8 – ALTERNATIVE TECHNOLOGIES

This chapter describes several potential alternative technologies that may be feasible for application in Olympia, and the challenges related to their use. Strategies for implementing alternative wastewater technologies are presented in Chapter 15.

HISTORY IN OLYMPIA

Olympia has investigated and implemented alternative technologies for wastewater management on several occasions. Examples include composting toilets, septic tank effluent pump (STEP) systems, and high-density septic/graywater systems. These have resulted in limited success. STEP systems, the most widespread application of an alternative to gravity systems, have demonstrated substantial financial and operational risks, as described in Chapter 7. Application of other technologies has illustrated some of the advantages and disadvantages. Most involve higher initial costs and would require different operating policies to be in place to be successful.

The LOTT Alliance has had success with certain alternative technologies as part of its water conservation program targeted at wastewater discharges. These technologies have focused on flow reduction, and have included education, rebates and installation of the following:

- Low flow toilets
- Low flow washing machines
- Water saving kits (showerheads, faucet aerators)
- Ice machine retrofits
- Leak seekers

These efforts, combined with general improvements in home building and appliance technology, have significantly dampened the increase in base wastewater flow in the LOTT service area in spite of heavy expansion over the past 10 years. From 1995 to 2005, the typical per capita wastewater generation rate had decreased by approximately 13 percent over the entire LOTT service area.

The LOTT Alliance studied graywater separation in the 1990s as part of the Wastewater Resource Management Plan (1998). Graywater is defined as any household effluent other than toilet flushes. Typically, graywater is collected and filtered. Filtered graywater may be applied to a subsurface, much like a septic tank effluent drainfield. A typical system is illustrated in Figure 8.1. The LOTT analysis involved building a separated system in a residential single-family dwelling and metering flows to determine the proportion of graywater in household wastewater.

The LOTT study determined that approximately 60 percent of daily household water use resulted in graywater and the costs for installation of the separate plumbing (excluding the drainfield) added approximately $3,000 to the cost of the home.

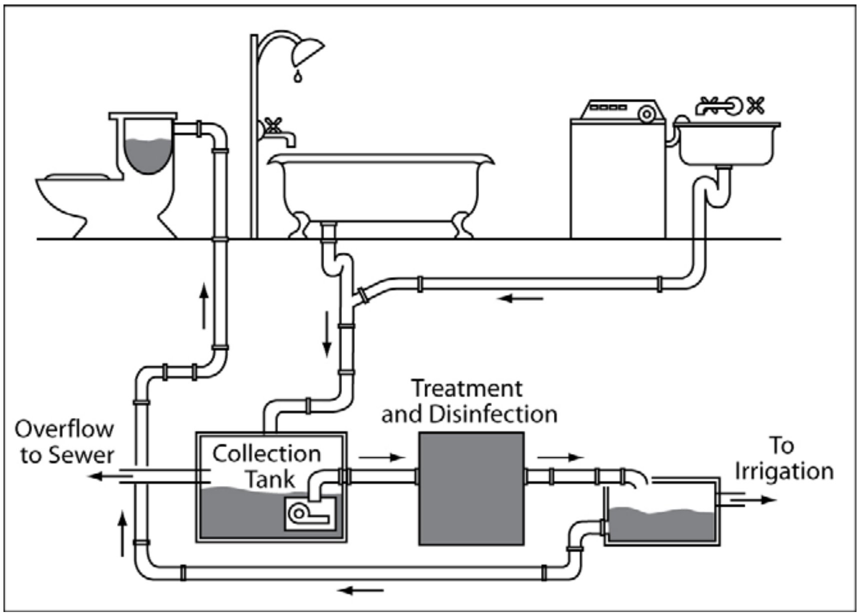

Figure 8.1. Graywater System

DESCRIPTION OF AVAILABLE TECHNOLOGY

Alternative treatment technologies cover a spectrum of applications. Some of the most promising or widespread involve alternative toilet technology, the use of plant-based treatment systems and graywater separation.

The EPA provides fact sheets on several alternative toilet technologies, of which two have potential for residential use.

- Composting toilets are waterless or extremely low flow toilets that discharge into a composting reactor. Inside the reactor, wastes are broken down aerobically into a soil-like substance that can be buried or hauled away for disposal. The key advantages of the system are the limited (typically zero) water use and the reduction in volume and strength of the wastes prior to disposal. The main disadvantage is the level of personal responsibility involved in maintaining and emptying the system and disposing of the product. The costs of these systems can range from $1,200 to $6,000 (EPA, 1999).

