2 – Context and Trends

This chapter provides the background for understanding the information in Chapters 3–10 about the current wastewater system and management program. The context for wastewater planning includes the service area and physical setting (geology and soils, topography and climate). Trends in land use, population and demand for sewer service are the basis for projecting wastewater flows and needs for wastewater infrastructure and programs.

SERVICE AREA

The City of Olympia is located on Budd Inlet at the southern end of Puget Sound. The Wastewater Utility currently serves the 17.5 square miles of the City itself and about 8 square miles in several portions of its Urban Growth Area (UGA) in unincorporated Thurston County. Many neighborhoods and individual lots within the City and unincorporated "islands" are still using onsite sewage systems. By 2035, Olympia expects public sewers will be extended to serve most of the entire UGA, about 26 square miles. Olympia may consider developing interconnection agreements with neighboring cities to more efficiently convey sewage through topographically challenging neighborhoods, and take advantage of the planned LOTT Alliance satellite treatment facilities.

For planning purposes, the service area is divided into seven major wastewater basins, shown in Figure 2.1.

HISTORY

The following historical summary is drawn from Olympia's 1989 and 1997 wastewater management plans.

Wastewater Collection

The town site of Olympia was established in 1850 and in 1892 the first permanent sewers were installed, generally short pipes flowing directly into Budd Inlet or the Deschutes Waterway. As the town developed, sewers were extended, usually with little planning. Until the mid-1950s, sewers carried both sanitary and storm flows in single pipes discharging into Budd Inlet. Adequate flushing and some dilution were seen as benefits over separate sanitary sewers. In 1955 the City mandated that storm and sewer flows be separated in future systems and initiated a program to improve the situation by treating wastewater at a cursory level prior to discharge. To date, a few sewers have been separated in the downtown area.

