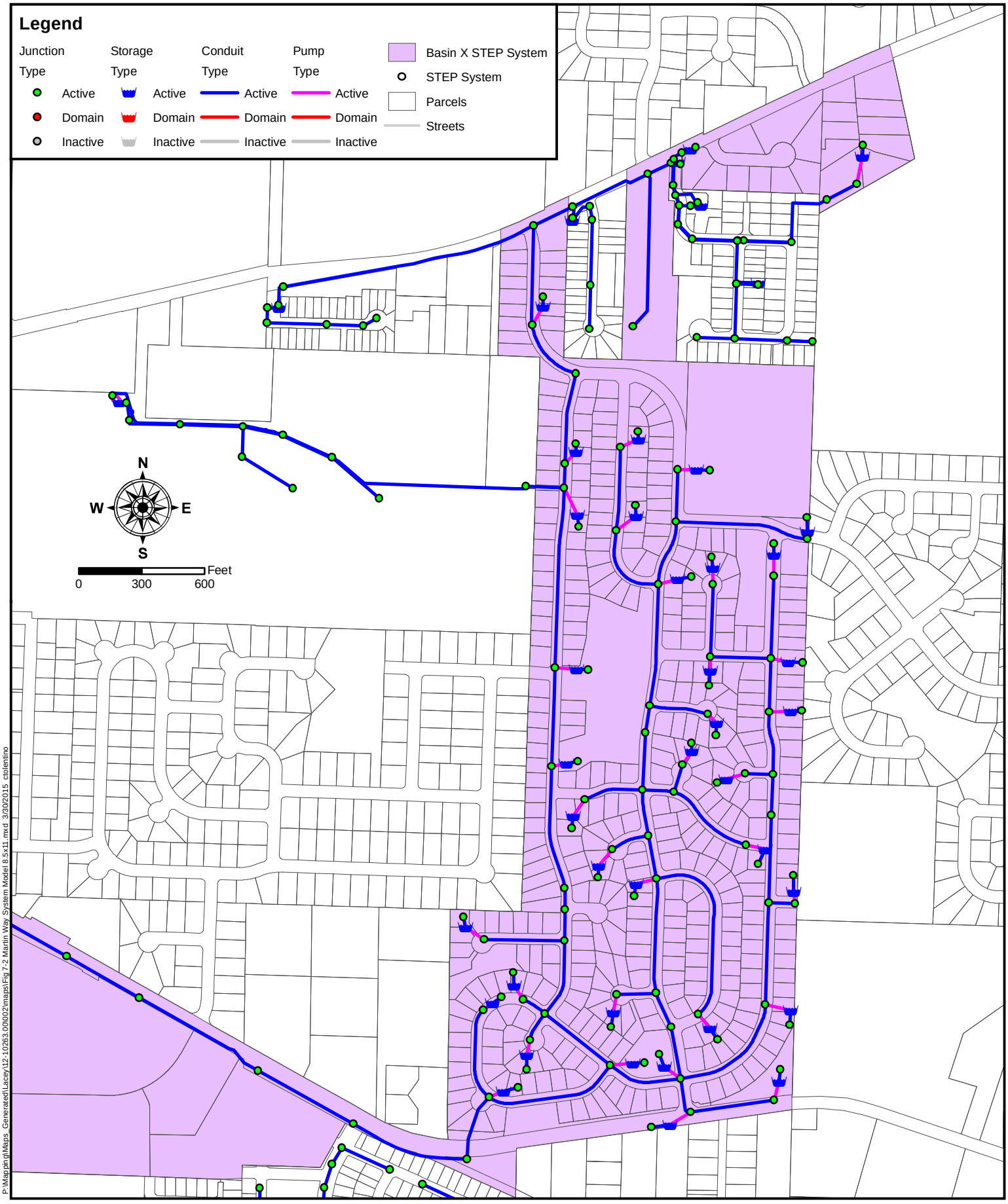
The Sleater Kinney South Basin includes a STEP system in the Avonlea mini-basin, as shown in Figure 5-2. Because the STEP system discharges directly into a gravity sewer, the pressure from the STEP system has no impact elsewhere in the sewer system. Therefore, the STEP mini-basin was modeled by directly loading flow into nodes connected to a pressurized force main, in lieu of modeling the pumps. Flow is injected directly into nodes and creates sufficient head for the flow to travel through the STEP main. This method did not fully capture the pressure fluctuations in the STEP piping, but did accurately model the flows from the basin. Because of the limited size and growth potential of the Avonlea STEP area is was not necessary to fully simulate the STEP Pumps' interaction to evaluate the adequacy of this particular basin.

7.3.3.2 Martin Way Basin

The Martin Way Basin model includes much larger and more complicated STEP systems in multiple basins. The STEP systems convey flow over rolling terrain and also incorporate community STEP lift stations that pump flow collected from local gravity systems. STEP system pressures vary significantly with time, depending on the number of individual STEP pumps that are operating at a time. These individual pumps are capable of operating at high pressures and when the majority of them are on at the same time, increased pressure in this system can cause the community STEP lift stations to back up on their pump curves and significantly reduce pumping capacity. The STEP system is modeled as a fully pressurized system, however the rolling terrain can create areas where air becomes trapped in the system. Trapped air has been observed in Lacey's STEP system and can create artificially high pressures. Since it is not possible to accurately model the effect of air in the system, this model is presented with the assumption that air release valves have been installed in the appropriate locations and that air is not allowed to accumulate in the system.

7.3.4 Lift Stations

Lift stations were imported to the model from the GIS database provided by the City. Pump curves were added to accurately represent pump operation. This is particularly important in those areas where lift stations are interconnected with the STEP systems and the resulting pressure fluctuates so that the interaction between pumps can be simulated. Wet wells are modeled based on lift station data sheets maintained by O&M staff. Depth to volume relationships and pump on/off set points are also added to increase accuracy. Modeled pumping rates were compared against factory pump curve data when available to ensure model accuracy and that the model out-puts were within a range of reasonably expected values.



P:\MappingMaps_Generated\Lacey\L2-10263.00\002\maps\Fig 7-2 Martin Way System Model 8.5x11.mxd 3/30/2015 ctolentino

GIS Data: City of Lacey.
This map is a geographic representation based on information available.
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Martin Way Existing Collection System Model
Representation of Basin "X" STEP System
Wastewater Comprehensive Plan Update
City of Lacey
April 2015

Figure
7-2

7.4 Model Loading

Meaningful modeling results can only be obtained if the quantity of flows and the location where they enter the system in the model reflect actual conditions. Wastewater flow consists of two separate elements: sanitary sewer flow and infiltration and inflow (I/I). Sanitary sewer flow is typically referred to as Dry Weather Flow (DWF) in the model (DWF in the collection system usually includes a minor amount of base I/I that is accounted for in the model I/I loading). I/I is loaded into the model as an external source of flow. All flow is loaded to model "nodes", which are manholes in gravity systems and points upstream of pumps in individual STEP systems.

7.4.1 Sanitary Sewer Flows

Existing and projected sanitary sewer flow rates were developed for each basin on a gpd/acre basis using the following information:

- Population and employment data from the 2010 Census (described in Chapter 3)
- Population and employment projections from the TRPC (described in Chapter 3)
- Student population projections (described in Chapter 3)
- Mini-basin areas (described in Chapter 5)
- Existing measured flow rates (described in Chapter 6)
- Unit sewer flows (described in Chapter 6)
- Diurnal curves (described in Chapter 6)

Some of the City's wastewater service area is served by individual septic systems, rather than connections to the sewer system. Therefore, not all of the sewer flow generated within the City is loaded into the model. Some basins are unsewered and/or largely undeveloped and do not currently contribute any flow to the collection system.

Some basins are partly, but not entirely served by the collection system. The percent of the basin served was approximated using aerial photography, sewer account information, and the existing sewer system data. These basin sewer flows were verified against measured flow data.

Model loading is assigned on a flow per unit area basis, for nodes identified in each basin. The model assigns flow to the nodes, based on the amount of contributing area calculated for each node using the Thiessen polygon method.

7.4.2 Infiltration and Inflow (I/I)

Existing and projected I/I rates were developed on a gallons/inch-diameter-mile basis using the following information:

- I/I (described in Chapter 6)
- Existing pipe inch-diameter-mile (described in Chapter 5)

Total I/I was divided by the total inch-diameter-miles of pipe loaded in the model. I/I for a given pipe run was calculated and then loaded to the node directly upstream of the pipe run it was calculated for.

A key issue is determining how I/I should be projected into the future as the collection system expands and ages. Based on the King County Regional Infiltration/Inflow Control Program,

a widely accepted assumption in Western Washington is to increase the I/I component of sewer flow by 7 percent per decade, up to a maximum of 28 percent. The City adopted this method for estimating I/I.

7.5 Model Calibration

The model was calibrated using flow meter data collected by LOTT and the City. The majority of the flow metering sites used weirs to estimate the flows to an accuracy of 5-10%. The primary calibration points were at LOTT flow monitoring stations L6, L7, and the Martin Way Pump Station. Combined, these flow monitoring stations record all sewer flows from the City conveyed to LOTT's system. The Martin Way Pump Station diverts up to 2 mgd to the Martin Way Reclaimed Water Plant, which was taken into account during calibration by adding the diverted flow to L6 to compare the Martin Way Basin model flows. The flow monitoring stations are shown on Figure 6-1.

The model results were also compared with the analyses in the following reports to ensure consistency with measured flows:

- *2010 Flows and Loadings Report*, LOTT, October 2010
- *2010 Inflow & Infiltration and Flow Monitoring Report*, LOTT, October 2010
- *2011 Inflow & Infiltration and Flow Monitoring Report*, LOTT, February 2012

7.5.1 Calibration to 2012 Flow Data

7.5.1.1 Dry Weather Flow Calibration

The first step in calibrating the model was to compare predicted sanitary flows without I/I to measured dry weather average annual flow data. Dry weather flows were determined by selecting the lowest daily flows from measured data and comparing these with winter water usage developed by LOTT in the *2010 Inflow & Infiltration and Flow Monitoring Report*. After the modeled sanitary sewer volumes were verified, diurnal flow patterns were loaded and adjusted until the variations in simulated flow throughout the day reasonably matched the measured dry weather flow conditions.

7.5.1.2 Average Annual Flow Calibration

Average annual I/I was loaded into the model and simulation results were compared with the average annual flow at the flow meters throughout the City. The modeled flow volumes were compared with the measured average annual flow volumes to ensure model loading was correct. After the modeled average annual sewer volumes were verified, diurnal flow patterns of the I/I component were loaded and adjusted until the variations in simulated flow throughout the day reasonably matched the measured average annual flow conditions.

7.5.1.3 Peak Day Flow Calibration

Peak day I/I was loaded into the model and simulation results were compared with the peak day flow at the flow meters throughout the City. The modeled flow volume was compared with the measured flow volume during peak days as determined by LOTT to ensure model loading was correct.

7.5.1.4 Peak Hour Flow Calibration

Diurnal flow patterns for the peak day I/I were developed and input to the model, then modified as necessary to match diurnal flow variations at L6 and L7, ensuring that the modeled peak hour flow matched the metered data.

7.5.2 Calibration Results

7.5.2.1 Sleater Kinney South Calibration

The Sleater Kinney South Basin was calibrated to LOTT flow monitoring data at stations L5 and L7. Average annual flows were calibrated to within 2 percent; peak day flows to within 8 percent; and peak hour flows to within 3 percent. This is within the accuracy limits of the flow meters used and is considered acceptable.

7.5.2.2 Martin Way/Sleater Kinney North Calibration

The Martin Way and Sleater Kinney North Basins were calibrated to LOTT flow monitoring data at stations L2, L3, and L6, and at the Martin Way Pump Station and LS-9. Average annual flows were calibrated to within 8 percent, peak day flows to within 7 percent, and peak hour flows to within 7 percent. This is within the accuracy limits of the flow meters used and is considered acceptable.

7.6 Future Sewer System Expansion

While system expansion resulting from new development can be reasonably estimated based on population and employment data provided be TRPC, the issue of converting existing on-site septic systems to sanitary sewer can be a contentious and political topic. As such, the rate at which those conversions will take place in the future is much less certain. For the purposes of this plan, future septic to sewer conversion is assumed to occur at a rate of 2 percent per year, or approximately 200 septic systems per year. All future population growth is assumed to connect to the sewer system.

An investigation was performed to extend sewer service into unsewered basins. The investigation incorporated:

- Topography
- Right-of way alignments
- Service type (e.g. lift stations, STEP systems or grinder pumps)
- Connection points to the existing system
- d/D criteria for gravity sewers (percent of flowing full)
- Maximum velocities for force and STEP mains
- Minimum velocities for force mains

The expanded future collection system was developed using an iterative process based on model results and discussions with City staff. Alternatives were analyzed to maximize the use of the capacity of the existing facilities by rerouting some existing sewer systems. These projects are described in Section 7.8.5. The resulting expanded collection system configuration was used to analyze future flow scenarios and identify capacity requirements for the proposed new service configurations as well as impacts and improvements required to the existing system to convey flow from the future developments. Figure D-1 in Appendix D illustrates the future collection system configuration. Service to the majority of the future basins is presumed to be provided with STEP systems, particularly in the south-east portion of the service area. This is

due primarily to the rolling terrain in the new basins (otherwise requiring numerous lift stations) and the connection points to existing STEP systems. Figure 7-3 schematically illustrates the connectivity and configuration of the future collection system.

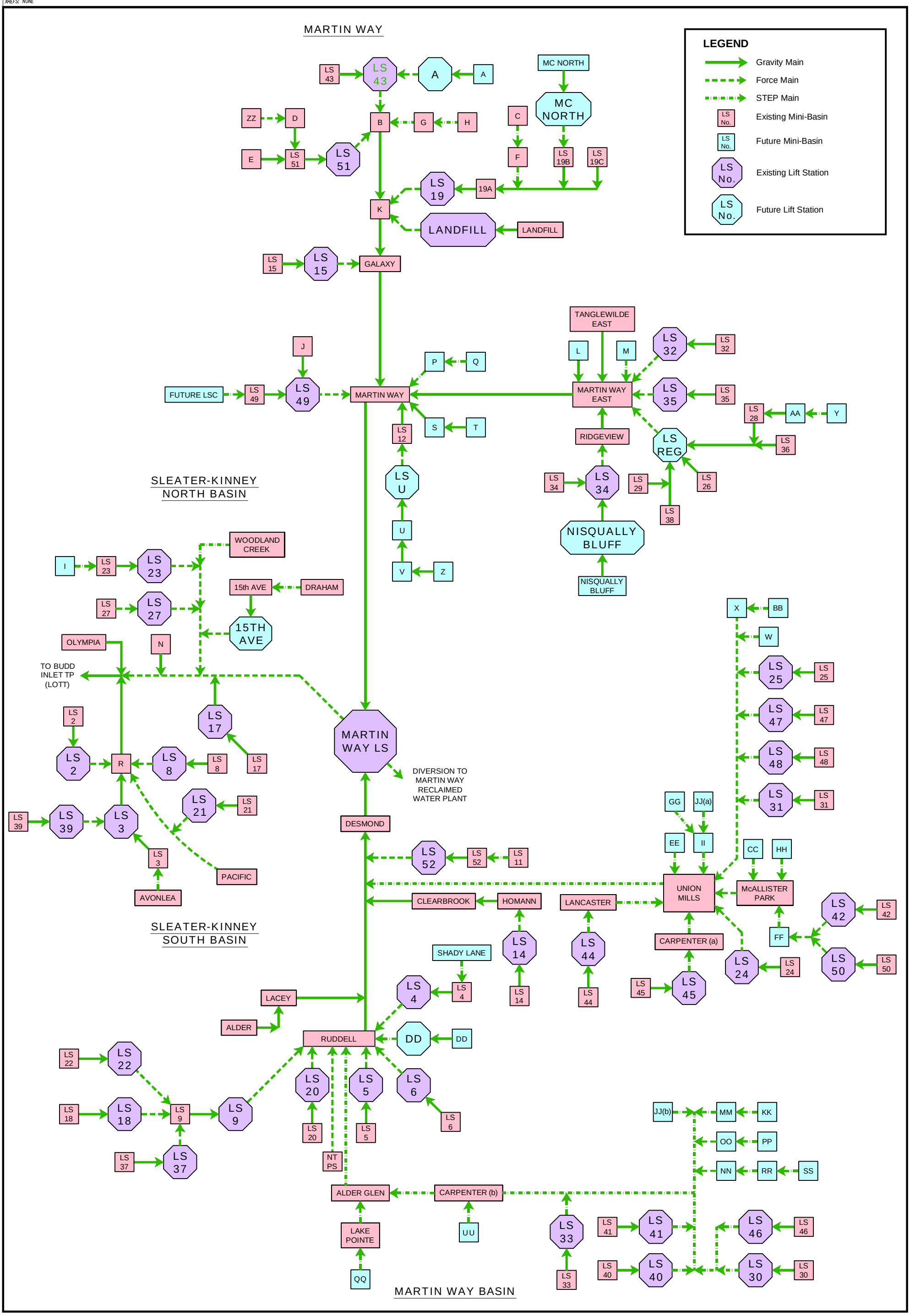
7.7 Modeling Scenarios

The following four scenarios were developed to analyze the City's wastewater conveyance system utilizing the population and unit flow projections described in Chapters 3 and 6, respectively:

- Existing Scenario, calibrated utilizing available flow data
- 2018 Scenario
- 2032 Scenario
- Build-out Scenario

FILE NAME (UPDATED BY)	PLOT DATE & TIME
S:\CAD\LACEY\12-1026J COMP PLAN\DWGS\F12-1026J0_FIG 7-3 22X34.DWG (PLS)	MAR 30 2015 15:29:00

XREFS: NONE



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Future Sewer Schematic

City of Lacey
April 2015

Figure

7-3

Table 7-1 Projected Wastewater Flows, Sleater Kinney South Basin (MGD)				
Flow	**2012**	**2018**	**2032**	**Build-Out**
Average Annual	0.88	0.97	1.15	1.20
Peak Day	2.04	2.19	2.48	2.68
Peak Hour	2.97	3.16	3.50	3.83

Table 7-2 Projected Wastewater Flows, Martin Way/Sleater Kinney North Basin (MGD)				
Flow	**2012**	**2018**	**2032**	**Build-Out**
Average Annual	2.93	3.72	5.19	8.36
Peak Day	4.36	5.22	7.34	10.24
Peak Hour	6.91	8.06	10.58	14.69

7.8 Hydraulic Modeling Analysis

7.8.1 Design Capacity

The design capacity of the gravity mains is considered to be 80 percent depth (0.80 d/D ratio), which is equivalent to 87 percent of the hydraulic capacity. The maximum design capacity of STEP mains and force mains are exceeded when flow velocities are greater than 8 feet per second. System pressure is also evaluated in the STEP areas to ensure that existing pump systems are able to operate against fluctuating head conditions. The firm capacity of a lift station is defined as the capacity of the lift station with the largest pump out of service. When model simulation results exceed these design capacities in piping or in lift stations, they are identified as deficient and system improvements are identified to resolve them. Modeling results for all scenarios are included in Appendix D.

7.8.2 Existing System – Results

The following areas were identified in the model as being deficient:

- The existing Sleater Kinney trunk surcharges over the crown of the pipe during peak day flow conditions from the discharge manhole of LS-3 (MH VQD02) to the outfall to LOTT's interceptor (MH UYW01).
- The gravity main in Lakeview Drive surcharges during peak day flow conditions between MH VZD01 to MH VSV01.
- The gravity main in 26th Loop SE surcharges during peak day flow conditions between MH VSK01 and MH VSM01.

7.8.3 2018 Scenario – Results

The following areas were identified in the model as being deficient:

- The gravity main in 26th Loop SE from MH WVM01 to MH VSK01 is expected to surcharge for approximately 2 hours during peak day conditions.

- Model results predict LS-2 is under capacity during peak day conditions. A gravity pipe rehabilitation project is planned upstream of the lift station that will likely reduce I/I in the LS-2 basin. The reduction in basin flow will likely bring LS-2 back into compliance. After the rehabilitation project is completed, the City should closely monitor flows to determine if an upgrade is still required.

7.8.4 2032 Scenario – Results

The following areas were identified in the model as being deficient:

- The gravity main in Lakeview Drive surcharges during peak day flow conditions between MH VYR01 and MH VZD01.
- The gravity main in Lacey Boulevard SE surcharges during peak day flow conditions between MH VBQ01 and MH VCJ01.
- Velocity in the 4-inch STEP main in Mullen Road, from the intersection with Kagy Street to Carpenter Road (3EW02), exceeds the maximum allowable during peak day flow conditions and should be upsized to 10-inch. New piping will be installed in Mullen Road, east of Kagy, serving new basins as the collection systems are developed.
- Velocity in the 6-inch STEP main in Mullen Road, from Carpenter Road (3EW02 to 4GW05) to just east of Ruddell Road, exceeds the maximum allowable during peak day flow conditions and should be upsized to 12-inch. A 10-inch line is sufficient to convey flows for the 2032 scenario, however the additional capacity provided by the 12-inch line is necessary to convey build-out scenario flows.
- The 21-inch gravity sewer in Ruddell Road surcharges during peak day flow conditions and should be increased to 30-inch between 32nd Court SE (MH WY601) and 27th Avenue SE (MH WTU01). The 30-inch size is adequate to convey build-out scenario flows.
- The LS-23 is deficient during peak day flow conditions and the capacity should be increased by replacing the pumps and replacing the existing 4-inch force main with a larger force main to reduce velocities and headloss for the larger capacity pumps.

7.8.5 Build-Out Scenario – Results

The following concepts were developed in concert with the City to reduce the number of deficiency-related CIP projects:

- The Steilacoom Road Regional Lift Station and associated force main will replace Lift Stations 26, 28, 29, 36, and 38. The force main will likely discharge into the Martin Way South interceptor near the intersection of Martin Way and Hoh Street.
- Routing flow from future development in the southeast portion of the sewer system into the new Mullen Road STEP main, and into the Ruddell Road interceptor.

The above concepts utilize the excess capacity in the existing sewer system, and reduce flow in the Union Mills and Carpenter Rd areas of the STEP system that would otherwise become deficient over the planning horizon. The Steilacoom Road Regional Lift Station will divert flows from the northern part of the Union Mills STEP system, reducing the operating pressure in that area and preserving capacity in the Union Mills trunk line for future growth to the south along Marvin Rd. This has the added benefit of eliminating 5 community STEP lift stations, reducing operation and maintenance costs. Routing flow along Mullen Rd to the Ruddell Rd interceptor will keep pressure manageable in the extreme south-east portion of the STEP area without impacting the Carpenter Rd and Union Mills STEP systems.

Chapter 8 Collection Facilities Improvements

This chapter provides a compilation of specific projects, improvements, and programs the City should implement, providing the tools necessary for long range project planning and budgeting. These projects are derived primarily from the system analysis and discussions with the City's operations and engineering staff. Other non-project recommendations can be found throughout the preceding chapters. Each project is accompanied by a planning level opinion of probable cost and a schedule identifying when the project is anticipated to begin and end. The City should review the CIP periodically to adjust for significant changes in the priority of each project, its cost, and scope.

Collection facilities improvement projects for the City wastewater system are broken into the following five categories:

- **Capacity:** Improvements classified as insufficient in capacity are determined based on whether or not the infrastructure can effectively convey the incoming flow. Gravity sewer pipes are considered to have insufficient capacity when the flow through the pipe is 80 percent or more of the pipe flowing full (d/D > 0.8). Force mains are considered to have insufficient capacity when the velocities exceed 8 feet per second. Pump stations are considered to have insufficient capacity when inflow exceeds the flow produced by the pump station with the largest pump out of service. As described in Chapter 7, the conveyance system was evaluated using existing flows and flows projected for 2018, 2032, and build-out conditions. The evaluations determined system deficiencies when subjected to these existing and future flow conditions. Following identification of system deficiencies, the computer model was used to evaluate and select system improvements to alleviate the system deficiencies.
- **Operations & Maintenance (O&M):** O&M projects will replace facilities identified by the City O&M staff as having unacceptably high maintenance requirements, both in terms of frequency and in magnitude.
- **Obsolescence:** Improvements classified as obsolete are based on the age of the infrastructure. Mechanical and electrical equipment is expected to have a typical usable life of 25 years. Structures are expected to have a typical usable life of 50 years. Pipes are expected to have a typical usable life of 100 years.
- **General:** General improvement projects are those identified by City staff for various reasons that do not fall within any of the remaining four categories. These projects may be needed to simplify system operation, ease O&M efforts and reduce O&M costs, consolidate and/or eliminate redundant facilities, reduce or eliminate non-critical O&M concerns, or to meet ongoing sewer system management needs.
- **Developer:** Projects identified as developer dependent are needed to serve new developments but are not needed to provide continuation of service to existing customers.

Projects are also identified as either "Replacement", "Upgrade", or "Expansion" or a combination of the three. This gives a quick indication of the driving need for the project and the appropriate funding source.