- Incinerating toilets discharge into a furnace, converting wastes into a fine, inert ash. The process uses no water, and has the advantage of producing an extremely small volume of ash that can be disposed of in normal household trash. The disadvantages include a relatively high energy cost. The level of personal responsibility is less than with the composting toilet, but still involves emptying the ash and periodically cleaning the combustion chamber. In 1999, the EPA estimated a purchase and installation cost of $4,000, with an average operation and maintenance cost of $3,148 over a 10-year service life (EPA, 1999).

Either of these systems, used in conjunction with graywater separation, could result in a relatively self-contained wastewater treatment system.

Another alternative treatment option, geared more towards a small community, involves the use of ecological networks in what has been called a “living system” as shown in Figure 8.2. These systems are typically designed as a series of tanks, each of which supports a host of organisms ranging from plants to micro-organisms as well as higher species. The system can achieve tertiary treatment by incorporating a series of reactive tanks – anaerobic, anoxic and aerobic – into the process. Living systems may also include such features as settling tanks, clarifiers and filtration devices. The systems are typically enclosed in a greenhouse to encourage ecological processes under optimal environmental conditions.

Source: U.S. EPA., 2001.

Figure 8.2. Living System for Wastewater Treatment

The EPA indicates that such systems have reliably achieved treatment goals for BOD, TSS, and ammonia in the 95 percent range and total nitrogen and total phosphorus in the range of 75 and 45 percent, respectively (EPA, 2002).

The system requires operation and maintenance similar to a small wastewater treatment plant, plus routine management of fish, snail and insect populations. Residual solids require stabilization and treatment, and may be applicable for composting.

Table 8.1 summarizes the alternative technologies discussed above, with some analysis of the costs and levels of personal responsibility.

Table 8.1. Summary of Potential Alternative Technologies

Technology	Scope	Waste Source	Waste Disposal	Level of Personal Responsibility	Cost[1]
Composting Toilet	Single home	Toilet waste only	Burial, permitted haulers.	High - emptying system, waste disposal.	$5,000 per home, plus waste disposal.
Incinerating Toilet	1-4 homes may share an incineration chamber	Toilet waste only	Minimal, regular trash.	Moderate - emptying system, periodic chamber cleaning.	$5,500 per system, $4,500 annual operating cost.
Graywater System	Single home	Non-toilet wastes	Subsurface drainfields.	Low - certain detergents and wastes may be problematic.	Significant, entire house must be plumbed separately.
Living System	Small community	All wastewater	Similar to small treatment plant. Limited phosphorus removal.	Low - acceptable wastes depends upon system.	Similar to small conventional treatment plant.

1. 2006 Dollars (escalated from 1999 EPA Reports using Civil Works Construction Cost Index).

CHALLENGES AND ISSUES

Following are some of the challenges presented when considering application of alternative technologies.

Ensuring Sanitary Management and Disposal

Alternative technologies must ensure the sanitary management and disposal of wastes for the individual users of the technology as well as the community. Demonstrating this protection of public health can be challenging. As a result, permitting alternative technologies is difficult and time consuming. Most of these technologies require a level of personal responsibility beyond that required of the conventional sewer customer.

Handling Changes in Ownership

As ownership changes, each new owner must be willing to accept the technology and the level of personal responsibility associated with it. New owners may elect to remove alternative technologies installed on their property in favor of conventional systems, and the City needs to be prepared to deal with the potential for future sewer connections in these areas. Homes or small developments electing to install graywater systems, composting toilets or living systems should have reserved stub-outs to the City sewer to cover the potential for future voluntary conversion.

Evaluating Life-cycle Costs

Before approving use of an alternative technology, the City would need to evaluate the life-cycle cost and policy and administrative impacts. The following factors should be considered:

- The connection fee and monthly service charge are often assessed to a structure (residence, commercial building, etc.) based on its configuration and expected water use. Users of alternative technologies may expect a credit for these fees because of reduced dependence on the system.
- As ownership changes, a new owner would need to accept responsibility for managing the alternative technology; or the City could assess the full fee balances (connection fees in particular) at the time of property transfer. This suggests the City must design and install the downstream infrastructure to allow for the future connection to the conventional system.
- The City must also account for the required maintenance practices and ensure long-term protection of public and environmental health. Depending on the City's level of service goals and risk tolerance, programs would be needed to certify installation and ongoing maintenance. These programs would require staff specialized in maintaining these systems as well as administrative staff to track their status and issue work orders. In addition, the City would need to determine who is responsible for replacement if it fails.
- Need for a technology review process with public involvement to determine the acceptance of a proposed alternative technology.
- Need to inform existing and new owners on best management/operating practices and expected performance of these technologies to assure continued protection.