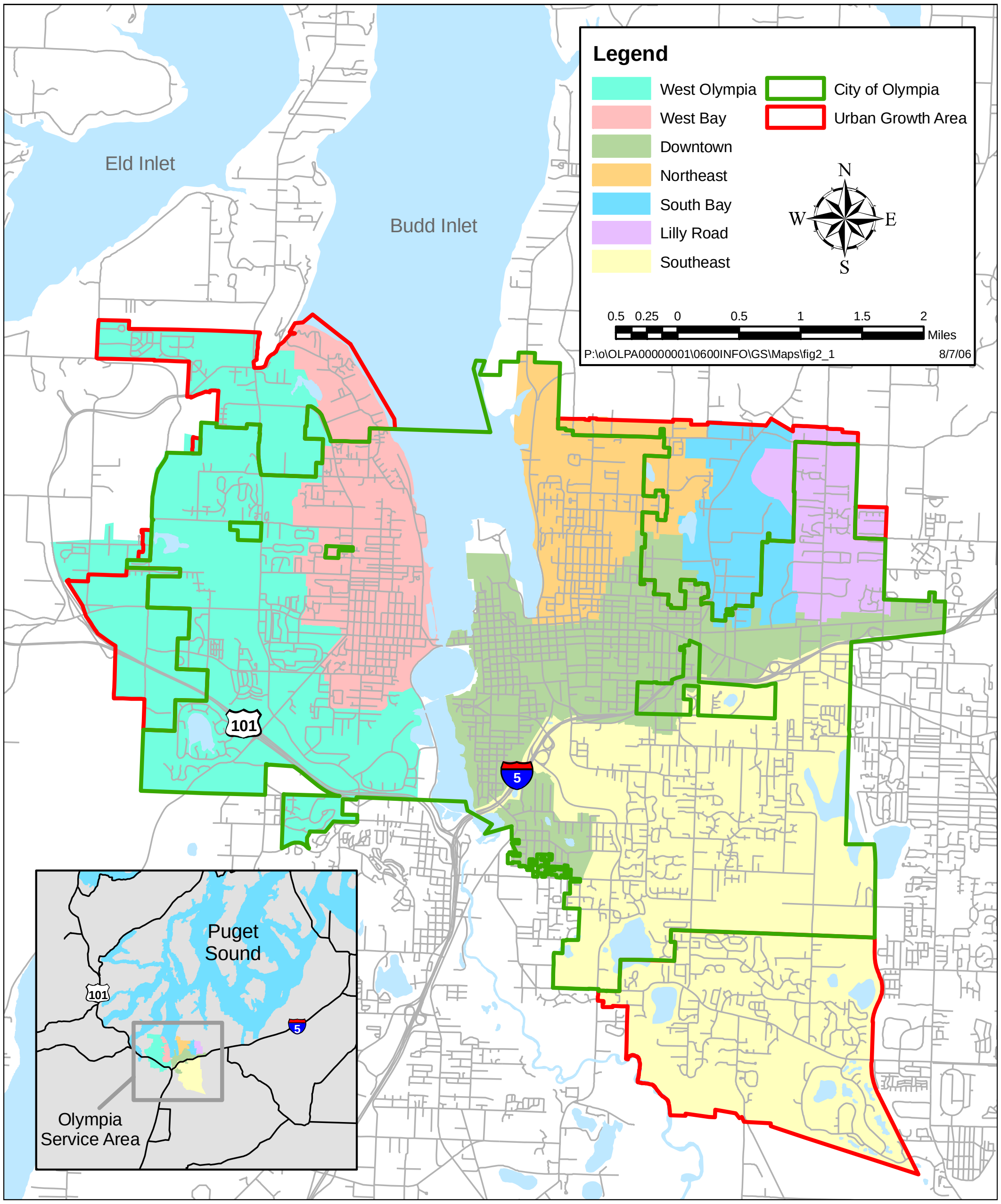


Figure 2.1. Olympia Service Area and Wastewater Basins

Several older areas, including parts of downtown Olympia, the Capitol neighborhood and parts of northeast Olympia, remain as combined sewer systems that carry wastewater and stormwater to LOTT. See Chapter 5 for more detail.

During the past 50 years, Olympia's wastewater infrastructure has grown substantially and has been extended into the UGA. In 1960, Olympia retained the Seattle consulting firm of Hill Ingman to complete the first comprehensive sewerage and drainage report. Olympia published its next Sanitary Sewer Comprehensive Plan in 1989, added Amendment No. 1 in 1992, and updated the

Plan in 1997. These plans guided development of the infrastructure for conveying sewage to the treatment plant with minimal risk to public and environmental health. Under these plans, publicly owned pipe systems have been funded, constructed, repaired and maintained.

Wastewater Treatment

By the late 1940's and early 1950s, reports of pollution in Capitol Lake and Budd Inlet made it clear that significant sewer infrastructure improvements would be needed as Olympia grew. Work in the 1940s had identified the need for routing wastewater flows from Tumwater and the Olympia Brewery towards a future treatment plant. The first sewage plant was constructed at the site of the present LOTT facility adjacent to the Port of Olympia, and began operation in 1952.

In 1955, a Pollution Control Commission study of water quality in Budd Inlet and Capitol Lake resulted in the closure of the lake and Budd Inlet south of Priest Point Park to recreational use. The commission recommended intercepting all wastewater to eliminate outfalls into Capitol Lake, West Bay and East Bay, and diverting it to the treatment plant.

In 1956, the Thurston-Mason County Health District found that pollution in Capitol Lake had declined since Tumwater began diverting its wastewater to the treatment plant; however, contamination of Budd Inlet had increased. Its report also recommended directing flows to the treatment plant.

In 1975, another study by the Pollution Control Commission found that Capitol Lake was still not safe for water sports although contamination had decreased. The report also noted that effluent was present along several streets in northwest Olympia, probably because poor soils had led to failure of onsite sewage systems.

The original treatment facility was owned and operated by the City of Olympia. The cities of Tumwater and Lacey began contracting for sanitary sewage treatment in 1954 and 1969 respectively, and the three cities and Thurston County formed the LOTT Partnership in 1976. Olympia continued to own and operate the treatment plant on behalf of the LOTT partnership until July 2001, when the Alliance was formalized as a separate organization.