- Replacement: These projects are generally intended to replace like infrastructure with like, they are typically the result of obsolete equipment that has exhausted its useful life or creates excessively high maintenance.

- Upgrade: These projects are normally targeted at reducing maintenance or improving operations, this may include new equipment or a replacement of equipment that is still functional but has not been optimized.
- Expansion: These projects can include new equipment or a replacement of equipment but their driving force is to provide additional capacity for future growth.

When possible, system improvement projects should be coordinated with other utilities to minimize disruption and reduce associated costs such as road and surface restoration.

Due to the number of projects scheduled in the 6-year CIP the City should periodically evaluate its progress in completing those projects and determine if current project engineer staffing levels are adequate to complete those projects efficiently.

8.1 6-Year CIP (2014-2019)

The projects recommended for the 6-year Capital Improvement Program (CIP) are illustrated on Figure 8-1 and described in Table 8-1. Developer improvements are expected to be privately funded by developers and are not listed in this section. The project order was developed by the City.

Summary sheets for CIP projects projected to occur prior to 2023 are included in Appendix H. The sheets include a description, opinion of probable project cost, and a more detailed project map.

8.1.1 Project Descriptions

CIP 1 - Wastewater Comprehensive Plan Update

The Wastewater Comprehensive Plan Update provides for recurring updates to the City's Wastewater Plan on an 8 year cycle. These planning efforts provide the basis for the City's policies, capital improvements, and financing of the wastewater utility. These recurring updates allow the City to periodically reevaluate existing and projected flows, condition of existing infrastructure, the need future improvements, and the utility's financing plan. This ensures a long lasting and reliable utility. This project is budgeted at $500,000 per cycle.

CIP 2 - Lift Station 25 & 31 Retrofit

Both lift stations 25 and 31 are located in the City's Union Mills STEP area. These lift stations were designed as community STEP stations but were originally installed with solids-handling submersible pumps. The intention was that this area would at some point be converted to a more traditional combination of gravity and lift station collection system. This STEP area has grown considerably since these stations were originally installed and the current pumps at these stations struggle to operate effectively against the variable head conditions. The City has determined that it is not cost effective at this time to transition the STEP area to a traditional combination of gravity and lift stations; and has instead elected to install more appropriate pumps at these stations. The new pumps will be Orenco high-head pumps which will greatly improve the stations' ability to operate in variable head conditions and will also improve overall efficiency. This project will also include electrical and mechanical updates as needed. Estimated cost for this project is $1,075,000; project completion is scheduled for the year 2014.

CIP 3 -Steilacoom Rd Lift Station

A new lift station along Steilacoom Rd, east of Marvin Rd, is planned to serve both future and existing customers. Many of the existing customers in this area are served by community STEP stations. The City has found that the large septic tanks associated with community STEP systems can be very problematic to operate and maintain, they also restrict growth in the tributary basins and drive up over all operating costs. A new lift station along Steilacoom Rd will accept wastewater from five separate community STEP stations (26, 28, 29, 36, 38), allowing them to ultimately be decommissioned. The new lift station will also be sized to accommodate future growth and septic-to-sewer conversions. This will be accomplished using a phased approach, making planned capacity improvements over time, as flows increase. This project also benefits the Union Mills STEP area by diverting flow from five community STEP stations north to the Martin Way gravity system. This will alleviate some concerns of increasing system pressure and allow for additional connections in the southern portion of the STEP area. Estimated cost for this project is $3,650,000; project completion is scheduled for the year 2017.

CIP 4 - Tanglewilde East ULID

A portion of Tanglewilde East is currently served by a large on-site septic system (LOSS), this system has been directed by the state department of health to take corrective actions related to the operation of their system. The most favorable option for this system is to connect directly to Lacey's collection system and decommission the LOSS. The City has offered to lead a project connecting the Tanglewilde East 3B system via gravity main. This project would be done as a ULID; in which the beneficiaries would reimburse the City for work done. This project will also be coordinated with a City water line replacement project to promote mutual cost savings. Estimated cost for this project is $3,776,000 (including connection fees); project completion is scheduled for the year 2015.

CIP 5 - College St and Martin Way ULID

There are four businesses located at the south east corner of College St and Martin Way, these businesses are currently served by the City of Olympia through a temporary service agreement. The City of Olympia has exercised its authority through the service agreement to terminate service to these businesses and they must now connect to Lacey's collection system. Lacey has offered to take the lead on this project through the ULID process, were the beneficiaries would reimburse the City for its work. This project would involve the installation of a gravity line across Martin Way, connecting the businesses to Lacey's existing collection system tributary to Lift Station 17. Estimated cost for this project is $758,000 (including connection fees); project completion is scheduled for the year 2014.

CIP 6 - STEP Main Air Release/Vacuum Relief Valves

The *City of Lacey Wastewater STEP Main Evaluation and System Plan (AECOM, 2012)* found that the City's Union Mills STEP area was experiencing higher than normal system pressure, likely due to air becoming trapped within the STEP mains. This project will help to reduce the occurrence of air in the mains by seeking out those areas where air is likely to be collecting and installing air release valves at those locations. By reducing the amount of air trapped within the STEP mains the STEP area will experience lower operating pressure and an overall increase in efficiency. Estimated cost for this project is $232,000; project completion is scheduled for the year 2015.

CIP 7 - Lift Station 18 Retrofit

Lift Station 18 is one of the City's older style of lift station, consisting of above grade vacuum prime pumps. This station also experiences abnormally heavy FOG and fibrous debris loads. The combination of vacuum prime pumps and heavy FOG/debris loads results in frequent pump and priming system failures, and necessitates an aggressive wet well cleaning schedule. In order to alleviate the excessive operation and maintenance effort required to keep this station functional the City replace the existing pump system with submersible chopper style pumps which are able to better handle the waste stream at this station. This project also includes ancillary mechanical and electrical upgrades. Estimated cost for this project is $762,000; project completion is scheduled for the year 2014.

CIP 8 - Lakeview Dr Gravity Upsize (Phase 1)

The existing Lakeview Dr gravity main which serves a large area adjacent to Chambers Lake is nearing its maximum capacity and needs to be upsized to reduce the risk of surcharging and to serve future growth. The City will be replacing the existing 10-inch main with a 12-inch to ensure sufficient capacity for full build-out of the sewer basin. This project will be done in phases, the first and most urgent phase is the northern portion of the main between 29th Ave and 26th Ave, the southern portion (Phase 2) will be done in subsequent years. Additionally, Phase 1 of this project will be coordinated with the City's Chambers Lake Regional Stormwater Treatment Facility project. Estimated cost for Phase 1 of this project is $500,000; project completion is scheduled for the year 2014.

CIP 9 - Lift Station 15 Generator/Flow Meter

Lift Station 15 serves an active commercial area in Lacey. This station has relatively little emergency storage capacity in the wet well and does not have on-site auxiliary power. The City is concerned that a delayed response to a power outage may result in surcharging of the upstream gravity system and potentially impact commercial customers. To increase reliability of this station the City will install an on-site generator to provide an auxiliary power source during outages. This project will also include the installation of flow meter so that the City can more accurately track flow from this basin and monitor pump performance. Estimated cost for this project is $350,000; project completion is scheduled for the year 2014.

CIP 10 - Avonlea Odor Control

This project includes the emergency cleanup associated with a faulty chemical storage tank used for odor control on the City's Avonlea STEP area. Also included is a replacement of the failed odor control facility on the existing site. Estimated cost for this project is $100,000; project completion is scheduled for 2014.

CIP 11 - Train Depot Sewer Line

This project includes extension of a gravity sewer line in Lebanon St to serve the future Train Depot/Lacey Museum. Estimated cost for this project is $61,800; project completion is scheduled for the year 2014.

CIP 12 - Carpenter Rd STEP Upgrades

This project will replace air release valves and the manhole structures they are housed in on the City's Carpenter Rd STEP main. The two locations are at 1530 and 2417 Carpenter Rd SE. These air release valves are needed to ensure any air trapped in the STEP main is allowed to escape, preventing excessively high system pressure. Estimated cost for this project is $50,000; project completion is scheduled for the year 2014.

CIP 13 - Lift Station #2 - Lift Station, Gravity, and Force Main Replacement

This project combines several issues that need to be resolved in the Lift Station #2 basin. Lift Station #2 was constructed in 1970 and is Lacey's oldest lift station still in operation. This station located along the shoulder of Westlake Dr and has very limited space for operations crews to perform routine maintenance tasks. It is also located very close to low hanging utility lines; both of these issues present a potential safety hazard to City crews. Recent safety regulations now limit the area around overhead utility lines in which boom operated equipment can safely operate, this impacts the City's ability to perform routine wet-well cleaning. This lift station is scheduled to be relocated to a more suitable location along Westlake Dr, where sufficient room can be provided for operation and maintenance of the facility. Property acquisition will likely be required for the replacement lift station. The force main discharging from Lift Station #2 currently follows a path across a private lot and underneath a home that was constructed some time after the piping was installed. The existing force main alignment has severely restricted access for crew to make repairs in the event of a failure and exposes the City to some degree of potential liability if a failure were to occur. The existing force main alignment should be abandoned following construction of the replacement lift station and a new force main should be installed along Westlake Dr, ultimately discharging to the Sleater Kinney gravity line. Finally, the gravity collection system located in Westlake Dr experiences high levels of infiltration. This is attributed to the high local ground water, age of the gravity system, and deterioration of manholes in this area. The gravity collection system along Westlake Dr should be replaced concurrent with the other improvements. Estimated cost for this project is $1,610,000; project completion is scheduled for the year 2017.

CIP 14 - Rumac St STEP Main

This project would extend a new STEP main along Rumac St, allowing the Lake Pointe STEP area to be diverted to the Mullen Rd STEP line. The Lake Pointe STEP area currently has three separate odor control facilities and requires relatively high chemical injection rates to reduce odors at the outfall to acceptable levels. This is due primarily to the limited amount of contact time that the chemical has with the STEP effluent, resulting in incomplete conversion of the hydrogen sulfide. By diverting the Lake Pointe STEP area to the Mullen Rd STEP line the City will be able to consolidate odor control facilities, resulting in more efficient odor control. It is anticipated that both the Lake Pointe and Mullen Rd STEP areas will be served by a single chemical injection facility for odor control. This project should be completed concurrently with or after the Mullen Rd STEP Main project and covers only the STEP main along Rumac St; budget for a future odor control facility is included in the Mullen Rd STEP Main project. Estimated cost for this project is $1,000,000; project completion is scheduled for the year 2016.

CIP 15 - Mullen Rd STEP Main

The Mullen Rd STEP main is intended to serve a growing STEP area in the south east corner of the City's UGA. This project will install a section of STEP main along Mullen Rd from the City's

eastern city limits to Rumac St, completing the line between Ruddell Rd and Kagy St. This will allow a portion of the existing STEP flow currently connected to the Carpenter Rd STEP main to be diverted to Ruddell Rd, as well as future flow from growth in the south east portion of the UGA. This diversion will help to moderate the high pressure spikes observed near Kagy St and will also preserve capacity in the existing Carpenter Rd STEP main. Once completed, the Lake Pointe STEP area can also be diverted to the Mullen Rd STEP main, allowing odor to be more effectively controlled. The diversion of these flows to the Ruddell Rd gravity system will require the installation of a new odor control facility which is anticipated to be a chemical injection site in the vicinity of Rumac St. This project should be constructed prior to, or concurrently with a planned county road project to reconstruct a portion of Mullen Rd. Estimated cost for this project is $500,000; project completion is scheduled for the year 2016.

CIP 16 - College St / 26th Ave Gravity Repair

This project will repair two locations of gravity main along the College St corridor that suffer from heavy root intrusion. The first location would involve a repair between manholes WVE01 and WVE02 along 26th Ave; the second location is between manholes WVV01 and WV502 along College St. This project may also include the installation of CIPP along College St between manholes WNE01 and WVM01, or roughly from 22nd Ave to 26th Ave. The CIPP will help to preserve the existing concrete pipe which is showing signs of deterioration through exposed aggregate and cracking at service laterals. Estimated cost for this project is $100,000; project completion is scheduled for the year 2015.

CIP 17 - Annual Sewer Line Replacement

As the City's collection system ages it will begin to show signs of deterioration, the oldest portions of the collection system are now approaching 50 years old and were constructed using techniques and materials that have fallen out of favor today. This general budget item provides a funding source to repair and replace problematic or deteriorated areas. This allows maintenance crews to monitor the condition of the City's collection system and make recommendations for repairs or replacement as warranted. This proactive approach will keep I&I rates low and preserves the overall functionality of the collection system. This also helps the City to avoid the high expenses often associated with emergency repairs. This funding program is intended to increase throughout the planning horizon as the overall age of the City's collection system increases.

CIP 18 - FOG / Fibrous Wipes Program

FOG (fats, oils, grease) and fibrous wipes present a significant challenge to maintenance crews. These items have a tendency to build up in the collection system and lift stations, reducing capacity and performance. In extreme cases, build up of these items can lead to sewer backups and frequent pump failures. In an effort to reduce the FOG and fibrous loading in the City's collection system an annual budget for education and outreach has been included. The initial goal of the program will be to educate wastewater customers on the impact these items have on the City's collection system and how to properly dispose of them.

CIP 19 - Generators / Flow Meters

Several of the City's lift stations currently do not have on-site generators to provide auxiliary power during outages. During wide spread power outages City crews must rotate portable generators from site to site. This consumes large amounts of staff time and is often

compounded by inclement weather or other emergency conditions. In order to reduce the staff time required to deploy portable generators during these events this project will install on-site generators at four of the City's existing lift stations (17, 20, 22, and 23). Several other lift stations are also scheduled to have on-site generators installed; installations at those sites will be coupled with other rehab and improvement projects. This project will also include the installation of flow and pressure monitoring equipment, allowing staff to more effectively monitor lift station performance and troubleshoot potential issues. Estimated cost for this project is $800,000; project completion is scheduled for the year 2016.

CIP 20 - Lift Station 49 Land Purchase

This project is to acquire additional land adjacent to Lift Station 49. The City feels it would be prudent to acquire additional property at this site to provide a buffer between the facility and a future residential development. This additional property would help to reduce the potential for noise and odor complaints, and also provide maintenance crews with additional space when repairs are needed. Estimated cost for this project is $120,000; project completion is scheduled for the year 2016.

CIP 21 - Lift Station 12 Abandonment

Lift Station 12 is one of the City's older above grade vacuum prime stations and is operating near capacity. Rather than performing extensive upgrades to keep this facility operational it is recommended to abandon this station completely. This can be accomplished with a new gravity line by-passing the station and following a westerly route to Carpenter Rd, where it can discharge to an existing gravity system near the Carpenter Crest apartments. This will reduce the need for costly upgrades and long-term maintenance costs. This project will require easements and/or property acquisition to provide a route for the new gravity line between the existing lift station and Carpenter Rd. Estimated cost for this project is $902,000; project completion is scheduled for the year 2020.

CIP 22 - Sleater Kinney Gravity Main Improvements (Phase 1)

This project will replace and up-size the existing gravity main along the southern portion of Sleater Kinney Rd from 250-feet north of 21st Ave to approximately 500 feet north of 14th Ave (manhole VQD02 to VGE01). This section of gravity main serves a large number of customers along the City's western boundary and operates in excess of the City's 80% depth criteria for maximum capacity during peak hour flows. Additionally, this main consists of older concrete pipe that is showing signs of deterioration (exposed aggregate, root penetrations) which would trigger repair/remediation work in the near future regardless of the capacity conditions. It is recommended that this section of pipe be completely replaced with 21-inch or larger to safely accommodate build-out flows. Estimated cost for this project is $1,300,000; project completion is scheduled for the year 2018.

CIP 23 - Lift Station Rehabilitation (Phase 1)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of two existing lift stations (15, 17). Both stations targeted with this phase will require the conversion of vacuum prime pumping systems to submersible pumping systems. Additionally, Lift Station #17 will require the replacement of the

upper section of the wet-well to allow for proper mounting of the new pumping system and to provide access for future wet-well cleaning and maintenance. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $1,900,000; project completion is scheduled for the year 2018.

CIP 24 - Lift Station Rehabilitation (Phase 2)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of three existing lift stations (19, 20, and 21). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $2,850,000; project completion is scheduled for the year 2019.

CIP 25 - Lift Station and STEP System Flow Meters

Many of the City's existing lift stations and STEP mains do not have any direct means of monitoring flow or pressure; an important tool in establishing the performance, remaining capacity, and in troubleshooting these systems. This project would install flow and pressure monitoring equipment capable of communicating to the City's existing SCADA system at strategic lift stations and locations in the various STEP areas (approximately 24 locations). Estimated cost for this project is $1,180,000; project completion is scheduled for the year 2020.

CIP 26 - Sewer Main Replacement (50th Ave)

This project will replace a section of gravity main along 50th Ave, near Ruddell Rd between manholes 5KK02 and 5KJ02. A section of this main was laid at a reverse slope which needs to be corrected. Additionally, the private sewer system serving the Cottages is currently connected as a single service lateral. Due to the size of this connection it should be reconfigured to connect at a manhole to facilitate maintenance and to prevent potential backups. Estimated cost for this project is $210,000; project completion is scheduled for the year 2019.

CIP 27 - Chemical Storage Tank Replacement

The City has three above ground odor control facilities utilizing single wall chemical storage tanks. It is recommended that the City replace these single wall tanks with either double wall tanks or to implement some other form of secondary containment. Estimated cost for this project is $150,000; project completion is scheduled for the year 2019.

CIP 28 - Sewer Main Replacement (34th Ave)

This project will replace a section of 6-inch sewer main along 34th Ave between manholes W3R01 and W3R02. This section of sewer main is a smaller diameter than City standards allow and was laid at a slope that is less than the minimum for this pipe size. It requires regular

cleaning by the City's maintenance crews and it is recommended that it be replaced with an 8-inch sewer pipe installed at an appropriate slope. Estimated cost for this project is $60,000; project completion is scheduled for the year 2019.

Table 8-1 6-Year CIP (2014-2019)

CIP No.	Project	Type	Replacement	Upgrade	Expansion	Project Description
1	Wastewater Comprehensive Plan Update (recurring)	General		☑	☑	▪ Update the Wastewater Comprehensive Plan as necessary to address the needs of the City's sewer collection system.
2	Lift Station 25 & 31 Retrofit	Capacity	☑	☑		▪ Convert from solids handling submersible pumps to Orenco STEP pumps. ▪ Upgrade electrical equipment. ▪ Repair wet well coating.
3	Steilacoom Road Lift Station	General		☑	☑	▪ Replace community STEP stations LS-26, LS-28, LS-29, LS-36, and LS-38 with a single lift station. ▪ Construct approximately 3,700 lf of gravity sewer to convey wastewater to the new lift station. ▪ Construct approximately 4,500 lf of force main from the new lift station to the Martin Way Interceptor.
4	Tanglewilde East ULID	General			☑	▪ Abandon the community septic system serving the Tanglewilde East area and connect the piping to Lacey sewer through a Utility Local Improvement District (ULID).
5	College Street and Martin Way ULID	General			☑	▪ Convert the parcels on the southeast corner of College Street and Martin Way from Olympia's sewer system to Lacey's. This would be done through a ULID.
6	STEP Main Air Release/Vacuum Relief Valves	O&M		☑		▪ Install air release/vacuum relief valves to remove air trapped in the Union Mills STEP area and to reduce operating pressures.
7	Lift Station 18 Retrofit	O&M	☑		☑	▪ Convert from above ground vacuum prime to submersible pumps.
8	Lakeview Dr Gravity Upsize (Phase 1)	Capacity			☑	▪ Upsize approximately 850 lf of pipe MH VZD01 to MH VSV01 from 10-inch to 12-inch.
9	Lift Station 15 Generator/Flow Meter	General		☑		▪ Install a backup generator set. ▪ Install a flow meter and pressure transducer and connect to SCADA.
10	Avonlea Odor Control	O&M		☑		▪ Replacement of existing odor control facility.
11	Train Depot	Capacity			☑	▪ Construct new 8-inch gravity sewer in Lebanon St to serve the future Train Depot/Lacey Museum
12	Carpenter Road STEP Upgrades	O&M	☑			▪ Replace air release/vacuum relief valves at Roo-Lan Road and 26th Street. ▪ Replace manholes.
13	Lift Station 2 - Lift Station, Gravity, and Force Main Replacement	O&M	☑			▪ Replace Lift Station #2 ▪ Reroute force main for easier access and reduced liability. ▪ Replace approximately 900 lf of gravity pipe and manholes in Westlake drive to reduce infiltration and inflow.
14	Rumac St STEP Main	General		☑		▪ Install approximately 4,400 lf of 6-inch STEP main along Rumac Street. ▪ Reduce the number of odor control facilities and operating costs.
15	Mullen Rd STEP Main	Capacity			☑	▪ Install approximately 1,200 lf of missing 6-inch force main in Mullen Road from the city limits to Rumac Street. ▪ Include odor control facility.
16	College St / 26th Ave Gravity Repair	O&M	☑			▪ Install approximately 1,300 lf of 8-inch CIPP to address deterioration in pipeline. ▪ Spot repairs in 2 locations to address root problems in pipeline.

Table 8-1 6-Year CIP (2014-2019)

CIP No.	Project	Type	Replacement	Upgrade	Expansion	Project Description
17	Annual Sewer Line Replacement	Obsolescence	☑			▪ Annual program to repair and replace deteriorating sewer mains
18	FOG / Fibrous Wipes Program	General		☑		▪ Conduct a second FOG pilot program to confirm preliminary findings of first program. ▪ If successful, expand program to other high-FOG areas. ▪ Coordinate program with other jurisdictions. ▪ Include fibrous wipes.
19	Generators / Flow Meters (LS-22, LS-23, LS-17, LS-20)	General		☑		▪ Install backup generator set. ▪ Install flow meter and pressure transducer and connect to SCADA.
20	Lift Station 49 Land Purchase	General		☑		▪ Purchase adjacent lot before it develops to prevent future odor and noise complaints from future resident
21	Lift Station 12 Abandonment	Obsolescence Capacity		☑	☑	▪ Replace LS-12 with gravity sewer. ▪ Abandon LS-12.
22	Sleater Kinney Gravity Main Improvements	Capacity			☑	▪ Upsize approximately 2,590 lf of pipe between MH VQD02 to MH VGE01 from 15-inch to 21-inch.
23	Lift Station Rehabilitation (Phase 1)	Obsolescence	☑			▪ Upgrade mechanical and electrical equipment in LS-15, and LS-17.
24	Lift Station Rehabilitation (Phase 2)	Obsolescence	☑			▪ Upgrade mechanical and electrical equipment in LS-21, LS-20, and LS-19.
25	Lift Station and STEP System Flow Meters	General		☑		▪ Install 21 flow meters and pressure transducers at lift stations that do not currently have them and connect to SCADA. ▪ Install 3 flow meters and pressure transducers in STEP mains and connect to SCADA.
26	Sewer Main Replacement (50th Ave)	General		☑		▪ Replace approximately 350 lf of 18-inch pipe with adverse grade, and install a manhole where the Cottages connect with the main.
27	Chemical Storage Tank Replacement	O&M	☑			▪ Replace 3 existing odor control chemical storage tanks with new double containment tanks.
28	Sewer Main Replacement (34th Ave)	Capacity		☑		▪ Replace approximately 100 lf of existing 6-inch sewer with 8-inch sewer.

Legend

Lift Stations
- City of Lacey LS
- LOTT LS
- Private LS

Force Main
- City of Lacey FM
- LOTT FM
- Private FM

Sewer Main
- City of Lacey Sewer Main
- LOTT Sewer Main
- Private Sewer Main

STEP System
- City of Lacey STEP System
- Private STEP System
- WWTP

CIP
- Capacity
- O & M
- Obsolescence
- General
- ## Project Number

Base Layers
- City Limits
- UGA
- Basins
- Parcels

N W E S

0 2,500 5,000 Feet

MARTIN WAY BASIN

SLEATER KINNEY NORTH BASIN

SLEATER KINNEY SOUTH BASIN

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

P:\Mapping\Maps_Generated\Lacey\12-10263.00\006 - CIP\maps\Fig 8-1 6-Yr CIP 11x17.mxd 3/30/2015 ctolentino

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6-YEAR CAPITAL IMPROVEMENT PROJECTS

WASTEWATER COMPREHENSIVE PLAN UPDATE

City of Lacey
April 2015

Figure

8-1

8.2 20-Year CIP (2020-2033)

The projects recommended for the 20-year CIP are described in Table 8-2. Developer improvements are expected to be privately funded by developers and are not listed in this section.

8.2.1 Project Descriptions

CIP 101 - 26th Loop SE Replacement

This project will replace and upsize a portion of gravity sewer main along 26th Loop between manholes WVM01 and VSM01. It is projected that this section of sewer main will exceed the City's design threshold for gravity mains during peak hour flow within the 20 year planning horizon. Estimated cost for this project is $520,000; project completion is scheduled for the year 2020.

CIP 102 - Lift Station 3 Pumps and Inlet Piping

The pumps and inlet piping at Lift Station 3 are expected to reach capacity within the 20 year planning horizon and should be upsized to accommodate full build-out flows. Estimated cost for this project is $230,000; project completion is scheduled for the year 2020.

