6 – STEP SYSTEMS

A septic tank effluent pump (STEP) system integrates the technologies of onsite sewage systems and gravity sewers. A STEP system consists of a tank where solids are collected and a pump that conveys the liquids via a low-pressure pipe into the gravity sanitary sewer system for treatment at the LOTT facility.

In low-lying areas or flat terrain, STEP systems are often preferred by developers over more expensive gravity sanitary sewers and pump stations. Pipes can be buried as shallow as 36 inches because they are pressurized and do not rely on gravity to maintain flow. Also, because there are no solids present, the pipe can be smaller. As a result, installation costs are less than gravity systems that may need deep trenching. However, maintenance costs are typically higher since pumps and associated equipment may break down and the tanks must be pumped periodically to remove the accumulated solids. Also, STEP system effluent is corrosive and may damage concrete gravity pipes and manholes. Under State regulations, the City owns these systems and is responsible for maintenance and replacement costs.

Figure 6.1 is a conceptual diagram of a STEP system. As with onsite sewage systems, each home or business requires its own STEP system.

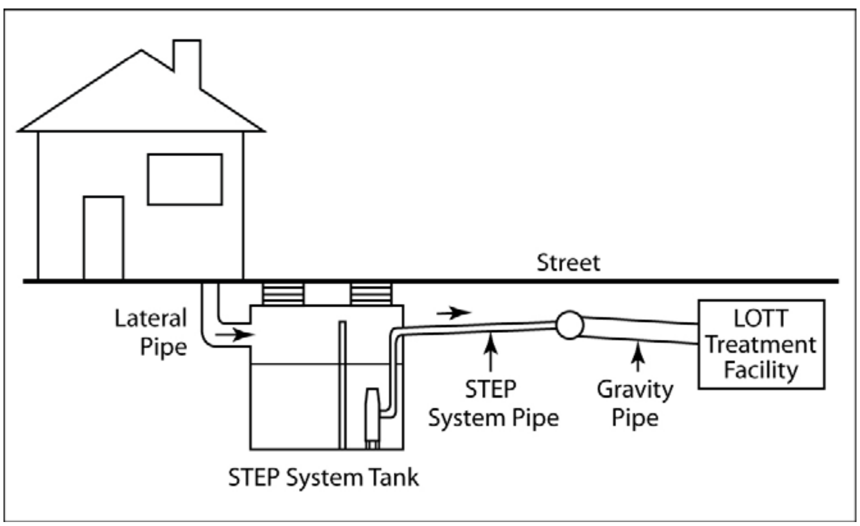

Figure 6.1. Conceptual Diagram of a STEP System

This chapter reviews how STEP systems have developed in Olympia, describes their location and condition, and outlines major challenges and issues. Strategies for managing STEP systems are presented in Chapter 13 and summarized in Chapter 17.

HISTORY IN OLYMPIA

In the late 1980s, the City was looking for ways to provide sewer service to rapidly developing areas with challenging terrain, and to encourage infill on vacant parcels that are difficult to serve with conventional sewers. In searching for alternate sewer technologies, the City found that STEP systems had been used successfully in Glide, Oregon, a town of 1,600, for the past five years. The technology seemed suitable in areas where gravity sewers were technically impractical or costly. The 1989 Sewer Comprehensive Plan recommended the use of STEPS on an experimental basis, and Olympia's first STEP system was installed in 1992 to serve the new Margaret McKinney School on the outskirts of southeast Olympia.

In 1994, the City's Comprehensive Plan was amended to allow future development to use STEPS (Ordinance 5757, July 12, 1994 Resolution No M-1383). The result was a rapid increase in the use of STEPS, especially for subdivisions in the UGA that were distant from existing gravity systems. By 1996 there were 479 STEP systems, most within the City limits.

The 1997 Sewage Disposal Master Plan identified two areas in northeast and southeast Olympia and its UGA where STEP systems were deemed financially appropriate due to topography and at the lack of existing gravity systems. Since then, STEP systems also have been allowed in pockets throughout the City where gravity sewer service is considered financially challenging, and increasingly in areas that could have been served by conventional sewers.

By 2001 there were far more STEP systems in the UGA than in the City. By 2005, 64 percent of the systems were located in the UGA. The use of STEPS has allowed development to conveniently reach into the UGA without extending gravity systems.