See Chapter 3 for more information on the current LOTT Alliance long-term management plan, facilities and programs.

PHYSICAL SETTING

Geology and Soils

Geology in Olympia and the rest of Thurston County is the result of glacial activity in Puget Sound. Receding glaciers left the land dotted with lakes, ponds and materials called glacial till or glacial drift, deposited during successive glacial periods. This material varies from fine particles to large rocks and is generally permeable, with the capacity to absorb the 50-plus inches of annual precipitation.

Soil characteristics present challenges for both gravity sewers and onsite sewage systems. The 1990 Soil Survey of Thurston County Washington identified 30 types of soil within the urbanized Thurston County UGA (U.S. Department of Agriculture Soil Conservation Service, 1990). Only about one percent of the county land area has soils that meet all criteria for ideal functioning of onsite sewage systems (Sandison, 1996). Soils in most of Olympia's UGA are either too porous, too close to groundwater, or too close to underlying impermeable layers to allow ideal onsite treatment of wastewater. During winter months, many soils are occasionally or consistently saturated.

Construction of gravity systems is influenced by soil texture, depth to the water table, and linear extensibility (shrink-swell potential), which can influence the resistance to sloughing. Depth to the seasonal high water table, flooding and ponding may restrict the period when excavations can be made, and slopes create more difficulty when using machinery. The areas with unfavorable soil conditions may limit installation of deep sewers without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

In some portions of the service area, especially west of Ken Lake, there is very little soil on top of the impermeable basalt layer. Soils are inappropriate for onsite systems and installation of gravity sewers is difficult. The soil in the Ken Lake area is also reported to have a significant amount of silts with seasonal wetness and potential for a high groundwater table and varying levels of cemented glacial till (hardpan) (City of Olympia, 2001).

Topography

Thurston County's topography is characterized by coastal lowlands and wooded prairies up to the Cascade foothills. In general, Olympia's topography slopes to downtown, where the LOTT Alliance main treatment facility is located. Land elevation within and between neighborhoods varies appreciably, often creating topographic barriers for the gravity conveyance of wastewater to the LOTT facility. To overcome these barriers, the Wastewater Utility currently operates 27 regional sewer pump stations and over 1,500 STEP systems. See Appendix E-1 for a detailed map of topography in the wastewater service area. Appendix E-2 shows streams, lakes, and other surface water.

Climate

Winter weather in Olympia is temperate, wet and generally overcast. Summer weather is moderate and comparatively dry. The average annual range in temperature is relatively narrow, from an average low of 39 degrees F to an average high of 60 degrees.

During the wet season, generally from October to May, storms usually arrive from the southwest and continue toward the Olympic Peninsula. Most precipitation occurs during November, December and January, with an occasional Arctic storm that brings freezing temperatures, hail or sleet, freezing rain or snow.

Water Supply

Olympia is dependent on groundwater for its drinking water supply. About 70 percent of Olympia's water comes from McAllister Springs, which is located about 10 miles east of the city. Water leaves McAllister Springs through a 36-inch transmission main and is pumped to the Meridian Storage Tank less than a mile southeast of the springs. The water then flows by gravity from the storage tank through the transmission main for an eight-mile journey to the storage tanks on Fir Street and 7th Avenue. From these storage tanks, McAllister Springs water is pumped and piped throughout the city.

The City also has five water supply wells. Three are on the west side of Olympia: two at Allison Springs and one on Kaiser Road. Two wells are in southeast Olympia: one on Hoffman Road and one at Shana Park, near the Indian Summer Golf Course.

For additional water supply and redundancy within the system, Olympia is developing the McAllister Wellfield (pending approval of a water right from the Washington State Department of Ecology) and planning to use an existing well at Indian Summer Golf Course (pending approval of a request to transfer water rights) (City of Olympia, 2004). See Appendix E-3 for a map showing location of Olympia's water supply sources, reservoirs, and major pipes.