CIP 103 - Lift Station 8 Generator and Flow Meter

Lift Station 8 serves City Hall and should be equipped with auxiliary power to ensure continued operation during power outages or other emergencies. It may be possible to operate this station with the existing generator currently serving City Hall. This station should also be outfitted with flow and pressure monitoring equipment. Estimated cost for this project is $200,000; project completion is scheduled for the year 2020.

CIP 104 - Lift Station 37 Discharge Manhole

The manhole directly receiving the discharge from Lift Station 37 experiences minor surcharging while the station is pumping. This manhole should be replaced with a larger structure to facilitate the transition of flow from the force main to the gravity system. Estimated cost for this project is $16,000; project completion is scheduled for the year 2020.

CIP 105 - Lift Station 11 Abandonment

Lift Station 11 is an aging facility that serves approximately 20 single family residences. It is typically not cost effective to serve a small number of customers with a lift station. It is recommended that the City abandon Lift Station 11 and replace it with a pressurized collection system utilizing individual grinder pumps. This will allow the City to avoid high replacement, operation, and maintenance costs generally associated with lift stations. Estimated cost for this project is $490,000; project completion is scheduled for the year 2021.

CIP 106 - Lacey Blvd Sewer Main Replacement

The gravity sewer main in Lacey Blvd is projected to reach its allowable capacity within the 20 year planning horizon. The section of sewer main between manholes VBQ01 and VCJ01

should be upsized to accommodate build-out flows. Estimated project cost is $389,000; project completion is scheduled for the year 2021.

CIP 107 - Lakeview Drive Gravity Main Replacement Phase 2

The existing Lakeview Dr gravity main which serves a large area adjacent to Chambers Lake is nearing its maximum capacity and needs to be upsized to reduce the risk of surcharging and to serve future growth. The City should replace the section of main between manholes VYR01 and VZD01 with a larger size to ensure sufficient capacity for full build-out of the sewer basin. Estimated cost for Phase 2 of this project is $239,000; project completion is scheduled for the year 2021.

CIP 108 - Lift Station 23 Upgrade and Force Main Upsizing

Lift Station 23 is not able to meet the anticipated increase in flows over the 20 year planning horizon. The existing pumps should be upsized along with the associated mechanical and electrical equipment. The existing 4-inch force main is also undersized and limiting the station's capacity. This force main should be upsized concurrently with the lift station upgrades. Estimated project cost is $1,291,000; project completion is scheduled for the year 2022.

CIP 109 - Lift Station Rehabilitation (LS-9, LS-24)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of two existing lift stations (9, 24). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $1,412,000; project completion is scheduled for the year 2023.

CIP 110 - Pacific Ave and Kinwood St Lift Station

This project would construct a new lift station near the intersection of Pacific Ave and Kinwood St and would serve both new growth in the area and septic systems converting to sewer. This project will require a pre-design report and property acquisition. Estimated cost for this project is $915,000; project completion is scheduled for the year 2025.

CIP 111 - Lift Station Rehabilitation (LS-27, LS-30, LS-32)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of three existing lift stations (27, 30, and 32). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the

Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $2,117,000; project completion is scheduled for the year 2027. It is anticipated that a new developer built lift station will be constructed along 15th Ave NE, if that station has been completed prior to this project the City should evaluate options for abandoning Lift Station #27 at that time and directing flow to the new 15th Ave Lift Station.

CIP 112 - Lift Station Rehabilitation (LS-33, LS-34, LS-35)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of three existing lift stations (33, 34, and 35). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $2,117,000; project completion is scheduled for the year 2028.

CIP 113 - Ruddell Trunk Replacement

This project would replace and upsize a section of the Ruddell trunk line between manholes WY601 and WTU01. This section of line is projected to exceed its current capacity by the year 2032. The timing of when this upsizing will need to occur will depend on the rate of growth in the new Mullen Rd STEP area. The City should monitor flows in this area to ensure an appropriate level of timeliness for this project. Estimated cost for this project is $1,220,000; project completion is scheduled for the year 2028.

CIP 114 - Mullen Rd STEP Main Upsize

As the Mullen Rd STEP area grows the existing 6-inch STEP main along Mullen Rd will become a significant restriction, resulting in high operating pressure. The existing STEP main will need to be upsized to safely accommodate long range flow projections. The City should monitor system pressure to ensure an appropriate level of timeliness and to evaluate options for phasing of this project. Estimated cost for this project is $3,372,000; project completion is scheduled for the year 2029.

CIP 115 - Lift Station Rehabilitation (LS-39, LS-40, LS-41, LS-42, LS-43)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of five existing lift stations (39, 40, 41, 42, and 43). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $3,939,000; project completion is scheduled for the year 2032.

CIP 116 - Sleater Kinney Gravity Main Improvements (Phase 2)

This project will replace and up-size the existing gravity main along the northern portion of Sleater Kinney Rd from 12th Ave to Interstate 5 (manhole U2M01 to VB401). This section of gravity main serves a large number of customers along the City's western boundary and is projected to exceed the City's 80% depth criteria for maximum capacity during peak hour flows. The City should closely monitor flow along this section of gravity main to ensure an appropriate level of timeliness for this project. Estimated cost for this project is $3,120,000; project completion is scheduled for the year 2031.

CIP 117 - Lift Station Rehabilitation (LS-44, LS-45, LS-46)

Mechanical and electrical equipment associated with lift stations typically have a much shorter useful life than the structural components. It is recommended that funds be budgeted for the rehabilitation/replacement of mechanical and electrical equipment based on its age. This project will provide for the rehabilitation of three existing lift stations (44, 45, and 46). These facilities should be carefully inspected prior to project scoping to accurately determine the extent of rehabilitation needed at each site. Significant reconfiguration of the wet-well or site layout is not anticipated at these stations. These stations should also have on-site generators, flow meters, and pressure transmitters installed if they have not already been done through the Generators / Flow Meters project. Wet-wells should be inspected and coated as needed. Estimated cost for this project is $2,117,000; project completion is scheduled for the year 2032.

Table 8-2 20-Year CIP (2020-2033)

CIP No.	Project	Type	Replacement	Upgrade	Expansion	Project Description
101	26th Loop SE Replacement	Capacity			☑	▪ Upsize approximately 1,150 lf of pipe between MH WVM01 to MH VSM01 from 8-inch to 10-inch.
102	Lift Station #3 Pumps and Inlet Piping	Capacity			☑	▪ Increase pumping capacity. ▪ Construct approximately 60 lf of new 15-inch inlet pipe to divert flow from southern and eastern portions of the basin directly to wet well to alleviate surcharging between MH VTA02 and MH VTA01.
103	LS-8	General		☑		▪ Install a backup generator set or connect to the City Hall generator. ▪ Install a flow meter and pressure transducer and connect to SCADA.
104	LS-37 Discharge Manhole Improvements	General		☑		▪ Repair or install appurtenances to relieve surcharging at existing discharge manhole for LS-37, located at the intersection of Yelm Highway and College Street.
105	Lift Station 11 Abandonment	General	☑			▪ Replace LS-11 with 20 individual grinder pumps and install 650 lf of 2-inch force main. ▪ Abandon LS-11.
106	Lacey Boulevard SE Replacement	Capacity			☑	▪ Upsize approximately 900 lf of pipe between MH VBQ01 to MH VCJ01 from 8-inch to 10-inch.
107	Lakeview Drive Gravity Main Replacement Phase 2	Capacity			☑	▪ Upsize approximately 500 lf of pipe between MH VYR01 to MH VZD01 from 10-inch to 12-inch.
108	LS-23 and Force Main Upgrade to 8-inch	Obsolescence, Capacity			☑	▪ Replace lift station and upsize 1,850 lf of force main from 4-inch diameter to 8-inch diameter in 2022. ▪ Mechanical, electrical.
109	LS-9, LS-24 (Rehabilitation)	Obsolescence	☑			▪ Replace in 2024. ▪ Mechanical, electrical.
110	New Lift Station Near Pacific Avenue and Kinwood Street	General			☑	▪ Construct a new lift station to allow for future septic to sewer conversions.
117	LS-27, LS-30, LS-32 (Rehabilitation)	Obsolescence	☑			▪ Replace in 2027. ▪ Mechanical, electrical.
112	LS-33, LS-34, LS-35 (Rehabilitation)	Obsolescence	☑			▪ Replace in 2029. ▪ Mechanical, electrical.
113	Ruddell Trunk Replacement	Capacity			☑	▪ Upsize approximately 1,850 lf of pipe between MH WY601 to WTU01 from 21-inch to 30-inch.
114	Mullen Road STEP Main Replacement	Capacity			☑	▪ Upsize approximately 5,200 lf of pipe between 3JS03 to 3EW02 from 4-inch to 10-inch. ▪ Upsize approximately 2,600 lf of pipe between 3EW02 to 4GW05 from 6-inch to 12-inch.
115	LS-39, LS-40, LS-41, LS-42, LS-43 (Rehabilitation)	Obsolescence	☑			▪ Replace in 2031. ▪ Mechanical, electrical.

Table 8-2 20-Year CIP (2020-2033)

CIP No.	Project	Type	Replacement	Upgrade	Expansion	Project Description
116	Sleater Kinney Gravity Main Improvements 2					▪ Upsize approximately 430 lf of pipe between MH VQD01 to MH VKW01 from 15-inch to 18-inch. ▪ Upsize approximately 800 lf of pipe between MH VGE01 to MH VBV01 from 15-inch to 21-inch. ▪ Upsize approximately 560 lf of pipe between MH VBV01 to MH VCH01 from 15-inch to 24-inch. ▪ Upsize approximately 1,430 lf of pipe between MH VBD01 to MH U7D01 from 21-inch to 30-inch. ▪ Upsize approximately 400 lf of pipe between MH U7D01 to MH U2W01 from 24-inch to 30-inch. ▪ Upsize approximately 1,270 lf of pipe between MH U2W01 to MH UYW01 (discharge to LOTT system) from 24-inch to 36-inch.
117	LS-44, LS-45, LS-46 (Rehabilitation)	Obsolescence	☑			▪ Replace in 2032. ▪ Mechanical, electrical.

8.3 Opinions of Probable Cost

Opinions of probable project costs for the 6-year CIP are listed in Table 8-3. These projects have been defined only to a preliminary level of design with approximate dimensions. All projects will require further definition and design refinement as part of the design process.

Construction costs were estimated from bid results for similar projects in the Puget Sound area and RS Means cost data for 2013. The opinion of probable construction cost includes the costs to build the various components and sales tax.

Opinions of probable costs for City labor and direct costs, planning, surveying, engineering services, permitting, bid advertisement, contract award, and services during construction were calculated as 30 percent of the opinion of probable construction costs. No costs are included for financing, easements, right-of-way, or property acquisition unless specifically noted.

Table 8-3 Opinion of Probable Project Costs, 6-Year CIP (2014-2019)

CIP No.	Project	Replacement	Upgrade	Expansion	Opinion of Probable Project Cost
1	Wastewater Comprehensive Plan Update (recurring)		☑	☑	$45,000
2	LS-25 and LS-31 Retrofit	☑	☑		$1,023,000
3	Steilacoom Road Lift Station	☑			$3,650,000
4	Tanglewilde East ULID			☑	$3,764,000(2)
5	College Street and Martin Way ULID			☑	$750,000
6	STEP Main Air/Vac's	☑			$224,000
7	LS-18	☑			$690,000(1)
8	Lakeview Drive Gravity Main Phase 1		☑		$500,000
9	LS-15 Generator/Flow Meter		☑		$350,000
10	Avonlea Odor Control		☑		$100,000
11	Train Depot			☑	$62,000
12	Carpenter Road STEP Upgrades	☑			$50,000
13	Lift Station 2 - Lift Station, Gravity, and Force Main Replacement	☑			$1,610,000
14	Rumac St STEP Main			☑	$1,000,000
15	Mullen Road Force Main		☑		$500,000
16	College Street Repair	☑			$100,000
17	Annual Sewer Line Replacement	☑			$300,000
18	FOG/Fibrous Wipes Pilot Program		☑		$50,000
19	Generator/Flow Meter LS-22, LS-23, LS-17, LS-20		☑		$800,000
20	LS-49 Land Purchase		☑		$120,000
21	LS-12 Abandonment		☑		$200,000(3)

Table 8-3 Opinion of Probable Project Costs, 6-Year CIP (2014-2019)

CIP No.	Project	Replacement	Upgrade	Expansion	Opinion of Probable Project Cost
22	Sleater Kinney Gravity Main Improvements		☑		$1,300,000
23	Lift Station Rehab (Phase 1)	☑	☑		$1,900,000
24	Lift Station Rehab (Phase 2)	☑	☑		$2,850,000
25	Lift Station and STEP System Flow Meters		☑		$690,000(4)
26	Sewer Main Replacement (50th Ave)		☑		$210,000
27	Chemical Storage Tank Replacement	☑			$150,000
28	Sewer Main Replacement (34th Ave)		☑		$60,000
Total Opinion of Probable Project Cost					**$23,048,000**

Notes:
(1) Costs for LS-18 only include construction costs. Other project costs were previously expended.
(2) Tanglewilde East is expected to be financed using bonds, to be repaid with funds from the ULID.
(3) LS-12 Abandonment includes land acquisition and allied costs. Construction will occur in 2020 and is not included in the 6-year CIP.
(4) Lift Station and STEP System Flow Meters construction will continue into 2020. The 2020 construction costs are not included in the 6-year CIP.

Chapter 9 Wastewater Reuse

The City does not own, operate, or maintain a wastewater treatment plant. LOTT treats and disposes of all of the City's sewage from the collection system. The agreement between the City and LOTT is included as Appendix A. LOTT owns and operates two treatment plants.

The Budd Inlet Treatment Plant (BITP) is LOTT's largest plant, and it serves the cities of Lacey, Olympia, Tumwater, and Thurston County. The BITP produces up to 1 MGD of Class A reclaimed water which is used for irrigation, cleaning, and a constructed pond.

The Martin Way Reclaimed Water Plant (MWRWP) only receives wastewater generated in the City and produces Class A reclaimed water. The Martin Way Pump Station diverts some flow to MWRWP, with excess flow conveyed to BITP. The MWRWP currently has a 2 mgd capacity, and is planned to be expanded to 8 mgd. The plant currently conveys reclaimed water to the Hawks Prairie Reclaimed Water Ponds/Recharge Basins, a series of constructed wetland ponds and groundwater recharge basins on a 40-acre site located off of Hogum Bay Road NE and 30th Ave NE via a 14-inch reclaimed water main. The reclaimed water system is shown on Figure 9-1.

LOTT makes Class A reclaimed water available to the partner jurisdictions, who then distribute the water to the end-user. This water may be used for irrigation, dual-plumbed buildings, environmental enhancement projects, and many other non-potable uses. LOTT reserves the first 0.25 mgd of reclaimed water produced at the MWRWP for its use at the plant and at the Hawks Prairie Ponds/Recharge Basins. The remainder of the first 1 mgd is allocated to Lacey and Olympia (60% and 40%, respectively), while 100% of the second 1 mgd is allocated to Lacey. Reclaimed water produced by MWRWP is shown on Table 9-1.

Table 9-1 Annual Average Reclaimed Water Produced at MWRWP

Year	Annual Average Flow (mgd)
2007	0.62(1)
2008	0.52
2009	0.87
2010	0.98
2011	0.47

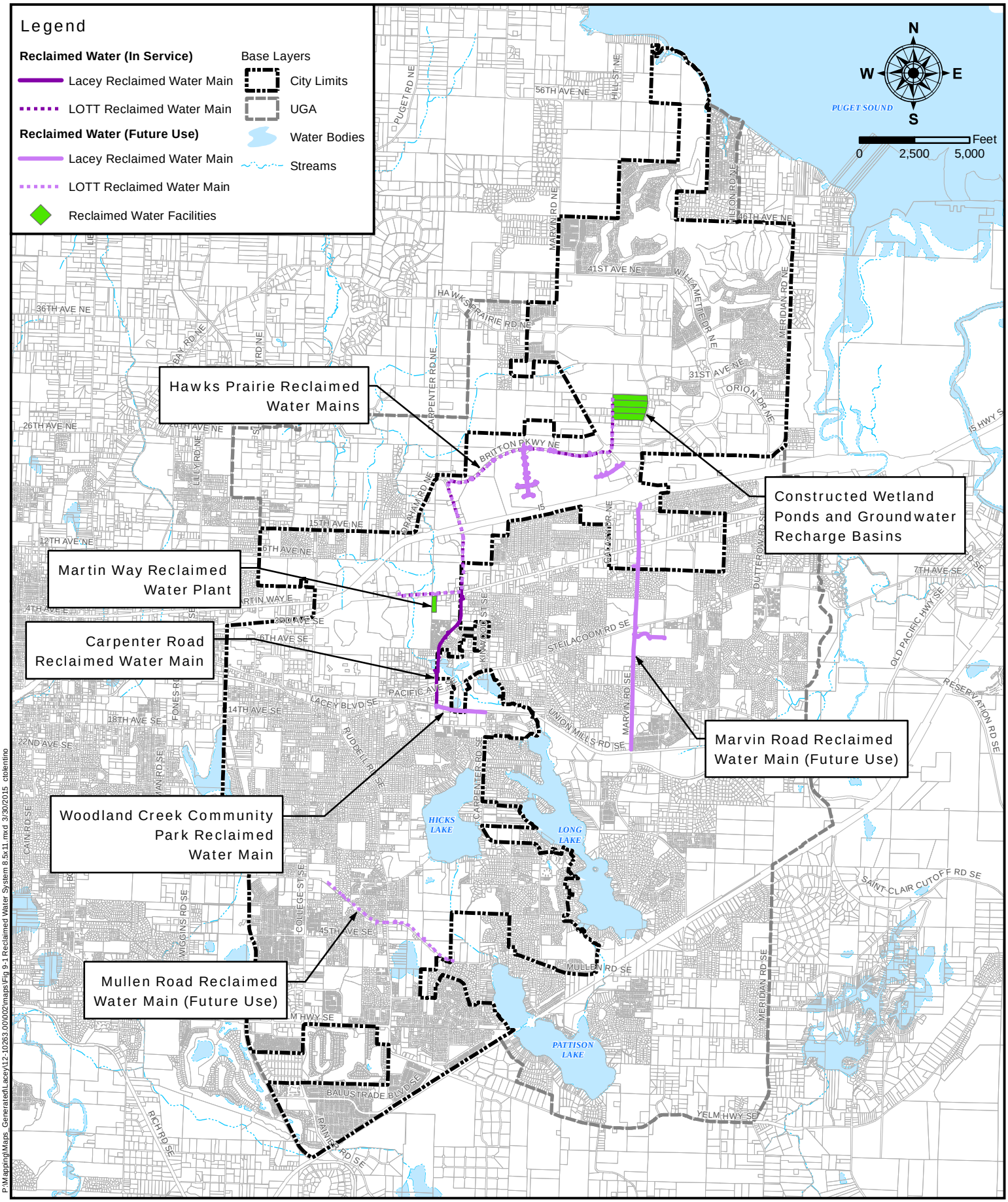
Notes:
(1) Reclaimed water in 2007 was only produced in October, November, and December.

The City will be diverting some of the reclaimed water to infiltrate at Woodland Creek Community Park off of Pacific Avenue to preserve stream flows in Woodland Creek and to serve as mitigation for additional water rights. The City has also planned to construct a reclaimed water distribution system, including a booster pump station and reservoir, which is tentatively planned to begin construction in 2021. This will provide access to reclaimed water along the City's Britton Parkway and future Main Street corridors.

The City has also installed reclaimed water piping in Marvin Road SE between I-5 and Union Mills Road SE. The pipe will eventually serve the Regional Athletic Complex (RAC), but is

currently dry. The pipe may be connected to the reclaimed water piping leaving the MWRWP, or to the City's future reclaimed water distribution system when it becomes economically feasible to do so.

LOTT has long-range plans to build a future reclaimed water satellite plant on Mullen Road near College Street. A 12-inch reclaimed water main owned by LOTT has already been installed in Mullen Road between College Street SE and Forest Glen Drive SE.



P:\Mapping\Maps_Generated\Lacey\12-10263.00\002\maps\Fig 9-1 Reclaimed Water System 8.5x11.mxd 3/30/2015 ctolentino

GIS Data: City of Lacey.
This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

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www.bhcconsultants.com

RECLAIMED WATER SYSTEM
WASTEWATER COMPREHENSIVE PLAN UPDATE
City of Lacey
April 2015

Figure
9-1

Chapter 10 Operations and Maintenance

10.1 Introduction

Wastewater Maintenance and Operations (O&M) is a group within the City's Public Works Division. Day to day operation of the City's wastewater utility is divided into five distinct budgeted programs, General Services, Customer Service, the Wastewater Lift Stations Program, the Wastewater Mains Maintenance Program, and the STEP System Maintenance Program. Of these five, the wastewater lift stations, mains maintenance, and STEP system maintenance programs directly apply to the daily field operation and maintenance of the collection system.

10.2 Organization of the Wastewater Sections

Wastewater Programs are under the direct supervision and support of the Water/Wastewater Supervisor and two Senior Technicians. These programs are divided into three main sections that include O&M of wastewater lift stations, wastewater mains, and STEP systems.

The Senior Tech leading the Lift Station Section is responsible for maintenance of the City's lift stations, auxiliary generators, and SCADA/radio communication systems. A second Senior Tech leads both the Wastewater Mains and STEP System Sections. Those responsibilities include maintenance of the City's network of gravity and pressure sewer pipe, manholes and cleanouts, odor control systems, and STEP systems. STEP systems include a mix of individual STEP pumps, community STEP lift stations, STEP pressure mains, debris tanks, and a growing number of residential grinder pump systems.

Of the thirty-five full time employees allocated to the Water/Wastewater Division, fourteen are assigned to Wastewater Programs. An organization chart showing the 2013 Wastewater Group structure is shown in Figure 10-1.

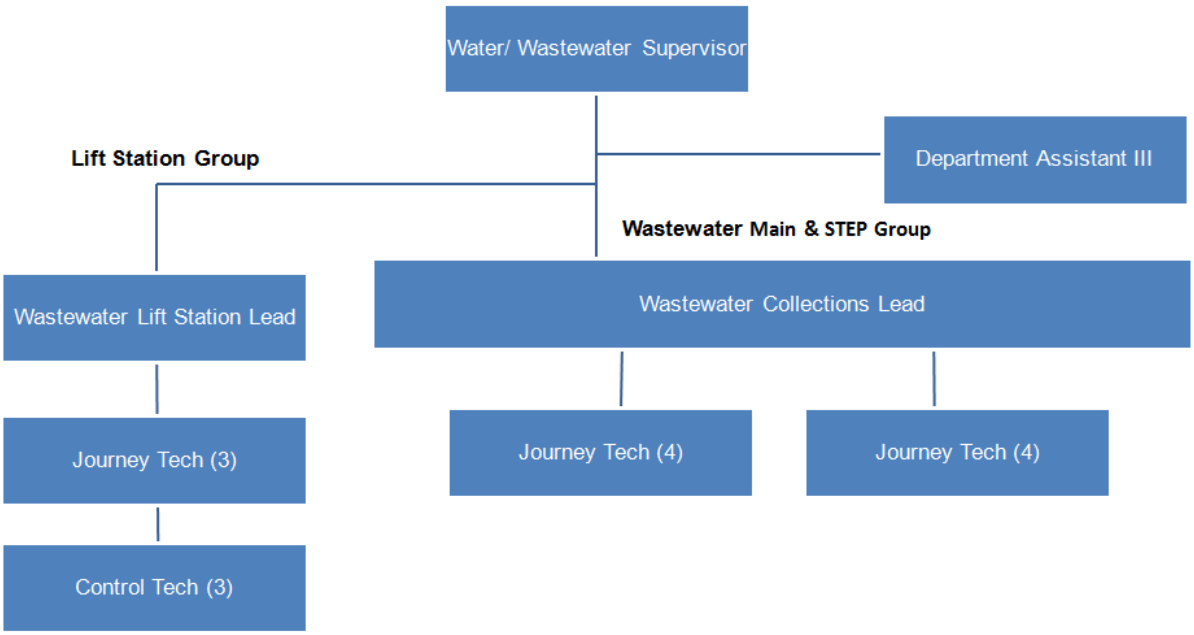


Figure 10-1 Wastewater Group Organization Chart

Wastewater staff is assigned to one of four crews that are responsible for the following activities:

1. Main line sewer cleaning
2. Closed Circuit Television (CCTV) inspection
3. STEP systems
4. Lift Stations
5. Auxiliary Generators
6. Odor Control

10.3 Infrastructure Condition Assessment

This section describes and summarizes the general condition of the facilities and infrastructure components that the department is responsible for operating and maintaining. A detailed description and mapping of the existing system of lift stations, force mains, major gravity lines, and STEP mains within the UGA is presented in Chapter 5: Existing Wastewater Facilities.