Ownership

The City of Olympia owns all 1,515 STEP systems, although they are located on private property. State regulations require that a public entity own domestic sewage facilities and be responsible for operation and maintenance (WAC 173-240-104). Accordingly, STEP systems are built by developers and acquired from the property owner via a bill of sale. To ensure maintenance access, the City obtains an easement, attached to the deed. Recently, easements have been obtained for an entire STEP system development rather than for individual parcels.

Easements include maintenance agreements that specify responsibilities of the City and property owners. Property owners are responsible for the pipe, drains and plumbing between the house or business and the tank. The City is responsible for the tank, pumping system and connection to the gravity sewer; and can be liable for damages resulting from a plumbing backup. The City is also responsible for eventually replacing or converting STEP systems to gravity sewer.

Moratorium

Although STEP systems had become the technology of choice for many developers, the increasing numbers were causing concerns about the City's increased liability, maintenance burden, and future capital cost of replacement. In early 2005, a large number of STEP systems were proposed for several major residential developments in the Olympia UGA. The City realized that without changes to the sewer policy, recent development patterns and subdivision applications would result in permitting of an additional 1,800 STEP systems, a 150 percent increase.

In February 2005, the City Council placed a six-month moratorium on approval of new STEP systems. On July 19, the City Council passed a resolution limiting approval of new STEP systems to infill lots and "vested" subdivisions whose development applications have been accepted as complete. Staff was authorized to consider converting STEPS to gravity when it makes financial sense to do so, and to consider public funding for extending gravity systems to areas served by STEPS when appropriate.

DESCRIPTION AND LOCATION

The City is currently responsible for a total of 1,515 STEP systems, serving 9 percent of residential sewer customers. Another 700 residential systems are included in "vested" development projects awaiting final approval and likely to be in service within five years. The City also has 12 commercial or multifamily STEP systems.

The most extensive use of STEP systems is in southeast Olympia and the UGA. The longest STEP line extends along Boulevard Road SE and Yelm Highway to the far southeast corner of Olympia's UGA, with many connections. Others are located in pockets in northeast Olympia UGA along Lilly Road, northwest Olympia UGA along Overhulse Road, 11th Avenue NW and 14th Avenue NW, and along the west slopes of West Bay and Capitol Lake. Overall, the City's STEP system has approximately ten miles of force mains connecting the storage tanks with the gravity sewer system. Table 6.1 shows the number of STEP connections in each wastewater management basin. The locations of STEP mains are shown on the service area map, Chapter 5, Figure 5.3; individual connections are also shown on wastewater basin maps in Chapter 9.

Table 6.1. Distribution of STEP Systems by Wastewater Management Basin

Wastewater Management Basin	Residential STEP Systems	Commercial STEP Systems
West Olympia	113	Westfield Baptist Church
West Bay	35	
Downtown	9	
Northeast	11	Church of the Latter Day Saints
South Bay	4	
Lilly Road	340	Group Health Medical Facility Huntington Apartments Landis Point Apartments Sequoia Ameri-Park St. Francis House
Southeast	1,003	Margaret McKinney School Grace Community Church Indian Summer Clubhouse Setina Manufacturing Stratford Home Condominiums

CONDITION ASSESSMENT

All STEP systems in Olympia have been installed in the past 15 years and have a life expectancy of at least 20 years. The condition assessment, using criteria described in Chapter 5, reveals several key findings.

Pipeline and Tank Integrity

STEP system pipes are pressure tested before installation, but the test has not been repeated as part of maintenance. Since all pipes have been installed within the last 15 years and are made with PVC materials, problems with pipeline integrity are unlikely.

Inflow and Infiltration

Infiltration is unlikely, since STEP systems are tightly sealed and pressurized, and installed using new construction techniques. However, inflow may enter the system at the home, typically through gutters and storm drains.

Operating Efficiency

Operation and maintenance of STEP systems is labor intensive. In past years, STEP systems generated 90 percent of the total wastewater system service calls. Emergency repairs include replacing clogged pumps, cleaning screens, fixing broken float switches and repairing electrical equipment and alarms. Some malfunctions that require O&M response are caused by improper disposal of items that clog the screens or pump. The City's practice has been to give the home or business owner an educational pamphlet to encourage proper practices. Fines may be assessed for continued sanitary sewer disposal violations, but this is rarely done.