POPULATION AND LAND USE TRENDS

Land Use Trends

Residential and commercial properties are developing rapidly in Olympia, its UGA, and the adjacent cities. Olympia is permitting relatively large subdivisions at an increasing rate, with approximately 300–500 homes constructed per year. Many of these are being constructed at land use densities of five to seven units per acre compared to historical densities of four to five units per acre. Urban villages and other planned unit developments are also common.

Southeast Olympia and the associated UGA are currently experiencing the greatest development pressure. Areas of northwest Olympia and, to a lesser extent, northeast Olympia are also developing rapidly.

Population and Demand for Sewer Service

Population data in this Plan is based on the Thurston Regional Planning Council's The Profile (October 2005), adjusted for projected development based on projects now in the process of permitting. Historic population trends for the City of Olympia are shown in Table 2.1. In the past, demand for new sewer service has ranged between 175 and 300 connections per year. Recently, the City has processed a large number of development requests. If all the proposed developments are constructed and occupied, the number of additional connections per year would increase substantially. Currently, Olympia is expecting 300–500 residential connections per year and planning conservatively for up to 1,000. The conservative approach reflects a decision made in concert with the LOTT Alliance and public works staff from the Cities of Lacey and Tumwater to accept the high potential for development, but to spread it out over a long period of time (15–20 years).

Table 2.1. City of Olympia Historic Population Trends

	1995	2000	2001	2002	2003	2004	2005 (est)
City	37,734	42,514	42,530	42,690	42,860	43,040	43,390
UGA	8,670	9,270	9,640	9,870	10,000	10,580	10,664
Total	46,404	51,784	52,170	52,560	52,860	53,620	54,054

Source: Thurston Regional Planning Council, The Profile (October 2005). 2005 Estimate based upon TRPC 2003 Population Density Projection combined with development forecasts agreed upon by LOTT and its Partners in October 2005.

Table 2.2 shows population forecasts and annual rate of change. Table 2.3 shows year-by-year population and employment projections and the projected increase in population served by public sewers.

Table 2.2. City of Olympia Population Forecast

	2010	2015	2020	2025	Average Annual Rate of Change 2005-25
City	45,937	50,272	54,575	58,378	1.49%
UGA	13,159	18,823	24,062	27,957	5.11%
Total	59,096	69,095	78,636	86,335	2.40%

Source: Thurston Regional Planning Council 2003 Population Density Forecasts combined with development forecasts agreed upon by LOTT and its Partners in October 2005.

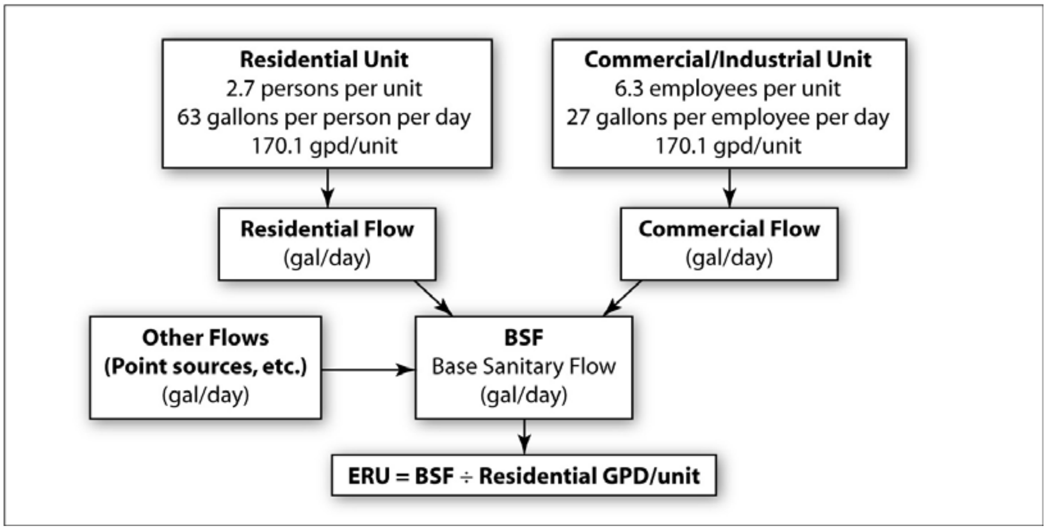
Table 2.3. Population and Employment Projections