The City discharges all of its wastewater to the LOTT Clean Water Alliance for treatment. There are multiple discharge points to LOTT's system, which generally follows Martin Way from Galaxy Drive to Sleater Kinney Road. Areas entering LOTT's system west of Desmond Drive flow toward Olympia and ultimately to the Budd Inlet treatment plant. Areas that enter LOTT's system between Desmond Drive and Galaxy Drive ultimately flow to the Martin Way pump station (formerly Lacey's LS-16). The Martin Way pump station then directs flows to either the Martin Way Reclaimed Water Plant or to the Budd Inlet treatment plant as needed.

Following are descriptions of the City's sewer system components and their condition in relation to the Wastewater Division's operation and maintenance activities.

10.3.1 Sewer Mains

At a system-wide level, the gravity system is generally in very good condition, with little evidence of excessive inflow or infiltration, which is a common indicator of sewer system degradation. There are isolated areas in the older portion of the system, such as along Sleater Kinney Road. Where CCTV inspections indicate that sewer rehabilitation or replacement is warranted. However, modeling has indicated that this area is hydraulically deficient, and as such, work associated with this line is addressed in the Capital Improvement Plan of this report.

The objective of the on-going CCTV and manhole inspection programs is to identify structural problems early, before they become significant and costly to repair. The objective of the line cleaning and manhole washing maintenance programs is to relieve potential blockages, greatly reducing system overflows, and minimizing emergency call outs. The City maintains the inventory of sewer main components shown in Table 10-1. This also includes a portion of LOTT owned sewer lines which are maintained by the City through an inter-local agreement, a copy of the agreement is included in Appendix A.

Table 10-1 2010 Inventory of Sewer Main Components

Sewer Mains	141 miles
Sewer Mains (LOTT owned)	2 miles
Force Mains	15 miles
Force Mains (LOTT owned)	2 miles
STEP Mains	52 miles
Manholes and Clean-outs	4,000

10.3.1.1 Gravity Sewer Connections

The majority of sewer accounts are connected to the sewer system by means of gravity connections. Gravity connections account for approximately 75 percent of all connections. See Table 10-2 below for connection counts in 2004 and in 2009, 2010 and 2011.

Table 10-2 Gravity Connections

Year	2004	2009	2010	2011
Gravity Connections	7,416	11,111	11,453	11,639
Gravity EDU's	10,897	15,196	15,556	15,750
% (of total connections)	71%	76%	75%	75%

10.3.2 STEP and Grinder Pump Systems

There were 2,974 active STEP connections throughout the City in 2004 (including community STEP). That number had increased to 3,937 by 2011. While an increasing number of grinder pump systems are being constructed in areas where STEP is not practical, the number of grinder pump accounts is still small compared to the number of STEP accounts. As such, all equipment, operations and maintenance activities associated with the grinder pump accounts are included in the STEP System Program.

Individual STEP systems tend to be more costly from an O&M perspective than individual residential grinder pump systems. This is largely due to the maintenance requirement that the tanks in which the STEP pumps are located must be pumped out, similar to septic tanks used for on-site treatment systems. Wastewater Division staff are responsible for conducting these pump outs as part of their regular maintenance activities.

Operations staff currently has a generally positive outlook on grinder pump systems and are considering whether to promote their use. Since the grinder systems do not require the use of storage or septic tanks, pump out maintenance costs are considerably lower. It is also anticipated that grinder pumps will contribute lower levels of corrosive and odiferous gasses when compared to STEP, particularly when used in limited numbers with relatively short force main lengths. However, the individual pumping units are more expensive to replace and may have a shorter life span due to pumping raw sewage rather than screened effluent.

Individual homeowners currently own and are responsible for any maintenance or repairs to the grinder systems. This is in contrast to STEP systems, which are fully owned and maintained by the City. Because of this discrepancy the City is currently assessing whether or not to take over ownership and operation of these and future grinder pumps and whether the future cost of ownership, including O&M costs, would be less than or equal to that of STEP pump systems. If so, the City may choose to promote their use in areas of the collection system where a pressure sewer alternative is the best option.

E/One grinder pumps manufactured by Environment One, Inc. are commonly used by agencies across the Pacific Northwest, including the City. According to the manufacturer, there is an average of ten years between service calls on these pumps. Local agencies are equally divided in how they manage their grinder pump systems. Some agencies own and maintain the pump systems, while other agencies, including the City, do not own or maintain them for the homeowner.

Prior to the preparation of the *2005 Wastewater Comprehensive Plan*, maintenance costs for individual STEP systems had been steadily increasing to the point that the City was considering halting construction of new STEP systems. The Capital Improvement Plan for the 2005 Plan was based on the assumption that all future growth would be served by means of traditional gravity sewers and pump stations, and no future STEP connections would be allowed. Significant contributors to the high cost of maintenance were costs associated with pumping out STEP tanks.

Orenco Systems, Inc., the manufacturer of the individual STEP pumps used by the City, assisted the City's Wastewater Division and Engineering staff in conducting a study to determine an optimal cleaning rate for the tanks. It was determined that pump out frequency could be reduced from the previous service level of once every five years to a new service level of once every eight years, without increasing the risk of plugging the system with solids.

This reduced level of service has been implemented and has greatly reduced the cost of maintaining STEP systems, primarily through reductions in labor. These cost reductions have once again made STEP connections economically viable alternative to traditional gravity/lift station systems. At this time, it is anticipated that some future growth areas will be served using STEP systems.

The STEP system was evaluated in 2011 to determine the remaining capacity of the system and to address concerns regarding higher than anticipated operating pressures and long run times at some of the City's community STEP lift stations (CSLS). The results of the study were reported in the *2011 Wastewater STEP Main Evaluation*. It was determined that the STEP system was not reaching capacity due to wastewater loading, even though system pressures were limiting the ability of some community lift stations to pump wastewater into the STEP system during peak flow periods. Two of the City's CSLS's, LS-25 and LS-31, were found to have pumps that are not compatible with the range of pressures expected in the area. It was recommended that these stations be fitted with pumps more appropriate for the application.

It was also found that STEP system pressures would drop immediately following line cleaning (pigging) but would return to an elevated state after only 1-2 weeks of normal operation. The speed with which the pressure would increase following pigging suggests that entrapped air in the STEP mains was the primary reason for the elevated pressures. This, along with significant elevation changes and relatively small main sizes is the likely cause of long runtimes reported at some CSLS's along Steilacoom Road, north of Madrona Park. Faulty air/vacuum valves were identified as the probable reason for the air entrapment and Operations staff has been actively repairing and replacing existing air/vacuum valves since that time. Valve maintenance and line cleaning activities have combined to maintain system pressure at acceptable levels until such time as flow from those CSLS's can be diverted north following construction of the Steilacoom Road lift station.

Excluding the hybrid community STEP lift stations, the current STEP system includes the inventory of facilities shown in Table 10-3:

Table 10-3 2011 Inventory of STEP System Components

Individual STEP Systems	2,921
Pressure STEP Mains (City owned)	52 miles
Pressure STEP Mains (private)	0.5 miles
Sewer Air Relief valves	150
Grinder Pumps	98

STEP and grinder system connections account for approximately 25 percent of all connections to the City's sewer system. See Table 10-4 below for connection counts in 2004 and in 2009, 2010 and 2011. Note that the difference between the number of STEP Connections and the number of STEP tanks represents the number of homes connected to community STEP lift stations.

Table 10-4 STEP and Grinder Pump Connections				
Year	**2004**	**2009**	**2010**	**2011**
STEP Systems	2,654	2,861	2,867	2,921
STEP Connections (EDU's)	2,742	3,026	3,043	3,099
Community STEP Systems	10	19	19	20
Community STEP Connections (EDU's)	415	756	866	1,012
Grinder Systems	14	87	93	99
Grinder Connections (EDU's)	26	140	146	152
% of Total Sewer Connections	29%	24%	25%	25%

10.3.2.1 STEP System Flow Meter

The City currently has one flow meter for monitoring flows in its STEP areas. The meter is located on a 14-inch STEP main at 7509 Union Mills Road SE and measures flow originating from the eastern portion of the system, primarily along the Marvin Road corridor. Pressure measurements are also taken at this location. Flow and pressure monitoring can play an important role in diagnosing operational problems, determining existing operating conditions, and in future planning. It is recommended that the City install additional flow and pressure monitoring sites throughout its STEP areas so that it can better evaluate the performance and remaining capacity of those areas as well.

10.3.2.2 STEP System History

Construction of the first STEP systems in the City occurred in 1986 and the City has owned and operated STEP systems since 1989. By 1998 1,400 STEP systems had been installed and failure rates on individual systems had begun to increase noticeably, peaking at 26 percent annually that year. Failures require an emergency call out and are defined as the inability of an individual STEP system to operate, no matter what the reason.

Failure rates were reduced substantially by implementing a Full Service Maintenance (FSM) program in 1999. Two brief reports, both prepared by City staff, are included in Appendix I. Combined they provide a history of the STEP system and implementation of the FSM program. Maintenance activities that comprise the FSM program are described below in Table 10-10.

10.3.2.3 Odor Control Facilities

There are a total of 8 active odor control facilities being maintained by wastewater staff. Odor problems are typically related to the presence of hydrogen sulfide, therefore the alternatives for control of odor are typically aimed at preventing sulfide generation or at removing sulfides through chemical or biological action. The City takes odor complaints very seriously and utilizes a combination of chemical injection, aeration, and soil filter beds to reduce offensive odors to the maximum extent feasible. Chemical injection also provides the added benefits of maintain a residual effect in the downstream system and reducing corrosive gasses, prolonging the life expectancy of the City's infrastructure.

All odor control (OC) equipment, chemicals, and O&M costs are currently funded through the STEP System Program. However, to more accurately reflect actual cost activities to relevant

budgets, the OC budget should be treated as a stand-alone program benefiting the entire customer base.

Table 10-5 Inventory of Odor Control Facilities

Name	Address	Type	Telemetry
OCF 01	6620 Carpenter Rd. SE	Chemical Injection	No
OCF 02	9165 31st Ave. NE	Chemical Injection	No
OCF 03	6100 Stockton St. SE	Chemical Injection	Yes
OCF 04	5800 Rumac St. SE	Chemical Injection	No
OCF 06	4905 Ruddell Rd. SE	Soil Filter Bed	No
OCF 08	6120 Thornbury Ct. SE	Aeration/Soil Filter Bed	No
OCF 10	4031 Campus Green Dr. NE	Aeration/Soil Filter Bed	No
OCF 12	4119 Ingleside Lp. SE	Chemical Injection	No
OCF 05	Nelson St. SE	Soil Filter Bed	No
OCF 07	3065 Hogum Bay Rd. SE	Soil Filter Bed	No
OCF 09	6200 61st Ave. SE	Soil Filter Bed	No
OCF 11	800 Torden Ln. SE	Chemical Injection	No
OCF 13	8320 Vashon Dr NE	Chemical Injection	No
OCF 14	2365 Shady Glen Ct. SE	Chemical Injection	Yes

Notes:
1) Chemical storage tank levels are monitored through the chemical suppliers SCADA system. City staff also conducts bi-weekly site visits and an annual tank inspection.
2) Shaded facilities are currently inactive.
3) OCF 12 is currently in the process of being replaced and possibly relocated.

10.3.3 Community Septic Systems

The Wastewater Mains group is responsible for maintaining four community septic systems that are located within the City's system. These on-site treatment systems are viewed as temporary systems, which will be removed from service by the City as sewers are constructed nearby and connection to the City's system becomes economically feasible. The residents currently pay regular connection fees and rates. New community septic systems are discouraged. The City's policy is discussed in more detail in Chapter 4.

10.3.4 Lift Stations

At the end of 2012 there were 47 wastewater lift stations in service within the City's service area. Of these, 20 are hybrid community STEP lift stations (CSLS). City-owned lift stations range in capacity from 30 gpm up to 2,000 gpm. Rapid growth in the service area had been occurring prior to the time that the *Wastewater Comprehensive Plan* was last updated in 2005. By the end of 2003, the reporting year for the previous plan, there were 29 lift stations listed as being in service, an increase of 18 stations. Population growth has slowed substantially in recent years; however given the topography and distance to the existing gravity system from the outlying areas of the UGA where most growth is anticipated, the number of lift stations is expected to increase.

Wastewater service to support future growth in the outlying areas of the UGA is currently anticipated to be largely met by utilizing low pressure STEP or grinder pump systems. These alternative systems can be effective in areas where the terrain significantly limits the number of homes that are able to drain to a central location and will help to reduce the total number of lift stations at build-out. Lift stations will continue to be the preferred alternative in areas serving a sufficiently large number of customers. As such, O&M costs and labor effort are expected to rise due to the increased maintenance, repair, and power consumption associated with each new station. Chapter 4 discusses how the City will determine when STEP or grinder systems should be utilized or if a new lift station is warranted, and the cost effectiveness of each.

Auxiliary generators, which provide electrical power to operate pumps in the event of a power failure, are currently installed at 34 of the existing lift stations. During electrical outages, stations that do not have auxiliary power generation installed are kept in operation through the use of portable diesel driven generators delivered to the site by wastewater staff. These deliveries are often made under emergency conditions and in adverse weather. Five portable generators are available and maintained for this purpose. It is the City's goal to eventually install auxiliary power generation at all lift stations.

The City also owns 5 additional generators that are used for non-sewer purposes that are maintained by the Lift Station crew. These are located at water facilities, City Hall, the Maintenance Center, and Animal Services.

An inventory of City-owned lift stations and generators is included in the Lift Station Inventory provided in Appendix E.

10.4 Operation and Maintenance Programs

Organized maintenance planning is necessary to ensure continuous service to customers and to maximize the benefit derived from the wastewater assets that are owned, operated and maintained by the City. The Wastewater Division implements several maintenance programs designed to maintain system integrity, extend component life, and reduce the overall cost of owning and maintaining the collection system. These programs are funded through the Wastewater Main, the Wastewater Lift Station, and the Wastewater STEP System budget programs.

In general, the City's Wastewater O&M program conforms to practices recommended by the Water Environment Federation (WEF) in *Wastewater Collection System Management Manual of Practice* (published by WEF, 1992) and in EPA's CMOM program. See Section 10.6 and Appendix J *Checklist for Conducting Evaluations of Wastewater Collection system Capacity, Management, Operation, and Maintenance (CMOM) Programs, USEPA, 2005* for more details on CMOM.

This section describes most of the Lift Station maintenance programs that are currently in place. Descriptive text is provided for the maintenance programs that require the highest levels of labor or capital funding.

10.4.1 Wastewater Lift Station Program

The City owns and maintains 47 lift stations ranging in complexity and size having nameplate capacities ranging from 30 gpm to 2,000 gpm. There is a mix of submersible, wet well/dry well, and above grade/vacuum prime configurations. While each station is unique, they generally consist of mechanical pumps and electric motors, enclosure and vaults, telemetry and process

control to allow for automatic pump control and remote monitoring. The City is slowly phasing out its existing above grade/vacuum prime stations and has standardized on submersible stations for all future installations.

In many cases a backup diesel powered electric generator is installed to ensure continuous service in case of power failure. Detailed operating instructions for pump station components are provided in the O&M manuals for each station. The manuals have been compiled by the various equipment manufacturers and are located at each station and on file at the maintenance shop. The City is also developing an electronic version of the O&M manuals that will be accessible through the City's network.

Lift station maintenance programs include the operation, maintenance and repair of lift station structures and components, auxiliary power generators, STEP system electrical support, Supervisory control and data acquisition (SCADA) programs. Field work associated with odor control facilities is also the responsibility of the lift station section.

Figure 10-2 shows a breakdown of the regular labor hours spent on wastewater lift station maintenance.

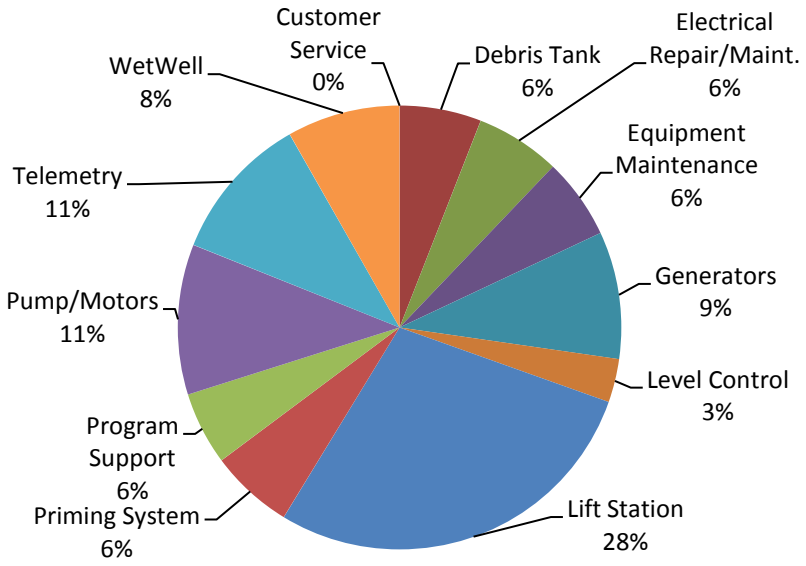


Figure 10-2 Wastewater Lift Station Maintenance Program Labor Hours

The Wastewater Lift Station crew consists of seven staff: one Senior Technician, three Journey Level Technicians and three Control Technicians. This crew is responsible for the on-going activities listed in Table 10-6 (level of service in parenthesis), all maintenance programs associated with the City's lift stations, and the activities listed in Table 10-7.

Table 10-6 Sewer Facility Maintenance Checks

▪ Wastewater facility security management ▪ Wastewater production report support ▪ Power failure support equipment ▪ Pipes and check valves (annually) ▪ Sump pumps (monthly) ▪ Lighting ▪ Heating and ventilation ▪ Facility site and station checks (semi-annual) ▪ Equipment (varies by manufacturer)	▪ Motors (annually) ▪ Control valves (monthly) ▪ Oil and filters (bi-annually) ▪ Buildings and vault O&M (semi-annual) ▪ Blower and vent screens (monthly) ▪ STEP Electrical Support ▪ STEP effluent sampling (bi-weekly) ▪ Training

Table 10-7 Maintenance Activities for Wastewater Lift Stations

Maintenance Activity	Definition	Benefit to the City	Target Service Level	Rationale for the Service Level	2011 Actual Service Level
Wet Well Cleaning	Flushing, jetting and evacuating wet wells. (Preventive Maintenance)	Minimizes odor and corrosion; ensures reliable level control.	Frequency varies based on type of station, flows and debris in wet well.	Based on industry standard and operator's observations.	100% of target
Service Electrical Control Panels	Inspection, cleaning and calibration of electrical control panels (15 tasks). (Preventive Maintenance)	Ensures efficient and reliable operation	Weekly inspection, quarterly calibration and annual cleaning and testing	Based on industry standards and manufacture's recommendations.	100% of target
Maintain Buildings and Enclosures	Cleaning, inspection and maintenance including grounds maintenance. (Preventive Maintenance)	Ensures security and protection of equipment in buildings	Monthly, quarterly and annual cleaning and inspection	Based on industry standard.	100% of target
Pump Service	Pull pump, clean, inspect, and service pump components (12 tasks). (Preventive Maintenance)	Improves lift station reliability, Identifies need for pump repairs	Annual	Based on industry standards and manufacture's recommendations.	100% of target
L/S Checks and Readings	Checks and readings of pump stations. (Preventive Maintenance)	Record pump run times	Weekly and year end pump hour readings	Based on industry standard	100% of target
Telemetry System Test	Physical test and inspection of telemetry system. (Preventive Maintenance)	Improves SCADA reliability and accuracy	Semi-annual	Based on industry standard	100% of target
Generator Inspections	Generator inspection and testing. (Preventive Maintenance)	Confirms operation to ensure that generators will function when required in emergency situations.	Portables monthly. Fixed generators weekly exercising and hour meter readings.	Manufacturers' recommendations	100% of target
Vehicle/ Equipment Maintenance	Weekly cleaning, fueling and stocking of line cleaning and TV inspection vehicles to ensure they are ready for work. (Includes equipment servicing, small equipment and tools) (Preventive Maintenance)	Ensures rapid and efficient mobilization of crews. Improves reliability of vehicles and equipment.	Weekly maintenance of vehicles (presently conducted at end of shift on Fridays)	Preparation of vehicles in advance of weekends (when emergency call outs may occur)	Generally met the target
HTE Support for Automated Maintenance Management System (AMMS)	Updating the HTE system (Record Keeping and Administration)	Maintains currency of AMMS	Daily, as required	Complete and timely information is required for management purposes	Generally met the target
Minor Maintenance	Includes a range of maintenance activities including start-ups, priming, supervision, level control, etc. (24 tasks each consuming less than 3% of the total pump station maintenance hours). (Corrective Maintenance)	Ensures system reliability and responds to the needs of customers	As required. Immediate response to emergencies. Routine work is scheduled as available.	Based on the past experience and best management practices.	As required

10.4.1.1 Supervisory Control and Data Acquisition (SCADA)

The SCADA system monitors the operation and alarms at the City's lift stations, generators, and odor control facilities. The system also alerts on-call staff of any alarms that occur outside of normal business hours. The system transmits and records wet well levels, pump cycles (starts and stop's), set points and work history. Flow and pressure monitoring is also being added to all new lift station, while existing stations are being retrofitted with these capabilities whenever the station undergoes significant upgrades. The lift station maintenance crews currently support the SCADA System Operation & Maintenance and perform semi-annual telemetry alarm checks.

A Site Survey Evaluation was conducted in 2012 to determine if additional repeater locations would help resolve chronic SCADA communication failures that were being experienced. At the time the radio communication system consisted of 86 Water/Wastewater facilities transmitting communication data to a single repeater. The survey identified a need to install three new repeaters.

Repeaters were installed at the Hawks Prairie, Judd Hill and McAllister water reservoirs. Installation of these repeaters has optimized water/wastewater SCADA communication abilities and minimizes communication failures. The old repeater at Union Mills is no longer required.

10.4.2 Wastewater Main Maintenance Program

The Wastewater Mains Program includes the operation, maintenance and repair of the City's wastewater mains, which range in size from 4- to 27-inches in diameter, pressure mains, manholes, sewer clean outs, and air release valves.

The Wastewater Mains maintenance crew consists of four Journey Level Technicians working under the supervision of a Senior Technician responsible for the Wastewater Mains and STEP System programs. This crew is responsible for maintenance programs associated with the City's gravity sewer mains, pressure mains, manholes and cleanouts. Components of the Wastewater Mains Maintenance program discussed in detail below include the Line Cleaning and the Closed Circuit Television (CCTV) programs.

Figure 10-3 shows a breakdown of the regular labor hours spent on wastewater main maintenance.

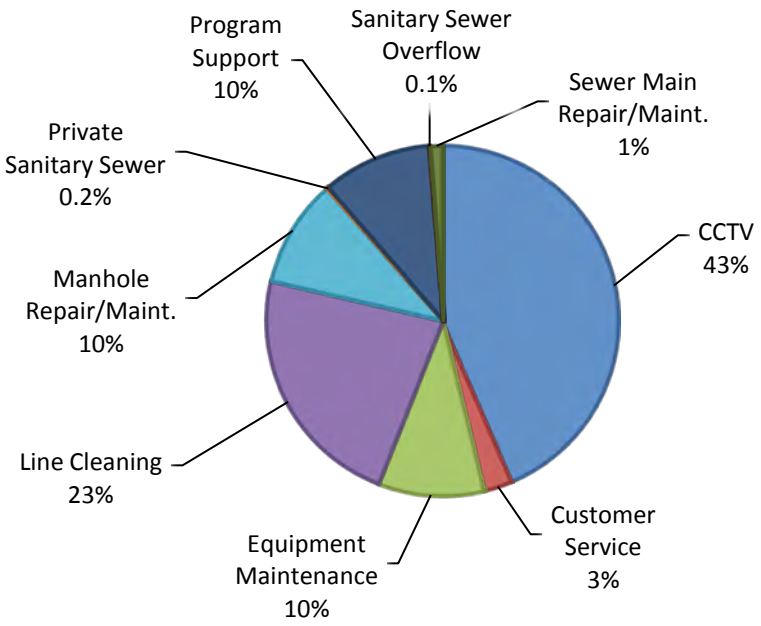


Figure 10-3 Wastewater Mains Maintenance Program 2011 Labor Hours

10.4.2.1 Line Cleaning Program

Two staff members are assigned to the Line Cleaning program. City-owned jetting equipment is used to conduct cleaning activities throughout the gravity main collection system.

Line cleaning helps to remove debris such as sand and rocks, silt, grease, and roots that accumulates in pipelines. If debris is allowed to accumulate, it reduces the hydraulic pipe capacity and blockages can occur, which in turn, can result in overflows from the system onto streets, yards, basements, or surface waters.

Gravity sewers are cleaned utilizing high pressure jetting equipment. A nozzle attached to a length of high pressure hose is connected to a high pressure water pump. Pressurized water expelled from the nozzle jets cleans debris and removes pipe blockages from the inside of the pipe. Debris is then removed from the system and decanted prior to disposal. Maintenance crews experience mixed results successfully removing roots. Operators are responsible for recording line segments, footage and the volume of water used on Line Cleaning reports.