Recently, the wastewater operations staff has focused on preventive maintenance, which has reduced the number of STEP system failures and overflows at individual homes and businesses. All systems are inspected every one or two years. Residential STEP systems are scheduled for maintenance every five years and commercial STEPS every two years. Scheduled maintenance includes pumping the tank to dispose of solids.

Risk

A review of liability issues associated with STEP systems identified substantial public financial risks in continued permitting of these systems. The risks primarily arise from the City's potential liability for damages and from its responsibility for ongoing operations and maintenance and eventually replacing the systems or converting them to gravity systems as it becomes financially feasible. A business case evaluation conducted by Brown and Caldwell in 2005 determined that the 20-year net present value cost of ownership of the STEP systems was $14.6 million higher than the cost of replacing all those systems with gravity sewers and disallowing the further introduction of STEP systems (City of Olympia, 2005).

CHALLENGES AND ISSUES

Below are some of the major challenges resulting from City ownership and maintenance of STEP systems.

Cost

High maintenance cost. In the short term, the biggest challenge with STEP systems is the labor-intensive maintenance required, which has been increasing exponentially with the number of STEP systems. Alarms and biosolids levels must be checked and tanks pumped out regularly. STEP systems generate 90 percent of emergency service calls, many after hours.

This level of service means 25 percent of staff time is dedicated to 10 percent of sewer customers, creating inequity for gravity system customers who pay the same rates as STEP system customers.

Long-term capital costs. In the long term the most significant challenge is the City's ownership of thousands of separate systems that will eventually wear out and need to be replaced or converted to conventional gravity sewers. Replacing the STEPS as they age would cost many millions in Wastewater Utility funds and would leave the City with a perpetual maintenance and liability responsibility. The cost of converting the STEPS to gravity systems represents a significant capital expenditure. In terms of net present worth, this expenditure is balanced against the ongoing cost of STEP system operations and maintenance. Over the long term, the operations and maintenance cost is higher than the capital cost associated with conversion (by an estimated $14.6 million over 20 years).

Effluent Problems

Because STEP systems operate anaerobically, decay of solids in the tank releases ammonia and hydrogen sulfide, which has an unpleasant “rotten egg” smell. The liquid effluent that enters the gravity system from STEP systems contains a high portion of hydrogen sulfide, making it highly corrosive to the downstream concrete gravity pipes and manholes into which it flows. The nature of the effluent creates a potential for groundwater contamination in corroded gravity sewer pipes and the need for supplemental aeration at the LOTT facility.

Odor. Hydrogen sulfide gases associated with STEP systems can be emitted from downstream gravity pipelines, resulting in neighborhood odor problems. Non-mechanical aerators and/or chemical filters may be necessary to neutralize odor as the effluent is discharged into the sewer system. In one neighborhood, costly odor control equipment has been installed to correct the situation.

Corrosion. Hydrogen sulfide is corrosive to concrete pipes and manholes, which may need to be lined or replaced with plastic pipes. In either case, capital costs can be high. In 2006, corrosion attributed to STEP system effluent required emergency response and extensive replacement of pipes along Martin Way and Lilly Road before the end of their design life.

Potential for groundwater contamination. Higher nitrate concentrations have been found in STEP system effluent compared to conventional gravity sewers (LOTT, 2003). Since STEP systems are under low pressure, a break in the pipes can allow effluent to leak out, contaminating groundwater.

LOTT treatment. The anaerobic nature of STEP system effluent requires supplemental aeration and treatment at the LOTT facility. The impacts result in additional holding capacity and energy inputs. Concurrently, the STEP systems’ inherent treatment capability acts to starve the organisms in the LOTT Budd Inlet Treatment Plant, which depend upon an ample amount of fresh sewage to thrive. Since the Tumwater Brewery closed in 2003, the LOTT facility has had to supplement influent sewage with methanol in order to optimize treatment. Methanol addition represents a significant operational cost at the Budd Inlet Plant.

Other

Potential for power failure. STEP systems rely on electrical pumps to function. Extended loss of power would result in widespread sewer backups. In contrast, regional pump stations operated by the City are equipped with emergency generators to avoid loss of service.