Year	Oly Pop	UGA Pop	Change	Total Employment	Sewered Residents	Sewered Employment	Sewered
2005	43,390	10,664	2.2%	58,783	42,579	53,109	85%
2006	43,855	10,767	1.1%	59,575	43,248	53,863	85%
2007	44,299	11,236	1.7%	60,466	44,017	54,724	85%
2008	44,732	11,755	1.7%	61,390	44,920	55,681	85%
2009	45,213	12,400	2.0%	62,335	46,102	56,675	86%
2010	45,937	13,159	2.6%	63,329	47,675	57,729	86%
2011	46,814	14,300	3.4%	64,477	49,680	58,946	86%
2012	47,685	15,437	3.3%	65,619	51,721	60,167	87%
2013	48,552	16,569	3.2%	66,756	53,921	61,405	87%
2014	49,414	17,698	3.1%	67,887	56,161	62,646	88%
2015	50,272	18,823	3.0%	69,012	58,684	64,029	89%
2016	51,142	19,878	2.8%	70,132	61,239	65,421	90%
2017	52,007	20,929	2.7%	71,247	63,851	66,821	91%
2018	52,868	21,976	2.6%	72,356	66,520	68,230	92%
2019	53,724	23,021	2.5%	73,459	69,173	69,644	92%
2020	54,575	24,062	2.5%	74,557	71,791	70,963	93%
2021	55,426	24,972	2.2%	75,649	74,300	72,411	94%
2022	56,237	25,847	2.1%	76,644	76,666	73,701	95%
2023	57,055	26,669	2.0%	77,600	78,893	74,950	95%
2024	57,839	27,366	1.8%	78,535	80,992	76,184	96%
2025	58,378	27,957	1.3%	79,423	82,771	77,377	97%

Note: Forecasts are based on TRPC 2003 data, adjusted to account for proposed developments using information provided by LOTT Partners.

Wastewater Flows

Demand for sewer service is calculated using a value called an “Equivalent Residential Unit” (ERU) to create a common base for determining the amount of wastewater generated from both residential and commercial sources. Olympia uses values from the 1997 LOTT Wastewater Resource Management Plan (2.7 residents per ERU and 6.3 employees per ERU) calibrated slightly based upon recorded flows at the LOTT treatment plant. ERUs and the associated typical flows (170 gallons per day per ERU) are used to plan infrastructure needs and define billing rates. Combining these typical wastewater flows with projections of future connections allows for evaluation of system capacities and needs. Figure 2.2 shows how the ERUs are calculated.



Note: It is coincidental that Residential and Commercial units both have the same net generation rate (170.1 gpd/unit). This is not always the case.

Figure 2.2. Calculation of Equivalent Residential Unit (ERU)

Based on flow monitoring information, Olympia's residential wastewater generation rate has been calibrated to 63 gallons per capita per day (gpcd) and 27 gpcd for employees, for a base flow of 4.18 million gallons per day (MGD). Table 2.4 shows the projected increase in ERUs through 2025.

Table 2.4. Equivalent Residential Units (ERU)[1] and Rate of Increase[2]

Year	Olympia	Olympia UGA	Increase
2005	21,384	1,259	1.57%
2006	21,592	1,323	1.52%
2007	21,801	1,388	1.71%
2008	22,010	1,452	1.95%
2009	22,254	1,572	2.34%
2010	22,504	1,696	2.88%
2011	22,740	1,828	3.49%
2012	23,010	1,979	3.42%
2013	23,319	2,156	3.52%
2014	23,662	2,409	3.46%
2015	24,103	2,718	3.75%
2016	24,618	3,138	3.66%
2017	25,137	3,569	3.60%
2018	25,660	4,057	3.54%
2019	26,187	4,558	3.40%
2020	26,767	5,131	3.21%
2021	27,359	5,707	3.06%
2022	27,958	6,297	2.77%
2023	28,563	6,904	2.55%
2024	29,171	7,503	2.37%
2025	29,769	8,084	2.02%

1. These values assume average household size of 2.70 and 6.30 employees per commercial unit. These figures were developed for the 1998 LOTT Wastewater Resource Management Plan and calibrated for Olympia's Wastewater Management Plan effort.
2. Increase from previous year.