It is the City's goal to clean 20% (147,000 LF) of the gravity collection system each year as recommended by the City's insurance carrier. In 2009 the City added a dedicated line cleaning truck and crew, since that time the City has outperformed its goals (Figure 10-3). A high frequency of line cleaning is critical to limiting the City's risk of sewer overflows and potential property damage. The City has not experienced an overflow due to line blockages in its gravity system in over 15 years.

Work orders are typically filled to clean sewers under one of three conditions below. The lengths of pipe cleaned are displayed in Figure 10-4.

1. Many sewer lines are cleaned on a rotating basis with a goal of cleaning approximately 20 percent (147,000 LF) of sewer annually, providing a system-wide level of service of 5-years.
2. Routine preventative cleaning is also scheduled at locations within the system where sediment deposition, FOG or root intrusion conditions are known to exist and cleaning more than once every 5-years is warranted. Levels of service for these high frequency areas vary from semi-annual to bi-annual frequencies.
3. Unanticipated and emergency cleaning is conducted on an as-needed basis. These conditions are typically identified through on-going television and manhole inspection activities, or through customer reports.

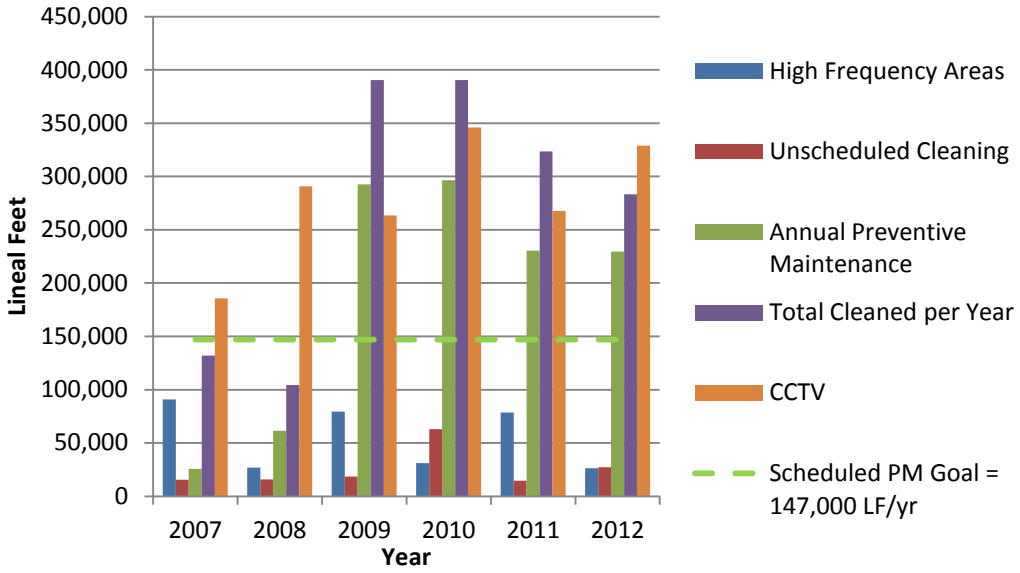


Figure 10-4 Annual Sewer Line Cleaning

10.4.2.2 Closed Circuit Television (CCTV) Inspection Program

Two operators are assigned to the CCTV program. The operators receive certification through the Pipeline Assessment and Certification Program (PACP). During certification, operators are trained in the use of a unified abbreviation and code system, which is an industry standard used to describe features, defects and conditions in underground pipes.

TV inspection is performed with City-owned equipment, utilizing a robotic camera that is lowered into the sewer line through a manhole. Consistent with most modern television inspection equipment, the system has the capabilities to move the camera forward and backward, change its angle of perspective, and digitally record and document a visual image of a pipeline's interior using computer management software. The camera is sized such that pipelines 8- through 27-inches in diameter can be inspected.

It is the Wastewater Divisions goal to inspect 20 percent (147,000 LF) each year. The City has exceeded its goal for this category in recent years, recognizing the benefits that TV inspection provides. Inspection reports produced by the CCTV program are used to identify problematic areas requiring higher cleaning frequencies and to monitor the condition of the pipes so that rehabilitation efforts can be initiated prior to a failure. Figure 10-3 shows the total length of sewer inspected using CCTV for 2009-2011.

10.4.2.3 Fats, Oils, and Grease (FOG), and Flushable Wipes

When fats, oils and grease are discharged into sewer systems they congeal and can clog collection system pipes which can lead to sewage spills, overflows at manholes or backups in homes and businesses. FOG reduces the hydraulic capacity in the collection system and causes clogging at lift stations. Its presence increases maintenance costs through increased pipe cleaning frequency, cleaning and repair of lift stations due to grease build-up, and increased inspection frequency to check the system for FOG build-up.

Operations staff experience indicates that commercial accounts such as restaurants tend to be the highest contributors of FOG into the system. The City's FOG program is currently taking an educational approach tailored to inform citizens of the negative impact that FOG has on the wastewater system. LOTT provides educational materials and program support due to the impact FOG can have on the treatment process. Historically the program has focused on commercial customers.

City staff recently conducted a pilot program to test the effectiveness of using educational materials to reduce FOG in residential areas. This low cost approach is used by many sewer utilities to reduce FOG at its source by informing the public of the negative effects of FOG on sewer systems.

For the pilot study, two lift stations that each have a history of high FOG related maintenance requirements were chosen for the pilot project. Door hangers containing educational materials were left at all homes in the service areas draining to the lift stations. Laboratory testing of the wastewater was conducted before and after distribution of the educational materials to determine if a FOG reduction in the wastewater stream could be detected. Lift station operators were also interviewed to determine if the level of observable FOG that needed to be cleaned from pumps and wet wells was reduced during the test period.

The lab results were inconclusive; however the operators stated that they observed less grease at the lift stations in the months during and immediately after the educational campaign. Approximately one year has passed since the pilot project and operators now report that grease at the lift stations appears to have returned to normal. The short-term improvements suggest that there may be benefits for conducting an on-going public education program. However, other wastewater utilities have experience mixed results from public education programs, with some agencies finding no appreciable benefit. The agencies that did experience improvements tended to embark upon extensive education programs.

A second FOG pilot program is planned to confirm the preliminary findings of the first pilot project. If the pilot projects are successful, similar educational techniques are planned for other high-FOG areas of the system, including commercial customers. Opportunities should be provided for City staff to develop the program further and to encourage communication and coordination efforts with other jurisdictions. Development of a privately owned grease trap inspection and maintenance program may provide additional benefits should an educational approach fall short of having the desired effect.

Flushable wipes also presents a significant burden to Operations staff. Service calls for system clogging and lift station pump failures due to fibrous ragging problems are becoming increasingly frequent and could lead to overflows in some cases. Many personal hygiene wipes and cleaning products are marketed as being "flushable." Despite confusing and misleading product labels, "flushable" or "disposable" products should never be flushed. Items labeled as

"flushable" or "disposable" (even "bio-degradable" ones) can get caught on roots in sewer pipes and contribute to blockages, back-ups, and overflows. Pump station operators must remove so-called “flushable” wipes from seized-up pumps on a frequent basis, a process that can take several hours.

However, consumers are typically not aware of the maintenance problems caused by these products. As maintenance costs associated with fibrous products increases, the City should consider embarking on a public education campaign, similar to the pilot FOG program discussed in Section 10.3.2.3. Educational programs at many wastewater utilities encourage customers with the tagline “*Dispose of them in the trash, not the toilet!”*

FOG and fibrous wipes programs are anticipated to be a collaborative effort between Water Resources and Operations staff.

Table 10-8 Maintenance Activities for Wastewater Mains

Maintenance Activity	Definition	Benefit to the City	Target Service Level	Rationale for the Service Level	2011 Actual Service Level
Line Cleaning	Cleaning of gravity sewers and manholes using high pressure flushing. (Preventive Maintenance)	Reduces blockages and sewer overflows and maintains pipe capacity. Minimizes odor and corrosion. Removes grease and debris from lines and problematic manholes.	Varies by area ranging from semi-annual to bi-annual. Target is to clean approx. 20% of system per year (5 year cycle)	Based on insurance and industry standards. City can defend against claims if cleaning occurs every 5 years	Target met, see Figure 10-3
Television Sewer Inspection	Visual inspection of main condition using Closed Circuit Television. (Preventive Maintenance)	Assesses condition of sewers to prioritize repairs	20% of system per year (5 year cycle)	Prioritization of repairs to reduce breaks and blockages	Target met, >20% per year
Vehicle/ Equipment Maintenance	Weekly cleaning, fueling and stocking of line cleaning and TV inspection vehicles to ensure they are ready for work. (Includes servicing of equipment in vehicles, other small equipment and tools.) (Preventive Maintenance)	Ensures rapid and efficient mobilization of crews. Improves reliability of vehicles and equipment.	Weekly maintenance of vehicles (presently conducted at end of shift on Fridays)	Based on best management practices. Preparation of vehicles in advance of weekends (when emergency callouts may occur)	Generally met the service level
Manhole Washing	Washing manholes using high pressure flushing (this activity is part of the line cleaning program) (Preventive Maintenance)	Reduces blockages and sewer overflows. Minimizes odor and corrosion.	20% annually (5 year cycle) performed with line cleaning. More frequent washing of priority manholes (~ 100 problematic manholes in system)	Based on industry standards and staff observations	Target met
Manhole Inspection	Physical inspection of manhole condition for the purpose of identifying defects. (Preventive Maintenance)	Assesses condition of manholes to prioritize repairs	20% of system per year (5-year cycle)	Based on industry standards	Target met, 20% of system per year
Manhole Repairs	Emergency and routine repairs to manholes (Corrective Maintenance)	Improves reliability of manholes and ensure continued system reliability	Immediate response to emergencies. Routine work is scheduled as available.	Based on best management practices and staff observations	Performed on an as-needed basis
HTE Support (AMMS)	Updating the HTE system (Record Keeping and Administration)	Maintains currency of AMMS. Complete and timely information is required for management purposes	Daily, as required	Based on best management practices	Target met
Minor Maintenance	Minor repairs and maintenance related activities including customer service, cut brush, locates, air release maintenance, odor complaint response etc.	Ensures system reliability and responds to the needs of customers	As required. Immediate response to emergencies. Routine work is scheduled as available.	Based on best management practices	As required
Spill incidents	Cleaning up of unpermitted discharges from the sewer system (Corrective Maintenance)	Protects the environment, private and public property. Responds to the needs of customers.	0 spills. Immediate response to spills that do occur.	Spills are unacceptable since they are a health and environmental hazard.	Target met

10.4.3 STEP System Program

The Wastewater STEP System crew consists of two field technicians. This crew is responsible for all maintenance programs associated with the City's individual STEP systems. In STEP systems small City-owned pumps move the effluent from individual City-owned septic tanks into a small diameter pressure sewer. The pressure sewer main subsequently connects to larger diameter STEP mains and ultimately to the gravity collection system.

The City's STEP and grinder pump systems meet the requirements set forth in Section C1-10.4 of Washington State Ecology's *Criteria for Sewage Works Design Water Quality Program* (Orange Book), August 2008. The Orange Book requirements address issues associated with long term system management, including maintenance management.

Figure 10-5 shows a breakdown of the regular labor hours spent on STEP Program maintenance.

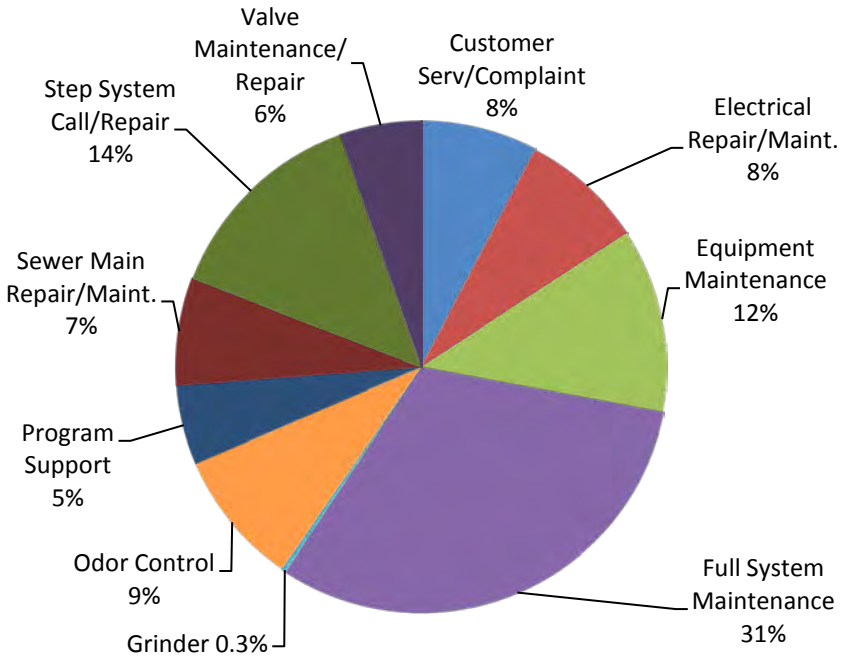


Figure 10-5 Breakdown of Wastewater STEP Program 2011 Maintenance Hours

STEP systems are prone to odor problems and experience higher levels of corrosive gas, which can drastically reduce the life expectancy of receiving gravity sewers if not adequately controlled. STEP systems maintenance costs per connection are often higher than the cost of gravity system connections, including those served by a lift station. However, STEP also possesses some very useful qualities, it can serve multiple small basins in rolling terrain more efficiently than multiple lift stations, and the effluent can be pumped for long distances at low velocities since the solids have been largely removed.

It is important to note that the City's attitude toward STEP has changed since the last wastewater plan was prepared. Although STEP system maintenance costs are higher than

maintenance costs for a gravity collection system, due to improvements to the STEP maintenance programs, the cost is now lower than when the last plan was prepared.

STEP sewer connections are a viable and economic alternative to conventional gravity sewers and lift stations when all costs associated with the construction and maintenance are accounted for.

The on-site portion of the low pressure systems operate as a septic system, except that the clear-water discharge from the septic tank is connected to a pressure main instead of a drain field. Within the City, major components associated with the STEP systems include:

- On-site 1,500-, 3,000, and 8,000 gallon settling and debris (septic) tanks
- High head, low volume pumps, biofilters, and float switches for level control
- Residence mounted control panels with control/alarm features.
- Air vacuum/relief valves.
- Odor Control system.
- An emergency support plan for up to 2,600 individual units during power outages.

Each STEP service is equipped with an audible alarm system to signal high sewage levels in the STEP tank. Once Operations staff is alerted by the homeowner of this condition, it is treated as an emergency, which requires immediate attention and maintenance.

Operations staff have developed standard operating procedures for STEP tank and pump maintenance and for start-ups. Additionally, in response to high STEP failure rates experienced in the 1990s, the City initiated a Full Service Maintenance (FSM) program in 1999.

The FSM program is a preventive maintenance approach that provides a level of service which initially called for replacing most major components and pumping out all tanks on a 5-year cycle. This level of service was later relaxed to 5-year intervals between site visits, replacing major components on an as-needed basis, and 8-year intervals between tank pump outs. The revision to the level of service occurred without increasing emergency call outs or failure rates (see Appendix I STEP System History).

STEP mains are cleaned using line pigging techniques. Pigging is an internal pipe-cleaning process commonly used to clean foreign matter from the inside of pressure water systems. It works by pushing an object, called a pig, using the water in the pipe, in the direction of normal flow. When performed correctly, line pigging will increase flow rates and reduce pumping pressures by removing sediment and air that is trapped in the system.

The STEP field crew is responsible for the maintenance programs associated with the City's individual STEP system, the programs described above, and the activities listed below in Table 10-10.

10.4.3.1 Grinder Systems

As an alternative to STEP systems the City has been contemplating the use of grinder pump systems. Similarly to STEP systems, grinder pump systems operate as a pressure system, with each individual system pumping into a common pressure main. But unlike STEP, which allows solids to settle out in debris tanks before pumping the screened effluent, these systems grind the waste stream into a slurry during the pumping cycle, discharging the liquid and solids together. This allows the grinder systems to operate with a much shorter residence time in the

tank, resulting in reduced odor and corrosion potential but as with any pressure system long residence time in force mains can lead to anaerobic conditions and the associated odor and corrosion issues. These systems do however require that scouring velocities be attained on a frequent basis to ensure that solids are adequately transported through the main. Grinder mains can benefit from periodic cleaning to remove accumulated solids through the use of pigging techniques.

While the City does allow the installation of grinder systems, their use has been limited. The City currently views these systems as private facilities, tasking the customer with maintenance and operation responsibilities for the on-site equipment. The City is re-evaluating this practice, as well as contemplating the use of grinder systems on a more wide-spread basis. Further discussion regarding future policies relating to grinder systems can be found in Chapter 4. If the City were to allow an increasing number of grinder systems and/or provide maintenance support for these systems then it is recommended that the on-site equipment and installation configurations be standardized so that an efficient maintenance program can be developed and to limit parts inventories. A future grinder system maintenance program would likely be modeled on the City's existing STEP maintenance program with only minor modifications.

10.4.3.2 Odor and Corrosion Control Program

The Odor Control (OC) program has historically been funded through the STEP system Budget Program, though recently these costs have been shared by both the STEP and Lift Station budgets. While this practice more accurately places the funding burden with the appropriate facility types, it can complicate accounting and program evaluations. It is recommended that a separate wastewater budget category, specific to odor and corrosion control be created. This will help promote future program evaluations without embedding the cost of this program in another.

The City utilizes a combination of differing approaches to odor and corrosion reduction. These include aeration, soil filter beds, and chemical injection. Chemical injection tends to be the City's preferred method, making up more than half of the eight active facilities. The OC program began in the mid-1990s with the construction of a Bioxide chemical injection system at the Bus Barn site (OCF 01). As the STEP system grew and more lift stations were constructed, additional odor control facilities were required. The OC program has been working well and odor control complaints are few, with only three reported complaints in 2010 and three in 2011.

While the chemical systems have been successful at odor and corrosion control, the cost of operating the systems has continued to rise with the cost of the injection chemicals. Operations staff has investigated several alternatives to chemical addition, but have yet to find a cost effective method that performs as reliably.

The Lift Station field crew is responsible for the odor and corrosion maintenance programs and the associated activities listed below in Table 10-9.

Table 10-9 Maintenance Activities for Septic Tank Effluent Pump (STEP) Systems and Odor/Corrosion Control

Maintenance Activity	Definition	Benefit to the City	Target Service Level	Rationale for the Service Level	2011 Actual Service Level
STEP Full System Maintenance (FSM)	Complete service overhaul of individual STEP sites. Replace major system components when needed. Pump out and clean debris tank. (Preventive Maintenance)	Improves reliability of STEP systems and reduces STEP failures. Improves customer service.	12.5% of sites per year (8 year cycle)	Based on manufacturer recommendations and industry standard	100% of target
STEP System Repairs	Emergency & routine work performed on a STEP system due to failures e.g. basket collapse, pump failure, control box failure etc. (Corrective Maintenance)	Maintains reliability of STEP systems. Improves customer service. Brings the system back to an operable state.	Immediate response to emergencies. Next working day for routine work.	Customer service. Maintains system functionality	As required (188 repairs in 2010)
STEP System Start ups	Connecting new STEP system connections	Commences new customer service. Ensures standards are met.	As required	Customer service	As required
Odor Control	Maintenance of OC facilities including readings. Includes emergency and routine repairs to facilities as identified by odor complaints. (Corrective Maintenance)	Ensures reliability of OC facilities & reduces odor complaints. Improves customer service. Reduces corrosion.	Quarterly maintenance on facilities and bi-weekly readings.	Based on best management practices and customer complaints	100% of target
H2S Monitoring	Monitoring H2S levels	Alerts staff of potential corrosion in sewers, ensures H2S treatment is effective. Improves customer service.	Monthly system checks, continuous data logging.	System optimization and customer service	100% of target
Odor Complaints	Investigating and resolving the cause of odor complaints. (Corrective Maintenance)	Improves customer satisfaction.	0 odor complaints. Immediate response to complaints.	Based on customer complaints	3 odor complaints in 2011
Community STEP Debris Tanks	Clean large STEP hybrid tanks ranging in size from 7,000 to 50,000 gallons	Ensures uninterrupted system operation	Each site has a customized schedule	Based on operator observations and waste-stream characteristics	Target met
HTE Support (AMMS)	Updating the HTE system (Record Keeping and Administration)	Maintains currency of AMMS	Daily, as required	Complete and timely information is required for management purposes	As required
Minor Maintenance	Special projects, electrical control panels, sewer breaks, locates etc. (Corrective Maintenance)	Ensures system reliability	As required	Corrective maintenance	As required
Spill Response	Response to sewer and chemical spills. Provide containment and clean-up. (Corrective Maintenance)	Limits exposure to potential contaminates	As required	Corrective maintenance	As required

10.4.4 Emergency Reponses

Operation of the sewer system under emergency conditions is a critical responsibility of Wastewater Operations. The City has a comprehensive Emergency Response Plan that is integrated with Operations and with Regional, County and State officials. The Operations Control Center (OCC) is an extension of the City's Emergency Operations Center (EOC). It is designed to focus on the management of the repair of the City's streets, utilities, facilities, and other required operations during an emergency.

The OCC supports the Emergency Response Plan and internal emergency operations. The Operations Division is responsible for assigning staff to maintain the capability to operate the OCC on multiple shifts, seven days a week during emergencies. The emergency plan includes maintaining operation of the sewer system and enables the City to leverage its own resources and those needed outside the City's resources. Lacey is also a member of WAWARN, a water/wastewater agency response network that allows water and wastewater utilities to receive rapid mutual aid and assistance from other member agencies (see Appendix L).

A goal of the OCC with regard to wastewater operations is to maintain sewer support for residents during emergencies. The Emergency Sewer Support Checklist provided in Table 10-10 defines essential actions required to provide the necessary support.

Table 10-10 Operations Control Center Emergency Sewer Support Checklist

Item	Description
1.0	Generator Support Fixed generators: Verify that generators are functional and operating Portable generators: Transport generators to key locations and rotate throughout system as needed.
2.0	SCADA Monitoring a. Monitor the SCADA system for lift station failures b. Dispatch staff to evaluate lift stations functionality
3.0	Sewer line inspections a. Alert police, fire, and City staff to be alert for sewer line breaks and to report observations.
4.0	STEP support a. Emergency Pumping capabilities in place b. Contract Pumping if necessary c. Small generator pump down of STEP tanks d.
5.0	Repair criteria a. Greatest good/Highest priority b. Public health and safety c. Protection of environment/wetlands d. Contract support if necessary

The City maintains a tracking system to ensure follow-up action to emergency work is taken in an appropriate timeframe using the SunGard HTE Work Management System. Refer to Section 10.5 for additional information on the maintenance management system.

An overview of the potential effects and recommended actions for emergency situations is presented in Tables 10-11, 10-12, and 10-13. The five emergency situations considered are power loss, flooding, hazardous waste spill, earthquake, and sabotage/vandalism. Potential effects and recommended actions are identified for sewage pump stations, force mains, and the gravity sewer system.

Table 10-11 Emergency Response Actions for Lift Stations

Emergency	Potential Effects	Recommended Actions
Power Loss	Pumps rendered inoperable, Auxiliary generators activated to run pumps.	Transport portable generators to Lift Stations that do not have auxiliary power, check other lift stations to ensure generators are operating.
Flooding	Station overflow	Deploy by-pass pump or pump to truck until flooding effects subside.
Hazardous Waste Spill	Spill enters wet well at a Lift Station	Isolate Lift Station receiving spill, pump out of wet well and dispose of hazardous material, notify Thurston County, LOTT, Health, and DOE of situation.
Earthquake	Wet well damaged, inlet and outlet piping severed or damaged.	Deploy by-pass pump or pump to trucks while repairs are made.
Sabotage/Vandalism	One or more pumps rendered inoperable	Isolate damaged Lift Station damage; operate other pumps while repairs are made. Deploy by-pass pump as needed.

Table 10-12 Emergency Response Actions for Force Mains

Emergency	Potential Effects	Recommended Actions
Power Loss	No anticipated effects.	No actions anticipated.
Flooding	Manholes surcharged	Implement bypass pumping at critical areas.
Hazardous Waste Spill	Spill enters sewer system.	Isolate Lift Station receiving spill, pump out of wet well and dispose of hazardous material, notify Thurston County, Health, and DOE of situation.
Earthquake	Breaks in sewer lines, Damaged Manholes	Isolate damaged area, implement bypass pumping until affected area is repaired. Install temporary force main as needed.
Sabotage/Vandalism	Force mains plugged or broken	Isolate damaged area, implement bypass pumping until affected area is repaired.

Table 10-13 Emergency Response Actions for Gravity Sewers

Emergency	Potential Effects	Recommended Actions
Power Loss	No anticipated effects.	No actions anticipated.
Flooding	No anticipated effects.	No actions anticipated.
Hazardous Waste Spill	No anticipated effects.	No actions anticipated.
Earthquake	Breaks in force main pipes	Bypass pumping where necessary
Sabotage/Vandalism	Force mains plugged or broken Gravity Sewers plugged or broken, Manholes damaged	Isolate damaged area, pump from affected lift station to trucks until affected area is functional. Attempt line cleaning to remove blockage.

10.4.5 Standby Procedures

The Wastewater Operations Division maintains a Standby Manual which contains general procedures for the most common wastewater calls that are likely to occur in emergencies and during periods after normal working hours. A duty Standby person is assigned to on-call and is the first point of contact outside of normal business hours. They are responsible for coordinating a prompt response to after-hours emergencies. The Standby person must comply with all safe working practices and City policies.

The manual also contains a list of the personnel that can be contacted for assistance or questions related to wastewater-related calls. The Standby person is required to leave a voice mail message if unable to contact personnel.

The Standby manual is updated annually and as required with new information or changes in policies. One copy of the manual is located in the Standby case which is passed from duty person to duty person. Another copy is kept at the Service Desk and may be checked out by employees at any time.

10.4.6 Sewer Overflow Emergency Response

The City's Sewer Overflow Emergency Response Plan (SOERP) was prepared to ensure that in the event of an emergency the Wastewater Utility can maintain or return services to full operational condition in a timely manner, while minimizing adverse impacts to people and the environment.

The SOERP was prepared consistent with LOTT's National Pollution Discharge Elimination System (NPDES) Permit. While LOTT is the primary NPDES Permittee, the permit designates the City as a contributing jurisdiction, sharing the responsibility for permit issues involving the treatment plant and wastewater discharges. As a contributing jurisdiction, the City is responsible for its collection system and lift stations and the discharge of wastewater to the LOTT system.

The SOERP contains the following standard operational procedures:

1. Field Response Procedures
2. Regulatory Agency Notification Procedures
3. Public Notification Procedures

The SOERP is designed to ensure that every report of a sewage overflow will be sent as quickly as possible to the appropriate City staff for confirmation. The procedures defined in the manual promote a quick response to minimize the impacts of an overflow on public health, beneficial uses, surface water quality, and on customer service.

10.5 Safety Program

The City has documented safety training procedures, which are readily available to all field staff in a consolidated manual, and regular safety training is well established. Required training is monitored, scheduled, and documented by City Human Resources staff in accordance with all local, State, and Federal regulations.

The City has adopted an *Accident Prevention Program* to ensure a safe workplace which respects the safety and health of employees, the environment, visitors and the communities served by the City. All City employees, contract personnel, and visitors at City-owned facilities are expected to understand, participate, and assist in the implementation of the program.

All employees receive training on general City policies and procedures, including safety. New employees receive an orientation on their first day of employment. Existing employees receive regular training updates. Topics include:

- An explanation of the City's safety programs
- On-the-job training
- Safety meetings
- Personal protective equipment
- Pertinent safety rules specific to the work area
- First aid supply equipment and training
- Vehicle safety
- Personal work habits
- A general overview of operation procedures, methods, and hazards as they relate to specific jobs and duties.

Operations staff may be required to work in confined space areas where dangerous atmospheric hazards exist, or may be in the presence of electrical and mechanical equipment. These conditions present hazards to personnel during the performance of operations and maintenance tasks.

A Safety Manual was prepared which contains the City’s policies and procedures for conditions that field employees might encounter while in the performance of their duties. Table 10-14 presents the chapters included the Safety Manual.

Table 10-14 Safety Manual Programs, Plans and Procedures	
▪ Accident Prevention Program ▪ Personal Protective Equipment ▪ Ergonomics ▪ Hearing Conservation Program ▪ Confined Space Entry Program ▪ Fall Protection Program ▪ Lock Out/Tag Out Program	▪ Hazardous Material Spill Response Plan ▪ Hazard Communication Program ▪ Heat Related Illness Prevention Program ▪ Blood Borne Pathogen Protection ▪ Respiratory Protection Program ▪ Emergency Action Plan ▪ Excavation, Trenching and Shoring

Safety procedures and guidelines are documented and were established many years ago. The City Human Resources department is responsible for ensuring safety policies and procedures are in compliance with current regulations. Regular checks are made to ensure that safety related equipment is replenished and in good working order, meeting all regulatory requirements and manufacturers recommendations.

10.6 Automated Maintenance Management System

Effective maintenance is an essential component of managing the City's wastewater system. The City's operations staff manages routine maintenance tasks, modifications to the existing infrastructure, and emergencies. Keeping accurate and up-to-date maintenance records is important for system evaluations and for scheduling preventative maintenance measures. Maintenance records are, in turn, used to monitor maintenance and repair activities, expenditures and labor-hours required to conduct the work.

10.6.1 Work Order Classification System

Since 2001 the City has utilized SunGard HTE, an Automated Maintenance Management System (AMMS) to assist in scheduling and managing maintenance activities for the City. Maintenance field personnel are responsible for keeping accurate inspection and maintenance records. Support staff enters the information into the SunGard database. The City tracks hours and expenses spent on each task through the AMMS system. The AMMS system divides maintenance activities into three categories: Preventative, Routine or non-preventative, and Emergency.

1. **Preventative maintenance (PM)** is defined as planned maintenance that is intended to ensure reliability, maintain operability, and maximize the life of equipment. PM is scheduled through the SunGard system based upon recommendations by manufacturers, industry standards, and historical operating experience. It is performed at defined, recurring intervals. The frequency of PM for a given asset is referred to as level of service.
2. **Routine maintenance (RM)** is work that must be planned to mitigate identified system problems, failures or deficiencies, or as an aid to other internal or external organizations. While deadlines are established, RM does not require an urgent or immediate response. This work is scheduled when work orders are issued for specific tasks.
3. **Emergency maintenance (EM)** corresponds to unanticipated work that must be responded to in an urgent or immediate manner. EM includes responses such as pump failures, power outages, overflowing toilets, etc. This work also includes high priority

responses to internal and external requests that require an urgent or immediate response.

This classification system is capable of facilitating adequate work analysis to plan future work, provided all relevant data is completed and stored reliably within the HTE system. The HTE system standard reports do not provide the information necessary for staff to manage system assets most effectively. This need is described in Section 10.5.4. Table 10-15 provides further details of the City's Work Order classification system.

Table 10-15 HTE Work Order Classification System

Type of Maintenance	Description	Includes	Results	Impact
Preventative Maintenance (PM)	PM is required to meet standard level of service. It is determined by vendor/operating experience	Not failure related. Required to assure the continued operation of wastewater systems and infrastructure	Ensures system reliability	None. Defines level of service
Routine Maintenance (RM)	Various maintenance tasks as identified through observation	Repairs that are not emergencies Work requests that do not require immediate response Tasks that can be planned ahead of time	Planned and scheduled maintenance	Can disrupt preventative maintenance schedules, depending on staff availability
Emergency Maintenance (EM)	Problem that may result in loss of service or other severe consequence to the utility (e.g.; spill, etc.)	Response to failures in the wastewater system Required to provide uninterrupted service to community Poses a risk to life, property or the environment	Deploy maintenance as soon as possible to mitigate emergency and to restore service	Disrupts maintenance schedules, may incur overtime, and high costs

The City's standard response time for conducting the initial assessment of an emergency situation (i.e. sewer back-up) is 15 minutes if it occurs during work hours, or 40 minutes if it occurs after work hours. The City's response time for a non-acute emergency is 24 hours (usually first thing next morning if notified in afternoon).

10.6.2 Maintenance Program Reporting

A shortcoming of the software that was specifically noted by operations staff is that the SunGard software does not allow operators to prepare unique reports that would allow them to manage maintenance activities more effectively. HTE reporting capabilities are limited to a relative few number of standard reports that can presently be generated from the system. Although the information is stored and available in the database, preparing useful, but non-standard reports is very difficult.

There is a need to develop more useful and user-friendly reports. Reports should be readily available in the system and targeted to assist utility staff in making decisions to improve maintenance efficiency in terms of labor and assets. As such, the City should consider developing a user interface, "dashboard," or other solution that would allow operators and supervisory staff the ability to pull information and prepare reports as needed. Until the reporting subsection of the Maintenance Management process is addressed, the overall system cannot realize its full benefits.

Reports should be designed to present the appropriate data to allow staff to make informed decisions regarding equipment maintenance strategies, maintenance work practice improvements, manpower scheduling, and equipment design modifications.

Examples of improved reporting capability could include locations of known FOG locations, failure analysis, lost time analysis, budget variance analysis, and common work-associated problem identification and resolutions.

In highly effective management systems, the maintenance management system is linked to the City's financial and GIS systems. The mapping system would be linked to the inventory of sewer system assets that includes information on asset age, material, dimensions, flow capacities, etc. The City could increase its ability to manage utility assets and labor by improving its mapping and data reporting capabilities. This may require the assistance of outside consultants familiar with GIS, data reporting, and utility management systems to assist in developing ways to improve access to information needed by operators and managers, and by creating industry standard and custom reports.

10.6.3 Work Orders

The information and layout of the printed HTE work order is good, but could be improved with the following features (according to *Wastewater Collection Systems Management Manual of Practice,* (WEF, 1992).

1. **Labor and material estimates:** Estimates should be confirmed in advanced and noted on the work order. Estimates should be realistic but reflect the requirements of the job, assuming no unforeseen complications or problems.
2. **Reference to applicable procedures, standards, and codes:** Ideally, documented procedures should be stored within the system and printable by the employee performing the work in advance.
3. **Work Order Issues/Notes:** This is a field in the work order where the employee can note problems or issues that occurred while performing the work order. This information is important in conducting Work Order Variance Analysis.

These types of business process improvement efforts can be labor intensive and if so, may require staffing that is not readily available to the Wastewater Division. To the extent possible, such improvements will be made internally.

10.6.3.1 Work Order Completion and Variance Analysis

Most, if not all of the data from completed work orders is now being entered into the HTE system. The following activities are recommended to complete the process:

1. **Work Order Variance Analysis:** This is a useful and potential cost-saving maintenance management process. Work orders that were completed as expected (in the anticipated timeframe and within the WO estimate) can be entered directly into the system and closed. Work Orders that experience a variance, either in terms of cost, schedule or the time it took to complete, should be examined by the Senior Technicians considering the following general criteria:

   - What caused the problem?
   - Does this happen frequently?
   - What can be done to ensure that the problem does not recur?

2. **Work Order Documentation:** The output of work order Variance Analyses should be documented and stored within the HTE system for future reference.

10.6.4 Continued Use of the SunGard HTE System

The HTE system, now in use for over twelve-years, is a stand-alone software program that is no longer supported by SunGard. Wastewater operations supervisory staff use personal experience to problem-solve usage issues as they arise and the City's IT staff is called in as needed when difficult hardware or software issues occur.

10.7 Consistency with EPA's CMOM Program

Capacity Management, Operations, and Maintenance (CMOM) is a planning and management structure that was developed for use by wastewater utilities to analyze and assess their system's capacity, operations, and maintenance management programs. From a federal perspective, CMOM programs are a suggested requirement of state and regionally administered National Pollutant Discharge Elimination System (NPDES) permits.

LOTT's NPDES permit does not require satellite collection systems (including the City) under its permit to create and maintain CMOM programs. However, the City is currently employing most of the key CMOM program components.

The United States Environmental Protection Agency (USEPA) Office of Enforcement and Compliance Assurance offers CMOM guidance. The *Guide for Evaluating Capacity, Management, Operation, and Maintenance Programs at Sanitary Sewer Collection Systems,* USEPA, January 2005 document is not a regulation nor does it impose legally binding requirements of the Clean Water Act or other related EPA regulation. It is intended as a guide for evaluators of sanitary sewer collection systems such as EPA or state inspectors, collection system owners and operators, consultants, third-party evaluators, or compliance assistance providers.

EPA's *CMOM Program Self Assessment Checklist* is a useful screening-level tool prepared to help utilities evaluate the general areas of strength and weakness in the way they operate and maintain their systems. The checklist can also be viewed somewhat as an inventory of current wastewater management best practices. In CMOM planning, the utility selects performance goal targets and then designs activities to meet those goals. Alternatively, as in the City's case, the checklist can be utilized to determine how closely current City practices compare against CMOM program guidance.

Wastewater Divisions staff recently completed a *CMOM Program Self Assessment Checklist*. The completed checklist is included in Appendix J.

10.8 Performance Indicators

Performance measurement is one of the keys to successful utility management. Consistent with CMOM guidelines, the Wastewater Division selects performance goal targets for key operations and maintenance activities. These targets, referred to as level of service targets are also discussed in Tables 10-7, 10-8, and 10-9.

Following is a partial list of Wastewater Collections Performance Measures for 2010, provided by Operations staff.

- 74 Miles of Collection Mains Cleaned
- 65 Miles of Collection Mains CCTV
- 356 STEP Systems Serviced
- 188 STEP System Repairs
- 87 STEP System Repairs After Hours
- 0 Main Collection Line Blockages
- 155 Manholes Repaired & Maintained
- 51,359 Gallons of Odor Control Product Used
- 95 Customer Responses

Performance indicators that are relevant to the City's system from other Western Washington wastewater utilities were difficult to obtain. Table 10-16 summarizes the City's performance indicators, which can be used when making comparisons with other wastewater systems.

Table 10-16 Wastewater Utility Comparison

	City of Lacey		
Performance Indicator	**2009**	**2010**	**2011**
Wastewater Staff	14	14	14
No. of Collection Line Field FTEs	6	6	4
Lift Station Field FTEs	4	4	6
STEP Field FTEs	2	2	2
Sewer Mains Field FTEs /100 Mile Length of Gravity Sewer	3.9	3.9	3.9
No. of Lift Stations	44	44	47
No. of STEP Systems	2,861	2,867	2,921
% Length of sewers cleaned	54%	54%	44%
% STEP Systems Serviced	12%	13%	12%
Annual % of WW Mains Program Hours spent on sewer cleaning	28%	18%	23%
Annual % of WW Mains Program Hours spent on Manhole Repairs	8%	14%	10%
Generally operate in conformance with CMOM Requirements?	yes	yes	yes
% Length of sewers Inspected via CCTV	36%	48%	37%
Annual % of WW Mains Program Hours spent on CCTV Inspection	36%	46%	44%
No. Sewer accounts / WW FTE	1,021	1,049	1,111
No. of WW FTEs / 100 connections	0.10	0.10	0.09

It is recommended that data on the above performance measurements be gathered on an on-going basis and analyzed for trends on an annual basis to observe long term changes in wastewater operation efficiencies. In addition, data on the following performance measurements should be gathered, as this information was of interest to wastewater operations staff:

- Number of manholes inspected per year
- Number of sewer related customer complaints per year
- Number of air release/vacuum vents repaired per year

10.9 Staffing Summary

Wastewater Program staffing levels during the period 2009-2011 have remained level. Previously anticipated staff increases in the STEP program were not required, largely due to redefining the STEP system FSM level of service. As discussed in Section 10.5.3, the FSM program reduced the frequency that individual STEP tanks are cleaned from once every 5 years to once every 8 years. The requirement to replace major system components from every 5 years to replacement on an as-needed basis was also made, also causing a reduction in labor hours.

Maintenance and repair programs are ultimately the responsibility of the Water/Wastewater Supervisor and are carried out by the senior and field technicians.

According to *City of Lacey 2005 Wastewater Comprehensive Plan*, in 2004, the City employed a total of 26 staff to serve both the water and wastewater utilities. In 2011 there was a total of 35 Water/Wastewater Operations FTEs.

The City employs 16 total staff at approximately 14 FTE's in the Wastewater Division. Of these, 7 are assigned to the Wastewater Lift Stations Program, 9 are assigned to the Wastewater Collections Program. In addition to these staff, the Water/Wastewater Supervisor and one Department Assistant III provide supervision, management and support for both the Water and the Wastewater Programs.

The 7 staff in the Wastewater Lift Stations field crew is responsible for operating and maintaining 47 lift stations, a total of 44 auxiliary generators, 9 odor control facilities, and the SCADA/ Radio communication system.

In the Wastewater Collections Program 2 staff are assigned to the line cleaning program, 2 operators are assigned to the television inspection program, 2 staff are assigned to the STEP program, 2 are assigned to collection system maintenance (although a substantial portion of their time is dedicated to assisting the water utility), and one Sr. Technician oversees and manages the group.

Technicians from the Water and the Wastewater programs support each other when necessary. Support required for the water system can negatively impact the wastewater group by reducing the amount of time that wastewater staff have available for wastewater O&M activities.

The *2005 Wastewater Comprehensive Plan* reported that approximately 11 percent of wastewater staff's regular hours were spent supporting other departments. Currently the wastewater division is providing nearly 2 FTEs worth of support to the water division; however, City staff report that negative impacts on the wastewater program have been reduced.

Operations staff is unionized and are members of the American Federation of State, County and Municipal Employees (AFSCME, part of the AFL-CIO), Local 618-L.

10.9.1 Staffing Hours

Figure 10-6 shows the average annual percentage of labor hours for wastewater staff to conduct maintenance activities on Wastewater Lift Stations, Gravity Mains, and STEP programs.

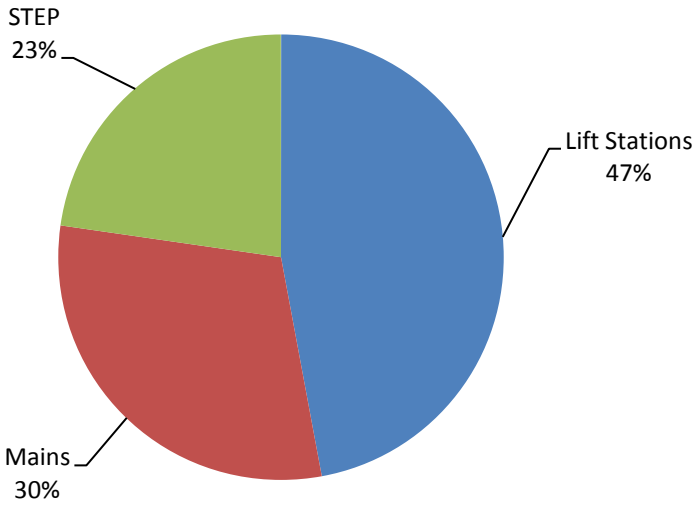


Figure 10-6 Wastewater Programs Annual Labor Hours

10.9.2 Staff Training and Institutional Knowledge Transfer

The commitment that the City has made to training is a crucial element in the success of the Water and Wastewater Programs, both now and in the future. City supervisory staff wish to provide adequate training for employees to encourage staff retention and build a competent, motivated, adaptive, and safe workforce in the future. Training also facilitates retainage of employee institutional knowledge and provides opportunities for professional and leadership development. Lastly, training provides for an informed senior leadership team.

The City recognizes training as an expense item in its annual budget. A guideline for the typical amount of annual funding for training is three to five percent of the gross budget for the collection system, as stated in USEPA's *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM)*, prepared by the Office of Enforcement and Compliance Assurance in January 2005. In 2010, the Water/Wastewater Program spent approximately 10 percent of its budget for certifications and training combined. These expenses included job-specific training on topics such as water production, CCTV inspection, and wastewater lift stations.

Although certification is not explicitly required under Washington State regulations, in the past, all of the City's Water/Wastewater employees were required to maintain either a water or wastewater certification. This policy was relaxed beginning in January 2013 as a result of the City's desire to minimize the administrative effort associated with maintaining certification levels and in consideration of personal preferences of staff not wishing to maintain certifications if not mandated by the City.

The Water/Wastewater Operations Division leadership regularly communicates training requirements to operations staff. In January 2013 a memorandum was sent to all operations staff which defined the job classifications and designations that require certification. The City's certification requirements match State of Washington requirements. New employees that require certification must have already gained the required certifications before being hired or must attain those certifications within a specified period of time.

Within clearly defined guidelines, the City pays for employee certifications, renewals, and training. Three types of training opportunities are made available for employees. During each three year CEU reporting period employees can choose: 1) attendance at a Washington Operator Workshop (WOW) conference; 2) attendance at six local training workshops; or, 3) a water/wastewater conference of their choice and three local workshops. A copy of the City's Training Policy can be found in Appendix M.

Many organizations, including the City, are now facing the challenge of an aging workforce that may retire in a few years. Lacey's training efforts are intended to train staff for their work assignments as well as transfer institutional knowledge before employees retire.

10.9.2.1 Injuries and Time Off

Time off for injuries can be disruptive and costly; however according to time off records, individual events tend to be short lived. Time off labor codes indicate that the total time off for Labor and Industries (L&I) injuries coded as L&I Vacation, L&I Sick Leave, and L&I Comp Time have averaged approximately 2 percent (0.4 FTE) of total time off for the years 2009, 2010, and 2011. Total staff time off for vacations, sick leave, leave without pay, L&I injuries, family leave and bereavement has averaged an equivalent of 4.5 – 5.0 FTE's per year during the same period or approximately 35 percent of payroll hours, therefore operating at approximately 65 percent effective working time. In EPA's *Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities,* their estimate for an average effective working time is 90 percent of payroll labor hours. While the City operates approximately 25 percent below the recommended effective working time, the sewer system is operated and maintained very effectively. Additionally, the City continually reviews the need for additional staff.

10.9.2.2 Water and Wastewater Programs Cross Training

Technicians from the Water and the Wastewater programs occasionally support each other's work loads when necessary. However, some of the support tasks and assignments require skills, experience or knowledge that is unique to the water or wastewater industries. Because specialized skills may be required for staff to "crossover" between programs on an occasional basis, supervisory staff believes that there is an increasing need for cross training water and wastewater staff.

10.9.3 Recommendations for Staffing Levels

There are no recommended additions to wastewater staff at this time. Current internal practice is to evaluate staffing levels on an on-going basis to assess work required and staffing needs.

Replacement staff will need to be hired as current senior level staff approaches retirement. Replacement hiring should be conducted in a planned manner, which provides advancement opportunities for junior staff and adequate time for training new employees under the mentorship of experienced employees.

Additional staff will likely be required as population growth in the service area occurs or as O&M requirements change. The Lift Station program has seen a significant increase in workload in recent years as the number of stations has increased. This trend is expected to slow in the coming years, but will continue to increase. As patterns in new development change and occur farther from the City's core, it's likely that the STEP program will begin to see increases in workload as a result. It is likely that an additional FTE will be needed in the future due to growth of the overall system, this may occur as early as 2017.

Supervisory staff estimates that using current FSM maintenance methods and assuming the existing rate of emergency call outs continues, the existing equipment and crew should be able adequately maintain the STEP system until approximately 5,000 individual STEP tanks are in service. However, by that time the existing staff and equipment will have reached maximum capacity. Two additional staff, one septic pumper truck and one service van will need to be acquired to maintain additional STEP connections once approximately 5,000 STEP tanks are in service.

In anticipation of meeting future staff and equipment requirements, the City should begin planning to hire an additional STEP crew and purchase necessary equipment when a total of 4,000 individual STEP systems are in service (about 1,000 more than current).

10.10 Recommended Operation and Maintenance Improvements

1. All odor control (OC) equipment, chemicals, and O&M costs are currently funded through the STEP System Program. The cost of odor control should be made into its own budget program so that associated costs can be more easily tracked and are not embedded in any one particular program.
2. Continue to inspect and monitor single-wall Odor Control chemical storage tanks at OCF 2 (31st Ave. NE), OFC 3 (Romac St. SE) and OFC 4 (Stockton St. SE); and replace as needed.
3. A second FOG pilot program, extending over several years, should be conducted to confirm the preliminary findings of the first pilot project. If the pilot projects are successful, similar educational techniques should be planned for other high-FOG areas of the system, including commercial customers. Opportunities should be provided for City staff involved with the FOG program to develop the program further, and to communicate and coordinate education efforts with other jurisdictions. LOTT may also provide assistance with this program.
4. The impact of fibrous wipes on the sewer system includes system plugging, backups, potential overflows, and pump clogging. Sewer customers are often not aware of the maintenance problems caused by disposable wipes and similar products. As maintenance costs associated with fibrous products increases, the City should consider embarking on a public education campaign. Educational programs at many wastewater utilities encourage customers with the tagline "*Dispose of them in the trash, not the toilet!"*
5. A shortcoming of the SunGard HTE Automated Maintenance Management Software that was specifically noted by operations supervisory staff is that the SunGard software does not allow operators to prepare unique reports which would allow them to manage the utility's maintenance activities more effectively. Although the information is stored in the database, preparing useful but non-standard reports is very difficult. The City should develop a dashboard, or provide a solution that will allow users of the software the ability to prepare reports as needed. It may be necessary to retain a consultant to prepare some initial reports along with training of in-house staff to maintain and develop future reports.
6. Staff has stated that there is a need for cross-utilization of water and wastewater staff for common O&M activities. Specific training should be determined by Water/Wastewater Operation supervisory staff.
7. Internal performance measurement should be increased to help determine whether the utility's performance is improving or diminishing in areas of interest. The information gathered would be utilized to analyze on an annual basis how each measure is trending.