CHALLENGES AND ISSUES

The trends described above present a number of challenges for wastewater management. These issues, summarized below, are addressed in Chapters 12–17.

Geology and Soils

Only about one percent of the county land area has soils that meet all criteria for ideal functioning of onsite sewage systems (Sandison, 1996). Soils in most of Olympia's UGA are either too porous, too close to groundwater, or too close to underlying impermeable layers to allow ideal onsite treatment of wastewater. During winter months, many soils are occasionally or consistently saturated prompting poor treatment and potential surfacing of effluent. Additionally, high water tables encourage the infiltration of groundwater into leaky sewer pipes, thereby unnecessarily increasing treatment needs at LOTT. Other more permeable soils can allow contamination of groundwater by sewage.

Topography

Topography has been a key influence on Olympia's wastewater infrastructure policies and practices, sometimes resulting in system inefficiencies and potential inequities. Scouring by glaciers created a local topography with a subtle series of north-south troughs and hills. Because the LOTT facility is centrally located, most effluent must be piped east or west, often across the troughs and hills. Given this topography, gravity conveyance of wastewater will continue to be challenging, especially as areas increasingly distant from LOTT are developed. Private and public costs of conveying wastewater from outlying areas to LOTT can be high.

Climate

Rainwater enters the wastewater system either intentionally through street drains or unintentionally as groundwater through aging joints and cracked pipes in combined stormwater/wastewater sewers, and wastewater sewers. Earthquakes and the gradual aging of pipes can also cause breakages that allow inflow into the system. Inflow and infiltration is particularly common in pipes installed before the 1960s. These additional flows to the sewer collection system and the LOTT treatment facility result in reduced pipe capacity, increased potential for overflows and stressed treatment operations. The ability of onsite sewage systems to adequately treat and dispose of effluent is also compromised by high soil moisture.

Long-term effects of climate change may cause additional challenges: more precipitation falling as rain rather than snow, more flooding and increases in sea level relative to current pipe elevations. These effects could be significant within 20 years.

Population/Land Use Trends

Rapid land development without adequate infrastructure planning and construction has resulted in a fragmented wastewater system of pump-assisted gravity pipes, STEP systems and onsite sewage systems. Often, sewer systems have been installed to meet the short-term needs of a particular development rather than long-term goals for cost-effectiveness and equity.

Changing course to a more regional infrastructure system at this point in Olympia's development history will be difficult, especially given the current and projected surge in development. Additionally, development of many remaining undeveloped parcels is financially challenging regardless of sewer needs. These issues compound the continuing challenge of repairing or replacing existing sewers that in many cases were built over 50 years ago, and the need to manage a projected total of some 2,200 STEP systems and correct damage their corrosive effluent is causing in gravity sewer mains.

Wastewater Flows

Conveying wastewater flows from new developments in outlying areas to LOTT relies upon having adequate pipe capacity in existing pipes downstream of the development. Some of the existing pipes were not sized to convey the new flows. These capacity problems can be exacerbated as policies and regulations to convert existing onsite septic systems to gravity systems are implemented. Financial resources are needed to upsize public infrastructure in advance of new development and onsite system conversions.

Equity

Regardless of its type, sewer infrastructure is costly. However, the distribution of costs between developers, builders, home-buyers and ratepayers varies depending on the type of infrastructure and the timing of its construction. Equity among residents can be expected to increase with planning and consistency, rather than deteriorate with system fragmentation and pursuit of short-term solutions.