Performance measurement for items listed in Table 10-15 and in the following areas is recommended:

a. Number of manholes inspected and repaired per year
b. Number of sewer related customer complaints per year
c. Number of air vents repaired per year
d. Number and estimated volume of sewage overflows per year

Chapter 11 Financial Plan

11.1 Introduction

The objective of the financial plan is to identify the total cost of providing wastewater service and to present a financial program that allows the wastewater utility to remain financially viable during execution of the Capital Improvement Program (CIP) identified previously in this Comprehensive Plan. This viability analysis considers the historical financial condition of the utility, the financial impact of executing the CIP, the sufficiency of utility revenues to meet current and future financial and policy obligations, and the affordability of rates.

11.2 Historical Financial Condition

This section includes a historical (2008 - 2013) summary of financial performance as reported by the City of Lacey on the Statement of Revenues, Expenses and Changes in Fund Equity and the Statement of Net Assets, specific to the wastewater utility.

11.2.1 Comparative Financial Statement: Revenues, Expenses and Changes in Net Assets

Table 11-1 shows a consolidated Statement of Revenues, Expenses and Changes in Net Assets for the period 2008 – 2013.

Findings and Trends: Revenues, Expenses and Changes in Net Assets

Operating income (including depreciation expense) has been positive three out of the six years, but there has been a noteworthy drop off when comparing 2008-2011 with years 2012 and 2013. In year 2009, operating income was just below breakeven. In 2010-2011, operating income was slightly positive, totaling $43,000 and $59,000 respectively. In 2012 and 2013, operating income was a negative $210,000 and negative $236,000 respectively, the lowest amounts in the six year table. Operating expenditures increased 11% from 2011 to 2013 while operating revenues only increased 9%. Most notably within the Operating Expenses heading, there was a 15% increase in maintenance expense during that time. It is important to note that depreciation is a non-cash expenditure, so even though operating income has been negative in some years, cash flow was positive in each of the six years in the table.

Table 11-1 shows that over the past six years, revenue from wastewater service charges has increased from $11.11 million to $13.94 million (25% total increase), reflecting increases in both the Local Sewer rates and the Lacey, Olympia, Tumwater, and Thurston County (LOTT) treatment charge as well as growth in the number of customers within the wastewater system.

During this same time period, total expenses from operations increased from $10.5 million to $14.2 million. Operating expense has increased by 37%, maintenance expense has increased by 32%, and depreciation expense has increased 26%.

In summary, total operating revenues have increased by a total of 26% from 2008 to 2013 and operating expenses have increased by 35%. As a result, operating income has eroded over time. In 2008, operating income was over $560,000, while operations in 2013 resulted in a negative operating income of $236,000.

Reflecting this overall trend, the following key performance indicators have gradually eroded over this historical time period. These ratios are expected to improve as the recommended rate increases are incorporated over the multi-year study period.

- **The O&M Coverage Ratio:** *[Service Revenues ÷ Operating and Maintenance Expenses (excludes depreciation)]*
  - **Result:** This coverage ratio has declined from 1.23 in 2008 to 1.13 in 2013.
  - **Benchmark:** A ratio of less than 1.0 is not considered a good financial result; a ratio of 1.0 or greater is indicative of sufficient revenues to meet cash operating expenses. It may be prudent to aim for an O&M coverage ratio significantly above 1.0 if it is the policy to recover a portion of depreciation expense through rate revenue.

- **The Operating Ratio:** *[Total Operating Expenses (excludes depreciation) ÷ Total Operating Revenues]*
  - **Result:** Increased from 82% in 2008 to 88% in 2013.
  - **Benchmark:** A ratio greater than 90% indicates there is little room for new debt service and increased annual capital replacement without additional rate increases. A ratio greater than 100% indicates that operating expenses exceed operating revenues and is reflective of an unsustainable financial condition.

Table 11-1
Statement of Revenues, Expenses, and Changes in Fund Net Assets: 2008 - 2013

Category	2008	2009	2010	2011	2012	2013
OPERATING REVENUES						
Charges for services	$11,112,482	$11,161,598	$11,873,620	$12,816,912	$13,215,579	$13,940,042
Miscellaneous Operating Revenues	-	-	-	-	415	14,452
Total operating revenues	$11,112,482	$11,161,598	$11,873,620	$12,816,912	$13,215,994	$13,954,494
OPERATING EXPENSES						
Operating expense	$ 7,226,399	$ 7,774,356	$ 8,198,898	$ 8,904,825	$ 9,322,083	$ 9,904,395
Maintenance expense	1,706,121	1,710,091	1,854,827	1,950,432	2,134,748	2,246,613
Debt discount amortization	-	-	-	-	-	-
Depreciation expense	1,486,699	1,554,352	1,638,476	1,748,764	1,810,284	1,876,625
Taxes	129,732	127,277	138,874	153,561	158,875	162,469
Total operating expenses	$10,548,951	$11,166,076	$11,831,075	$12,757,582	$13,425,990	$14,190,102
OPERATING INCOME (LOSS)	$ 563,531	$ (4,478)	$ 42,545	$ 59,330	$ (209,996)	$ (235,608)
O&M Coverage Ratio	***1.23***	***1.16***	***1.16***	***1.16***	***1.14***	***1.13***
Operating Ratio	***82%***	***86%***	***86%***	***86%***	***88%***	***88%***
NON-OPERATING REVENUES (EXPENSES)						
Intergovernmental revenue	$ (11,821)	$ 1,110,594	$ 48,728	$ 670,178	$ 47,804	$ -
Investment earnings	521,855	162,221	58,079	40,218	37,876	38,448
Miscellaneous non-operating revenues	3,774	-	899	3,078	-	-
Interest expense	-	-	-	-	-	-
Gain (loss) on sale of capital assets	-	-	-	-	-	-
Total non-operating revenues (expenses)	$ 513,808	$ 1,272,815	$ 107,706	$ 713,474	$ 85,680	$ 38,448
Income (loss) before contributions and transfers	$ 1,077,339	$ 1,268,337	$ 150,251	$ 772,804	$ (124,316)	$ (197,160)
Capital contributions	$ 4,815,569	$ 673,488	$ 1,596,570	$ 632,296	$ 3,237,601	$ 1,183,720
Transfers in	295,263	295,263	-	-	-	
Transfers out	(1,548,523)	(702,767)	-	(78,104)	(2,940)	(138,692)
Change in net assets	$ 4,639,648	$ 1,534,321	$ 1,746,821	$ 1,326,996	$ 3,110,345	$ 847,868
NET ASSETS - BEGINNING	$73,090,504	$77,730,152	$79,264,473	$81,011,294	$82,338,290	$85,448,635
NET ASSETS - ENDING	$77,730,152	$79,264,473	$81,011,294	$82,338,290	$85,448,635	$86,296,503

11.2.2 Comparative Financial Statement: Statement of Net Assets

Table 11-2 shows a consolidated Statement of Net Assets for the period 2008 – 2013.

Findings and Trends: Statement of Net Assets

This statement shows that the City of Lacey's net wastewater assets, which is a measure of the amount of assets remaining after liabilities are paid, increased from $78 million to $86 million over the 2008 to 2013 time period; this represents an 11% increase over the six year period (approximately 2% simple annual average). This includes an overall increase in the current assets from $2.9 million in 2008 to over $12.1 million in 2013 which represents a 316% increase in total current assets. Cash and cash equivalents have increased by 389% over that same time period.

Non-current assets, which represent resources required for use or consumption beyond one year, have remained relatively level with $75.47 million in 2008 and $75.55 million in 2013. However, it should be noted that restricted cash for capital acquisition was moved into the current assets "cash and cash equivalents" section in 2010, which may account for a portion of the several million dollar increase in that non-restricted, current cash balance. A more detailed look at the change in capital assets over this six year period reveals that Land has increased 74%, Improvements Other than Buildings has increased 19%, and equipment has increased 30% while Buildings has decreased by 15%. Total liabilities for the City increased from $648,000 to $1.4 million between 2008 and 2013 which represents a 111% increase.

The following key performance indicators of the utility reflect the trends and discussion above.

Liquidity –

- **The Current Ratio** *[Unrestricted Current Assets ÷ Current Liabilities]*
  - **Result:** Has increased from 4.57 in 2008 to 9.00 in 2013. This ratio was as low as 2.39 in 2009 and then increased significantly when restricted cash for capital acquisition was moved into the current cash and equivalents account.
  - **Benchmark:** A current ratio of 2:1 or higher is considered good in terms of healthy liquidity. The current ratio is a measure of short-term financial strength and answers an important question: Are current assets able to cover expected current liabilities in the coming year?

- **The Quick Ratio** *[Cash plus Receivables(assumed to include ONLY customer receivables) ÷ Current Liabilities]*
  - **Result:** Has increased from 4.57 in 2008 to 8.55 in 2013. This ratio was as low as 2.22 in 2009. The main driver for this healthy ratio is the increase in current cash and cash equivalents over the time period.
  - **Benchmark:** The quick ratio is even more conservative than the current ratio as it only looks at the current assets of "cash" and "receivables". Considering this, a Quick Ratio of 2:1 is even healthier than a Current Ratio of 2:1.

Efficiency –

- **Accounts Receivable Collection Period** *[(Customer Receivables on Balance Sheet X 365) ÷ Annual Sales]*
  - **Result:** Ratio has increased from approximately 24 days in 2008 to almost 34 days in 2013. This ratio was as low as 18 days in 2009. If customers can be encouraged to pay their bills more quickly, this would increase the cash available which increases financial flexibility.

- **Benchmark:** Generally, less than 30 days is considered very good.

Capital –

- **Capital Structure Ratio** *[Total Debt ÷ (Total Net Assets + Long Term Debt)]*
  - **Result:** Ratio is currently at 0% debt and 100% equity. The wastewater utility currently does not have any outstanding debt.
  - **Benchmark:** This is compared to the general industry target of no greater than 60% debt and 40% equity. This indicates that the City has sufficient capacity to debt fund a portion of future capital projects. A balanced combination of cash and debt can help normalize rate impacts (and is assumed in this analysis).

Table 11-2:
Statement of Net Assets: 2008 - 2013

Assets	2008	2009	2010	2011	2012	2013
Current Assets:						
Cash and cash equivalents	$ 2,087,469	$ 1,709,017	$ 7,351,631	$ 6,858,404	$ 9,213,072	$10,210,030
Restricted cash and cash equivalents						
Customer deposits	76,987	147,177	175,553	-	-	16,384
Receivables (net allowances)						
Customer accounts	737,283	545,843	602,380	1,120,569	1,254,091	1,286,442
Accrued interest & penalty	8,319	8,650	3,909	3,909	3,909	3,909
Prepayments		168,213	-	-	-	-
Current portion of interfund loan receivable	-	-	-	400,000	600,000	600,000
Due from governmental units	1,641	4,538	-	660,627	3,475	733
Inventory	-	-	-	-	-	-
Total Current Assets	**$ 2,911,699**	**$ 2,583,438**	**$ 8,133,473**	**$ 9,043,509**	**$11,074,547**	**$12,117,498**
Non-Current Assets:						
Restricted Cash and cash equivalents						
Capital acquisition	$ 6,806,931	$ 6,029,196	$ -	$ -	$ -	$ -
Special assessments	16,195	13,567	-	-	-	-
Special assessments deferred	13,663	2,347		-	-	-
Interfund loan receivable	10,000,000	9,500,000	8,800,000	7,800,000	7,100,000	6,497,324
Capital assets, net of depreciation						
Land	770,599	770,599	1,254,348	1,321,855	1,334,404	1,341,514
Buildings	766,558	744,169	721,780	699,392	677,003	654,614
Improvements other than buildings	55,844,434	55,202,110	62,726,574	63,797,262	66,209,518	66,607,184
Equipment	156,190	156,136	136,581	115,157	177,854	203,298
Construction in progress	1,091,738	5,314,321	355,703	880,245	497,350	244,401
Deferred charges	-	-	-	-	-	-
Total non-current assets	**$75,466,308**	**$77,732,445**	**$73,994,986**	**$74,613,911**	**$75,996,129**	**$75,548,335**
Total assets	**$78,378,007**	**$80,315,883**	**$82,128,459**	**$83,657,420**	**$87,070,676**	**$87,665,833**
LIABILITIES	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Current liabilities:						
Accounts payable	$ 508,508	$ 838,993	$ 257,452	$ 183,166	$ 128,809	$ 107,637
Matured interest payable	-	-	-	-	-	-
Due to other governmental units	10,345	9,382	626,138	1,073,141	1,438,705	1,190,839
Compensated absences	24,411	25,704	31,823	39,640	28,502	30,213
Current liabilities payable from restricted assets:						
Customer deposits	76,987	147,177	175,553	-	-	16,384
Total current liabilities	**$ 620,251**	**$ 1,021,256**	**$ 1,090,966**	**$ 1,295,947**	**$ 1,596,016**	**$ 1,345,073**
Noncurrent liabilities:						
Compensated absences	$ 27,604	$ 30,154	$ 26,199	$ 23,183	$ 26,025	$ 24,258
Long-term portion of interfund loan payable	-	-	-	-	-	-
Total noncurrent liabilities	**$ 27,604**	**$ 30,154**	**$ 26,199**	**$ 23,183**	**$ 26,025**	**$ 24,258**
Total liabilities	**$ 647,855**	**$ 1,051,410**	**$ 1,117,165**	**$ 1,319,130**	**$ 1,622,041**	**$ 1,369,331**
NET ASSETS						
Invested in capital assets	$58,629,519	$62,187,335	$65,194,987	$66,813,912	$68,884,724	$69,034,983
Restricted:						
Debt service	-	-	-	-	-	-
Unrestricted	19,100,633	17,077,138	15,816,307	15,524,378	16,563,911	17,261,520
Total net assets	**$77,730,152**	**$79,264,473**	**$81,011,294**	**$82,338,290**	**$85,448,635**	**$86,296,503**

11.3 Current Financial Structure

The City of Lacey wastewater utility is a self-supporting enterprise and as such it is responsible to fund all of its related costs. It is not dependent on general tax revenues or other general fund resources. The primary source of funding for the utility is collections from wastewater 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 Wastewater Utility is divided into three major categories for budgeting and cost accounting purposes: Operating, Capital, and Debt. The following individual funds reflect these aforementioned categories (descriptions taken from the City's budget documentation):

- 402 Wastewater Operating Fund
  - Lacey's Wastewater Utility consists of a collection system of sewer pipelines, sewage pump stations, STEP systems, and community on-site septic systems. These facilities serve to collect, initiate treatment, and transport wastewater to the regional LOTT Treatment Facilities. Lacey's Wastewater Utility is responsible for operation and maintenance of approximately 220 miles of wastewater lines, 47 lift stations and nearly 3,000 residential and community STEP systems.

- 411 Wastewater Capital Fund
  - The Wastewater Capital Fund provides revenues to construct new or replace portions of existing wastewater collection and treatment systems. Revenues also provide funding for special studies and resources for system improvements.

- 451 Wastewater Debt Fund
  - Debt obligations must be retired from utility system operating revenues, general facility charges for new sewer connections, or by special assessment against benefited properties. Generally speaking, debt in the wastewater utility has been issued to finance lift stations and major transmission lines. When property owners request the formation of a local improvement district to finance the construction of sewer lines to serve their property, bonds are sold to provide financing. Property owners then make installment payments to retire the debt. There is no outstanding debt at this time.

11.4 Fiscal Policies

A brief summary of the key financial policies employed by the City, as well as those recommended and incorporated in the financial forecast are discussed below:

11.4.1 Reserve Policies

Utility reserves serve multiple functions; they can be used to address variability and timing of expenditures and receipts; occasional disruptions in activities, costs or revenues; utility debt obligations; and many other functions. The collective use of individual reserves helps to limit the City's exposure to revenue shortfalls, meet long-term capital obligations, and reduce the potential for bond coverage defaults. Common reserves among municipal utilities are operating reserves, capital contingency reserves, and bond reserves. Further discussion of these tools is shown below:

- *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. 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 annual revenues and expenditures.

Generally, utilities target a certain number of "days" of working capital as a beginning cash balance to provide the liquidity needed to allow regular management of payment cycles. The City's documented policies state that the Utility funds should maintain an operating reserve of at least two months operating revenue. However, to be consistent with industry practice, a working capital reserve target of between 45 to 60 days (12% to 16%) of operating and maintenance (O&M) expense is incorporated into the current analysis. Based on the City's current financials, this target would be equivalent to approximately $1.6 million to $2.1 million in 2014. The 2013 ending fund balance of the operating fund was $2,350,830 according to City staff (nearly 68 days of O&M). The financial plan presented later in this chapter provides for maintaining the reserve within the designated benchmarks as cited above.

- *Capital Contingency Reserve* – A capital contingency reserve is an amount of cash set aside in case of an emergency should a piece of equipment or a portion of the utility's infrastructure fail unexpectedly. Additionally, the reserve could 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 1) identifying a percentage of the utility system's total fixed assets (original cost) and, 2) determining the cost of replacing highly critical assets or facilities. For the purposes of this analysis, a minimum fund balance equal to 1-2% of system fixed assets is targeted. Based on total estimated assets at the end of 2014, a 1-2% minimum target balance ranges from roughly $950,000 to $1,900,000. The actual fund balance at the end of 2013 was $7.88 million which indicates the wastewater utility has the cash resources to directly fund a significant amount of capital projects and still remain above the targeted contingency reserve.

- *Bond Reserve* – Bond covenants often establish reserve requirements as a means of protecting an agency against the risk of nonpayment. This bond reserve can be funded with cash on hand, but is more often funded at the time of borrowing as part of the bond principal. However, there are currently no outstanding bonds in the wastewater utility.

11.4.2 System Reinvestment Funding (SRF) Policies

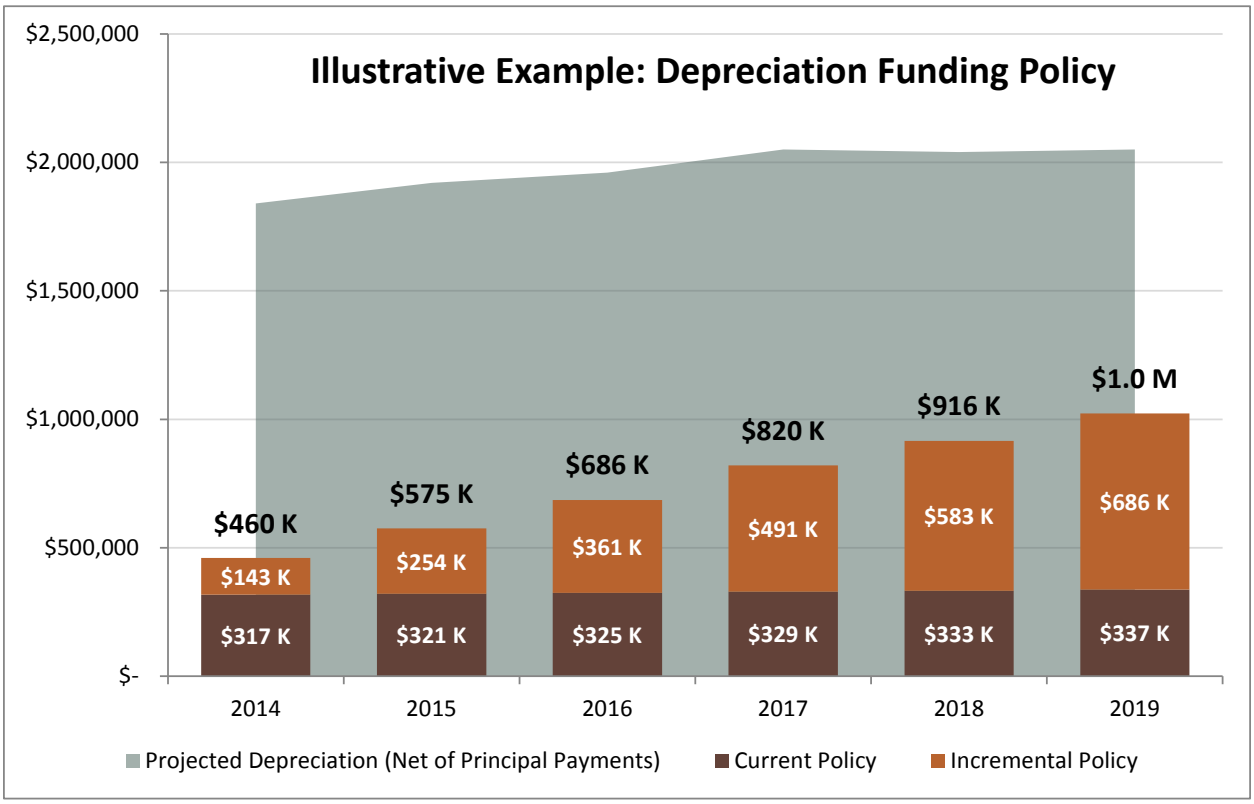
- Background: The purpose of system reinvestment funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operation. Each year, the utility's assets lose value, and as they lose value they are moving toward eventual replacement. That accumulating loss in value and future liability is typically measured for reporting purposes through annual depreciation expense (a non-cash expense), which is based on the original cost of the asset spread over its anticipated useful life. While this expense reflects the consumption of the existing asset and its original investment, the replacement of that asset may likely cost much more, factoring in inflation and construction conditions. Therefore, the annual replacement liability may be significantly greater than the annual depreciation expense. Depreciation is a non-cash expense and is not recovered through rates under the cash basis unless

specified by policy. Having a policy in place to recover at least a portion of system depreciation is a recommended industry best practice.

- One approach aimed at mitigating the accumulating asset replacement liability, as well as current rate impacts, is to fund an amount from rates equal to annual depreciation expense, net of annual debt principal repayment. Annual debt principal payments are one source of annual equity contribution to the system. Using annual depreciation expense as the measure of annual equity loss, and basis for a system reinvestment policy, it is appropriate then, to reduce the annual depreciation expense by the annual equity contribution, as measured by debt principal repayment. This approach tends to balance reducing near-term rate impacts with mitigating accumulating asset replacement liability.

- Current: The City currently deposits $1.25 of every local wastewater service charge into the utility capital fund for system replacement. For example, in 2013, $1.25 of every $16.48 was deposited into the capital account. In 2014, $1.25 of every $17.30 is deposited into the capital account. It is important to note that any policy in place is better than having no policy at all. However, the $1.25 does not increase over time; therefore the effectiveness of this policy gradually erodes. As the City's collection system continues to grow, the City is responsible for maintaining a growing number (and dollar amount) of assets. The City's current policy generates nearly $315,000 per year (about 17% of system-wide depreciation), but this amount does not increase as total system assets increase (note: this level of funding is projected to slightly increase each year reflecting assumed customer growth). For example, it's projected that within the next six years, this current level will only represent 15% of system depreciation, and this percentage will continue to decline (as depreciation expense increases) unless the policy is changed so that funding levels increase as depreciation expense increases.

- Recommendation: Our recommendation is that the City should update their system reinvestment policy to be based upon a defined percentage of depreciation net of any outstanding debt principal payments (the City does not currently have any outstanding debt in the Wastewater utility, so this net calculation is not applicable in the first several years). Our six year financial forecast phases in system reinvestment funding from approximately 17% (current level) to 50% of annual depreciation by 2019 (net of debt principal payments from new debt). This phasing technique is used to help avoid rate increase spikes in any single year and smooth the impact over the study period. We also recommend that the City continue to gradually increase this level of funding beyond 2019 until 100% of depreciation (net of annual debt principal) is funded. In the long-range capital financing forecast (through 2032), the analysis assumes that the City reaches this level by 2029, by assuming a 5% policy target increase per year.



11.4.3 Debt Policies

Bond covenants establish a minimum debt coverage ratio as a means of protecting an agency against the risk of nonpayment. The typical requirement for city utilities ranges from 1.0 to 1.5 times annual bond debt service. The City's wastewater utility currently has no outstanding bonds. For planning purposes, a debt service coverage requirement of 1.25 is assumed for future revenue bond issuances, which is more conservative than the City's internal policy of a 1.20 coverage ratio.

11.5 Operating Costs

The financial plan can only provide a qualified assurance of financial feasibility if it considers the total system costs of providing wastewater services, both operating and capital. The operating costs identify ongoing, annual non-capital costs associated with the operation, maintenance and administration of the wastewater system.

Operating costs are initially developed from 2014 budget documents. Future costs are adjusted annually for inflationary increases. Any known future changes such as new or enhanced programs, increased operating costs and/or additional staffing needs are added in the years they are planned. The following is a list of the key expense factors and assumptions used to develop the financial forecast.

- **Annual Operating Expenditures Inflation Factors** – General cost inflation ranges from 2.5% - 3.0% per year; labor and benefits cost inflation is 3% and 6% per year respectively; construction cost inflation ranges from 3% - 4% per year.

- **Additional Staffing Costs:** Based on future staffing recommendations found in Chapter 10, City staff projected that one FTE would be added in 2017 starting at $100,000 per year.

- **Fund Earnings Rate** – Assumed to begin at 0.15% and gradually increase to 1% during the study period.

- **Existing Debt** – The City currently does not have any debt.

- **Revenue Bond Assumption** – If revenue bonds are needed for capital financing, a 20-year term is assumed with a 4.5% interest rate with a 1% issuance cost. The interest rate is based upon an analysis of the Bond Buyer Index during the time of initial analysis (early 2014).

- **System Reinvestment Funding** – The City's current practice funds approximately 17% of depreciation through a fixed dollar amount of each monthly charge. As rates increase, this fixed amount remains unchanged; therefore the effectiveness of this policy erodes over time. As mentioned previously, it is our recommendation that this policy be linked to a growing percentage of depreciation (net of any outstanding debt). The funding level is increased annually and is projected to fund 50% of annual depreciation through user rates by the end of the six-year planning period and 100% of depreciation by 2029. This phase-in strategy serves to help mitigate volatile rate impacts in a single year and reduces the utility's need for debt financing in the future.

Annual operating costs are funded through ongoing revenue received from user fees and charges. The following is a list of the key revenue factors and assumptions:

- **Revenue** – The City has two general operating revenue sources: revenue from charges for service (rate revenue) and miscellaneous (non-rate) revenue. Rate revenue is expected to increase with customer growth and in the event of a forecasted annual shortfall, rates can be increased to meet the annual revenue requirement. Non-rate revenues are forecasted to increase with customer growth or remain the same, depending on the nature of the specific revenue.

- **Growth** – Although a higher growth rate is used for engineering planning purposes for this Plan, rate revenue was escalated based on a more financially conservative figure of 1.25 percent annual growth rate. This growth rate matches the customer growth rate assumed for the recently adopted Water utility's financial rate study. The lower growth rate for revenue is more financially conservative (we do not want to overestimate revenues), while the higher growth rate for capital planning used throughout the comprehensive plan is more conservative engineering-wise (engineers do not want to under-build system capacity).

- **General Facilities Charge (GFC)** – This represents a one-time charge to new customers connecting to the system. The GFC revenue for this plan is initially based on the City's 2014 GFC of $3,218 per Equivalent Residential Unit (ERU). The City's municipal code has historically provided for an annual inflationary adjustment based on the greater of the Construction Cost Index (CCI) or 6%.

Based on the recommendations of this study, the City Council revised the GFC annual adjustment policy to be based solely on the annual CCI adjustments. This change is reflected in Ordinance 1450, adopted in December 2014.

The CCI has ranged from 3% to 4% over the past ten years. The financial plan assumes 3% in the early years of the study period and then increasing to 4% for the latter years.

Additional annual ERUs are projected using the customer growth rate of 1.25% as mentioned above and GFC revenue is calculated by applying the current year's charge to the incremental ERUs.

11.6 Capital Costs (Six-Year Planning Period)

The CIP developed for this Comprehensive Plan identifies the total capital obligations for the planning period. Once the capital costs are identified, a capital funding plan defines a strategy for funding the CIP considering available funding sources such as existing reserves, GFC revenue, external contributions from grants/developers and new debt proceeds, if required.

Table 11-3 presents the estimated capital expenditures plan.

Table 11-3 : Projected CIP Costs

Year	2014 $	Inflated
2014	$ 3,892,012	$ 3,892,012
2015	$ 4,961,410	$ 5,110,252
2016	$ 4,855,000	$ 5,200,676
2017	$ 2,373,000	$ 2,643,636
2018	$ 3,457,000	$ 4,005,314
2019	$ 3,470,000	$ 4,181,191
6-Year Total	**$ 23,008,422**	**$ 25,033,082**
2020-2033	$ 27,705,000	$ 46,625,436
Grand Total	**$ 50,713,422**	**$ 71,658,518**

11.6.1 Capital Financing Strategy

An ideal capital 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. For this reason we are assuming bond financing if the City's available cash resources are insufficient. The capital financing strategy developed to fund the CIP identified in this plan assumes the following funding resources:

- Accumulated capital cash reserves
- Annual revenue collections from GFCs
- Annual cash from rates earmarked for system reinvestment funding
- Annual debt repayments from the Water utility for the Interfund loan[1]
- Annual transfers of excess cash (over minimum balance targets) from the operating fund, if any
- Low-cost loan or revenue bond financing (if applicable)

[1] Current outstanding principal is approximately $7 million with minimum annual payments of approximately $400K. Recent annual budgeted repayments have exceeded $600K.

Based on information provided by the City, the Wastewater Capital Fund began 2014 with $7.9 million in capital cash reserves. The GFC generated approximately $1.1 million in 2013 and is anticipated to generate revenues of between $800,000 and $1.1 million per year during the six-year plan (2014 – 2019) based on customer growth and charge escalation factors.

The System reinvestment funding level ("replacement sales") was approximately $315,000 in 2013 (about 17% of depreciation). This level of funding is phased into 50% of depreciation (net of debt principal payments) per year by the end of the 6-year study period (approximately $1 million per year). This funding source becomes significant throughout the study period and reduces the amount of debt that would otherwise be needed. It is assumed in the analysis that the City continues to increase this level of funding until a 100% level is achieved by 2029.

The capital funding strategy developed for this financial plan shows the need to issue revenue bonds beginning in 2016. Total net debt issues are projected to be approximately $5.6 million by the end of the study period in 2019. Total annual debt service on these issues is projected to begin at $140,000 in 2016 and increases to over $470,000 by 2019. Debt is a more significant tool in the near term, when annual capital needs are higher relative to later years, as well when the system reinvestment policy is being phased in. When appropriate, the City may want to consider issuing debt in larger, multi-year groupings rather than smaller, single-year issuances.

As shown in Table 11-4, it's projected that the City will need to issue $428,000 in additional debt beyond 2019. As the system reinvestment policy increases in significance year by year, the City can cash fund a majority of its capital projects in the 2020-2032 years, an intended result of this funding policy. Table 11-4 summarizes the capital funding plan, with the "Cash Funding" column combining existing reserves, GFC revenues, and rate funded system reinvestment.

Table 11-4: Capital Funding Strategy

Year	Capital Expenditures 2014 $	Capital Expenditures Inflated	Revenue Bond Financing	Cash Funding	Total Financial Resources
2014	$ 3,892,012	$ 3,892,012	$ -	$ 3,892,012	**$ 3,892,012**
2015	$ 4,961,410	$ 5,110,252	$ -	$ 5,110,252	**$ 5,110,252**
2016	$ 4,855,000	$ 5,200,676	$ 1,646,861	$ 3,553,815	**$ 5,200,676**
2017	$ 2,373,000	$ 2,643,636	$ 370,766	$ 2,272,870	**$ 2,643,636**
2018	$ 3,457,000	$ 4,005,314	$ 1,778,013	$ 2,227,302	**$ 4,005,314**
2019	$ 3,470,000	$ 4,181,191	$ 1,804,388	$ 2,376,803	**$ 4,181,191**
6-Year Total	**$ 23,008,422**	**$ 25,033,082**	**$ 5,600,028**	**$ 19,433,054**	**$ 25,033,082**
2020-2032	$ 27,705,000	$ 46,625,436	$ 428,306	$ 46,197,130	**$ 46,625,436**
Grand Total	**$ 50,713,422**	**$ 71,658,518**	**$ 6,028,334**	**$ 65,630,184**	**$ 71,658,518**

The capital funding plan assumes that capital is funded from cash available in reserves and from annual rate funding. New debt financing is assumed only when other resources are depleted. Treating capital funding in this manner minimizes rate impacts from annual capital funding needs. Capital funding only impacts rates directly through the level of rate funded system reinvestment assumed and through annual debt service as a result of new debt being issued.

11.7 Financial Forecast

The financial forecast, or "revenue requirement", projects the amount of operating and capital expenditures to determine the annual amount of revenue required. The objective of the financial forecast is to evaluate the sufficiency of the current level of rates in meeting the total revenue requirements of the system. In addition to annual operating costs, the revenue of the utility must also meet debt covenant requirements and minimum reserve level targets.

The rate strategy focuses on the planning period of 2014 through 2019. It is imperative that the City review the proposed rates and rate assumptions annually to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates should be adjusted as needed.

Table 11-5 summarizes the annual revenue requirement for the six-year horizon based on the forecast of revenues, expenditures, fund balances, fiscal policies, and capital funding from debt.

Table 11-5: Six-Year Financial Forecast

Revenue Requirements	2014	2015	2016	2017	2018	2019
Revenues						
Local Rate Revenues Under Existing Rates	$ 4,176,951	$ 4,229,163	$ 4,282,027	$ 4,335,553	$ 4,389,747	$ 4,444,619
Non-Rate Revenues (Includes LOTT)	9,036,567	9,376,095	9,774,851	10,192,041	10,623,736	11,071,317
Total Revenues	**$13,213,518**	**$13,605,257**	**$14,056,879**	**$14,527,593**	**$15,013,483**	**$15,515,936**
Expenses						
Cash Operating Expenses	$12,709,553	$12,993,004	$13,514,849	$14,158,356	$14,727,453	$15,320,196
Existing Debt Service	-	-	-	-	-	-
New Debt Service	-	-	138,650	169,865	319,556	471,468
Rate-Funded System Reinvestment	459,352	574,574	685,987	819,378	916,184	1,023,427
Total Expenses	**$13,168,905**	**$13,567,578**	**$14,339,485**	**$15,147,599**	**$15,963,193**	**$16,815,091**
Annual Surplus / (Deficiency)	**$ 44,613**	**$ 37,679**	**$ (282,606)**	**$ (620,006)**	**$ (949,710)**	**$ (1,299,155)**
Net Local Rate Revenue from Rate Increases	202,807	388,610	586,912	798,435	1,023,941	1,264,235
Use of Operating Reserves	(247,420)	(426,289)	(304,306)	(178,430)	(74,232)	34,920
Net Surplus / (Deficiency)	**$ 0**	**$ (0)**	**$ -**	**$ (0)**	**$ 0**	**$ (0)**
Annual Rate Adjustment	**5.00%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**
Cumulative Annual Rate Adjustment	**5.00%**	**9.46%**	**14.11%**	**18.96%**	**24.02%**	**29.29%**
Coverage After Rate Increases	**n/a**	**n/a**	**8.31**	**6.99**	**4.17**	**3.15**

The City Council adopted a rate increase of 5.0% for 2014 and then adopted the proposed five-year rate increase schedule of 4.25% annual increases from 2015 to 2019 (Ordinance 1450).

These rate increases will help fund the future staffing recommendations discussed in Chapter 10, new debt service payments, and policy objectives.

11.7.1 Funds and Reserves

Table 11-6 shows a summary of the projected Operating, Capital, and Debt Fund ending balances through 2019. As discussed previously, the Operating Fund has a target of 45 days to 60 days of O&M expenses, and the Capital Fund minimum target balance is between 1 and 2 percent of fixed assets. All funds are projected to meet or exceed their targeted ranges at the end of the study period.

Table 11-6: Ending Cash Balance Summary

Ending Cash Balances	2014	2015	2016	2017	2018	2019
Operating Fund	$ 2,089,242	$ 2,135,836	$ 2,215,549	$ 2,393,978	$ 2,468,210	$ 2,433,290
Capital Fund	$ 6,390,853	$ 3,553,815	$ 2,272,870	$ 2,227,302	$ 2,376,803	$ 2,539,159
Debt Reserve Fund	$ 31	$ 31	$ 138,680	$ 169,895	$ 319,587	$ 471,499
Total	**$ 8,480,125**	**$ 5,689,682**	**$ 4,627,099**	**$ 4,791,176**	**$ 5,164,600**	**$ 5,443,948**
*Combined Minimum Target Balance**	*$ 3,458,704*	*$ 3,595,855*	*$ 3,898,302*	*$ 4,066,279*	*$ 4,366,239*	*$ 4,674,853*

**Incorporates a Capital Fund minimum target balance of 2% of fixed assets*

11.8 Current and Projected Rates

11.8.1 Current Rates

The City's current rate structure is composed of an ERU charge comprised of two components: the treatment charge from LOTT and the local charge unique to Lacey's collection system. This ERU unit for each customer class is delineated below per Lacey Municipal Code (13.16.027):

- Single family residences and mobile homes: One ERU per living unit
- Duplex residences: Two ERUs
- Residences containing more than two living units (E.g. Triplex, Fourplex, Multifamily apartments): 7/10 of an ERU per living unit
- Commercial, industrial, and other customers: One ERU for each estimated 900 cubic feet of water consumed per month with a minimum monthly charge of one ERU

The City also offers a Low Income Senior/Disabled rate equal to 50% of the single family rate. Table 11-7 provides a summary of the rate structure in 2014.

Table 11-7: 2014 Rate Structure

Customer Description	Per Account Charges		
	LOTT Treatment	Local Sewer	Total
Single-Family	$35.01	$17.30	**$52.31**
Single-Family: Senior / Low-Income	$17.51	$8.65	**$26.16**
Multi-Family	$24.51	$12.12	**$36.63**
Mobile Home	$35.01	$17.30	**$52.31**
Duplex	$70.02	$34.60	**$104.62**
Commercial	$35.01	$17.30	**$52.31**

** Commercial accounts charged an additional $52.31 per 900 cubic feet water consumption reported*

11.8.2 Projected Rates

Table 11-8 shows the impact of the adopted rate increases to the local portion of the rate schedule on a per ERU basis. The ERU definitions for various rate classes are described in Section 11.8.1.

Table 11-8: Projected Rate Schedule (Local Charge Only)

Basic Sewer Service Charge	Actual 2014	Adopted 2015	Adopted 2016	Adopted 2017	Adopted 2018	Adopted 2019
Projected Across-the-Board Rate Increases: Local Sewer	5.00%	4.25%	4.25%	4.25%	4.25%	4.25%
Basic Sewer Service Charge per ERU	$17.30	$18.04	$18.80	$19.60	$20.43	$21.30

Table 11-9 shows the monthly impact to a single family residential customer when including the monthly LOTT charge, which is assumed to stay at its currently adopted 2015 level throughout the study period. The LOTT charge may increase each year, but without an adopted schedule, the 2015 charge is assumed.

Table 11-9: Rate Impact to Single-Family Customer

Single-Family Customer	2014	2015	2016	2017	2018	2019
Local Sewer	$17.30	$18.04	$18.80	$19.60	$20.43	$21.30
LOTT	$35.01	$36.06	$36.06	$36.06	$36.06	$36.06
Total	**$52.31**	**$54.10**	**$54.86**	**$55.66**	**$56.49**	**$57.36**
Local Dollar Increase		$0.74	$0.77	$0.80	$0.83	$0.87

Note: Assumes LOTT Stays at current level beyond 2015

11.9 Affordability

The Washington State Department of Health and Public Works Board has historically used an affordability index to prioritize low-cost loan awards depending on whether a system's rates exceed 2.0 percent of the median household income for the demographic area. As a result, if monthly bills are less than 2.0% of the median household income for the demographic area, they are generally considered affordable.

The median household income for the City of Lacey in 2012 was $58,963 according to the U.S. Census Bureau's 2008-2012 American Community Survey 5-Year Estimates. This is assumed to be the 2012 figure and is inflated annually. Table 11-10 presents the City's total sewer rate with the projected rate increases for the forecast period. The affordability mark (Monthly Bill*12 ÷ Median Income) is approximately 1% throughout the study period. As shown in the following table, the City's sewer rates remain within the affordability range. Without an adopted schedule, the LOTT charge included is assumed to remain at 2015 levels throughout this table, although even if it was inflated annually, the affordability benchmark would not likely be materially affected.

Table 11-10: Affordability Test				
Year	Inflation	Median HH Income	Projected Monthly Bill	% of Median HH Income
2012		$ 58,963	$49.00	1.00%
2013	2.50%	$ 60,437	$50.47	1.00%
2014	2.50%	$ 61,948	$52.31	1.01%
2015	2.50%	$ 63,497	$54.10	1.02%
2016	3.00%	$ 65,402	$54.86	1.01%
2017	3.00%	$ 67,364	$55.66	0.99%
2018	3.00%	$ 69,385	$56.49	0.98%
2019	3.00%	$ 71,466	$57.36	0.96%

Note: Bill includes LOTT charge, assume LOTT remains at 2015 levels

11.10 Available Funding Resources and Funding Assistance

Feasible long-term capital funding strategies should be defined to ensure that adequate resources are available to fund the CIP identified in this plan. In addition to utility resources such as accumulated cash reserves, capital revenues, and rate revenues designated for capital purposes, capital needs can be met from outside sources such as grants, low-interest loans, and bond financing. The following is a summary of the City's internal sewer utility resources and outside resources (government programs and bond issuances).

11.10.1 Internal Utility Resources

Sewer utility resources appropriate for funding capital needs include accumulated cash in the capital reserve, rate revenues designated for capital spending purposes, and capital-related charges such as general facilities charges and other connection fees. The first two resources were discussed in greater detail in the Fiscal Policies section.

General Facilities Charge

A general facilities charge (GFC) 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 GFC is two-fold: (1) to promote equity between new and existing customers; and (2) to provide a source of revenue to fund future 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. GFC revenues provide a source of cash flow used to support utility capital needs; 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 GFC, 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 GFC should recover a proportionate share of the existing and future infrastructure costs from a new customer. From a financial perspective, a new customer should become financially equivalent to an existing customer by paying the GFC.

The city's GFC is levied on a per equivalent residential unit (ERU) basis, as defined in City code section 13.16.027. The GFC in 2014 was $3,218 per ERU.

Local Facilities Charges

While a GFC is the manner in which new customers pay their share of general facilities costs, local facilities funding is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in a rate forecast since it is funded upfront by either connecting customers, developers, or through an assessment to properties - but never from rates. Although these funding mechanisms do not provide a capital revenue source toward funding CIP costs, the discussion of these charges is included in this section, as they are an impact to the new customer of the system.

There are a number of mechanisms that can be considered toward funding local facilities. One of the following scenarios typically occurs: (a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the GFC); (b) a developer funds extension of the system to their development and turns those facilities over to the utility (contributed capital); or (c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) which collects tax revenue from benefited properties.

A *Local Facilities Charge (LFC)* is a variation of the connection charge authorized through RCW 35.92.025. It is a city-imposed charge to recover the cost related to service extension to local properties. Often called a front-footage charge and imposed on the basis of footage of main "fronting" a particular property, it is usually implemented as a reimbursement mechanism to a city for the cost of a local facility that directly serves a property. It is a form of connection charge and, as such, can accumulate up to 10 years of interest. It typically applies to instances where no developer-installed facilities are needed through developer extension due to the prior existence of available mains already serving the developing property.

A *Developer Extension* is a requirement that a developer install onsite and sometimes offsite improvements as a condition of extending service. These are in addition to the GFC required and must be built to city standards. Cities are authorized to enter into developer extension agreements under RCW 35.91.020. Part of the agreement between a city and developer for the developer to extend service might include a late-comer agreement, resulting in a late-comer charge to new connections to the developer extension.

Latecomer Charges are a variation of developer extensions whereby a new customer connecting to a developer-installed improvement makes a payment to a city based on their share of the developers cost (RCW 35.91.020). The city passes this on to the developer who installed the facilities. This is part of the developer extension process, and defines the allocation of costs and records latecomer obligations on the title of affected properties. No interest is allowed, and the reimbursement agreement is in effect for a period of 20 years, unless a longer duration is approved by the City.

LID/ULID is another mechanism for funding infrastructure that assesses benefited properties based on the special benefit received by the construction of specific facilities (RCW 35.43.042). Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected by a majority of property ownership within the assessment district boundary.

Utility Funds and Cash Reserves

User charges (rates) paid by the utility's customers are the primary funding source for all utility activities. The rates cover total annual costs associated with operation and maintenance of the wastewater system, and other ongoing costs of providing wastewater services. Rates can pay for capital improvement projects in two ways: either paying for debt service or directly paying for capital projects. Although funding the capital costs directly through rates does not result in the additional interest expense associated with issuing debt, this approach can cause large and/or volatile rate increases.

11.10.2 Government Programs

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However due to budgetary constraints in light of recent economic events, these assistance programs have been either 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. Major funding sources are as follows:

Department of Ecology: Grants and Loans through the Annual Integrated Water Quality Financial Assistance Process

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. Eligible projects may include the following: upgrades and expansions of sewer plants and collection systems, septic system improvements, water re-use facilities, water cleanup projects, stormwater and groundwater projects, stream-side protection and restoration projects, and public clean water education projects. 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.

Further detail is available at:

- http://www.ecy.wa.gov/programs/wq/funding/funding.html
- http://www.ecy.wa.gov/news/news.html

Community Economic Revitalization Board (CERB)

CERB, a division of the Washington State Department of Commerce, primarily offers low cost loans; grants are made available only to the extent that a loan is not reasonably possible. The CERB targets public facility funding for economically disadvantaged communities, specifically for job creation and retention. Priority criteria include the unemployment rates, number of jobs created and/or retained, wage rates, projected private investment, and estimated state and local revenues generated by the project. According to their website, "CERB funds a variety of projects that create jobs including (but not limited to) domestic and industrial water, storm and sewer water projects, telecommunications and port facilities." Eligible applicants include cities, towns, port districts, special purpose districts, federally recognized Indian tribes and municipal corporations.

Funding details for the 2013 – 2015 Program are as follows per the Washington Commerce website: "$9 million was appropriated to CERB for the 2013-2015 Biennium. By state law, CERB must award 75% of this funding to projects in rural counties. The Board has also allocated $2,182,500 to be available for construction and planning grants on a first-come, first-served basis."

Program	Funding Limitations
Committed Private Sector Partner Construction	• $2 million per project loan award limit • Up to $300,000 or 50% of total award, **whichever is less**, may be grant funds. • 20% cash match required (minimum, percent of total project cost)
Prospective Development Construction	Available to rural communities only. • $2 million per project loan award limit • Up to $300,000 or 50% of total award, **whichever is less**, may be grant funds. • 50% cash match required (minimum, percent of total project cost)
Planning/Economic Feasibility Studies	• $50,000 grant per project award limit • 25% cash match required (minimum, percent of total project cost)

Further detail is available at:

- http://www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard/
- http://www.commerce.wa.gov/Documents/2013-15_Policies.pdf
- http://www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard/Pages/CERB-Traditional-Programs.aspx

Public Works Board (PWB) Financial Assistance

The Boards overarching goals is to provide community access to financial and technical resources that help sustain local infrastructure. Cities, towns, counties and special purpose districts are eligible to receive financial assistance for qualifying projects (including sanitary sewer projects). When funding is available, the following tools are accessible:

- ***Construction Loan Program:***
  - Funding Cycle: The Governor's proposed 2015-17 budget offers $69.7M for 19 projects.
  - Program Description: Low-interest loans for local governments to finance public infrastructure construction and rehabilitation. Eligible projects must improve public health and safety, respond to environmental issues, promote economic development, or upgrade system performance.
  - Terms: No local match is required, loans with terms less than five years have a rate of 1.28% and loans between 5 year and 20 year have a rate of 2.55%.

- ***Pre-Construction Loan Program:***
  - Funding Cycle: No funding has been allocated to the Pre-construction loan program for the 2013-15 biennium.
  - Program Description: Local governments may apply for low interest loans to finance pre-construction activities to prepare a project for construction.
  - Terms: Terms are limited to a five year repayment period (the loan term may be converted to 20-years once the project has secured construction funding) with a 1% interest rate.

- ***Emergency Loan Program:***
  - Funding Cycle: No funding has been allocated to the Emergency loan program for the 2013-15 biennium.
  - Program Description: The Emergency Loan Program provides funding to address public works emergencies, thereby helping provide immediate restoration of critical public works services and facilities.
  - Terms: Funds are limited to $500,000 per jurisdiction per biennium, and come with a 20-year term (or the life of the project), and a 3% interest rate. No local match is required.

- ***Energy and Water Efficiency Loan Program:***
  - Funding Cycle: No funding has been allocated to the Energy and Water Efficiency (EWE) loan program for the 2013-15 biennium.
  - Program Description: The EWE program is designed to encourage energy, water, and efficiency upgrades to existing infrastructure by providing low-cost loans.
  - Terms: The maximum loan amount is $1,000,000. The interest rate is dependent upon the term of the loan. Loans less than 5 years receive a 0.50% rate. Loans between 5 and 10 years receive a 1% interest rate. Loans between 11 and 20 years receive a 1.50% interest rate.

Further detail is available at:

- http://www.pwb.wa.gov/financial-assistance/Pages/default.aspx
- http://www.pwb.wa.gov/Documents/FINAL-MASTER-GUIDELINES.pdf

11.10.3 Public Debt Financing

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 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, these can sometimes play a valuable role in project financing. A rate savings may be realized through two avenues: the lower interest rate and related bond 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.

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 (added bond debt service coverage). The City agrees to satisfy these requirements by ordinance as a condition of 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.

11.11 Summary

The City Council adopted a rate increase of 5.0% for 2014 and then adopted the proposed five-year rate increase schedule of 4.25% annual increases from 2015 to 2019 (Ordinance 1450). These rate increases will help fund the future staffing recommendations discussed in Chapter 10, new debt service payments, and policy objectives.

It is recommended that the City regularly review and update key underlying assumptions that serve as the foundation of the multi-year financial plan to ensure that adequate revenues are collected to meet the total wastewater utility financial obligations.