

Oreco[®] Effluent Sewer Systems: Operational Cost – On-lot Components

Executive Summary

Communities that want to build or improve their wastewater infrastructure soon discover that more than one type of sewer system is available. When researching, bidding, and selecting a sewer system, community leaders and their consulting engineers often focus on up-front capital costs. Decision-makers will make a more financially sustainable decision if they evaluate all the costs of any given technology — up-front costs but also ongoing O&M costs (operation and maintenance) and future R&R costs (equipment repair and replacement). That's because these "life cycle" costs differ greatly by technology.

Community decision-makers need this complete cost picture for two reasons: 1) to make a fair cost comparison, before a technology is selected and buried underground, and 2) to establish a rate structure for citizens that will fully fund all system costs, after the system is operational.

Oreco's engineers have spent more than three decades researching, designing, manufacturing, and supporting the installation and maintenance of Oreco[®] Effluent Sewer Systems (also known as STEP systems or pressure sewers). Hundreds of communities throughout North America and around the world have selected Oreco Effluent Sewers for their wastewater needs. Not only are effluent sewer capital costs frequently lower than those for gravity sewers, O&M and R&R costs are lower as well. This position was first taken by the US Environmental Protection Agency in 1997.¹ And it was reiterated by the EPA again this year, in a March 2009 article surveying multiple effluent sewer systems in Alabama, Tennessee, and Georgia. According to the EPA's Robert Freeman and Joyce Hudson, effluent sewer systems in Mobile, Alabama (for example) "...have provided savings of 25% to 50% over centralized collection and treatment."²

In fact, based on the documented performance of thousands of households, the operational costs for an Oreco[®] Effluent Sewer total about \$10/month/residence.³

This Technology Fact Sheet explains the basis for that figure.

O&M and R&R costs for Oreco Effluent Sewers fall into four main categories. These categories and costs are summarized in Table 1:

Table 1. Oreco[®] Effluent Sewer O&M and R&R Costs

I.	Proactive Maintenance (PM)	\$ 1.67/month/residence
II.	Reactive Maintenance (RM)	\$ 1.00/month/residence
III.	Equipment Repair & Replacement (R&R)	\$ 4.00/month/residence
IV.	Tank Pumping	\$ 3.33/month/residence
TOTAL		\$ 10.00/month/residence

Each of these cost categories is described in greater detail in this Fact Sheet, beginning with a general overview of effluent sewer O&M requirements.

¹ *Response to Congress on Use of Decentralized Wastewater Treatment Systems*, USEPA, April 1997, pp. 13-14, and *Oreco Effluent Sewers: Cost-Effective Environmentally Sound Wastewater Collection System*, Oreco Systems[®], Inc., "A Fraction of the Cost of Conventional Sewers," p. 4.

² Freeman, Robert, and Hudson, Joyce, "Small, Green, and Useful," *Water Environment & Technology*, March, 2009, p. 68.

³ These costs are consistent with those reported by Kevin White, Ph.D., P.E., in his article titled "Decentralized Wastewater Cluster Management: Operation and Maintenance Experience and Costs," published in *WEFTEC 2005 Proceedings* by the Water Environment Federation.

Orenco Effluent Sewer Systems: On-lot Operational Costs (cont.)

Overview: Effluent Sewer O&M Requirements

Operation and maintenance of effluent sewers is relatively simple and, for most small communities, only requires a part-time operator and inexpensive equipment and tools.

Operation and maintenance of the mainlines for an effluent sewer system is, by and large, insignificant. Occasionally, the operator services or exercises the mainline valves, including air release valves. If the system includes odor control filters, these are periodically replaced. While it's possible to pig or flush the mains in an Orenco effluent sewer, it's rarely necessary. Also, breaks or leaks from collection mains are rare and very inexpensive to repair.

Most of the operator's time will be allocated to maintaining the on-lot part of the system: e.g., periodic checking and cleaning of the STEP (Septic Tank Effluent Pumping) components inside each property's on-lot tank. These include filters or screens, the pump, floats, controls, etc. Due to the number of components and products in the on-lot part of effluent sewers, the quality of the equipment purchased by system managers and operators has a profound impact on the overall cost of the system.

It is imperative to purchase and install reliable, durable equipment. Failure to do so will negatively affect operation and maintenance requirements and therefore greatly increase O&M and R&R costs.

According to Mike Saunders, an expert in asset management of wastewater systems, "a single technician with a pick-up truck" can maintain 2,000 STEP connections in an effluent sewer systems, as long as the system was correctly installed with high-quality products. Now working for Orenco Systems, Saunders previously served nearly 10 years as a Utility Engineer and Technical Services Manager for Charlotte County, Florida, and was responsible for coordinating and planning a system that included 360 miles of gravity sewer lines, 200 miles of force mains, 250 miles of effluent sewer lines, more than 6,000 STEP connections, and 300 lift stations.

To keep costs low, not only is it important to purchase and install high-quality equipment, it is also important to standardize on an equipment package so that operators can stock and carry a limited number of items that are designed to work together.

Following is additional information on the four main categories of O&M and R&R costs for effluent sewers systems.

I. Pro-Active Maintenance (PM) = \$1.67/month/residence

Preventive maintenance (PM) protocols vary widely between systems, which is one reason why system operators and their utilities report widely different O&M costs.

Typically, a PM program includes periodic servicing of the following on-lot components:

- Measuring the sludge/scum in the tank
- Cleaning the pump and its surrounding effluent filter or screen
- Verifying the operation of the floats and control panel

Some utilities have elected to operate their effluent sewers with little or no PM. In a 2009 article titled "O&M Considerations for STEP Systems,"⁴ Saunders notes that this approach can yield low PM costs in the early years but "major repairs and replacement activities will escalate as the system suffers from neglect." This increases reactive maintenance (RM) requirements and total operational costs.

Conversely, some utilities have elected to operate effluent sewers with highly aggressive — even excessive — PM schedules. This, says Saunders, can also "result in higher overall O&M costs when PM activities unnecessarily target components that have a significant level of reliability with less frequent PM." Saunders concludes, "The most cost-efficient STEP management approaches balance PM and RM to achieve the lowest overall cost for O&M."

Specifically, that means scheduling PM activities every 3-5 years. Conservatively estimating 1.5 hours per service visit at \$40/hour, that comes to \$60/visit over 36 months or a PM cost of \$1.67/month/residence.

Bethel Heights, Arkansas, (www.bethelheightsark.org) has an Orenco Effluent Sewer that is managed with a good balance of PM and RM protocols to maintain its on-lot components.

⁴ Saunders, Mike, "O&M Considerations for STEP Systems," *Water Environment and Technology*, March, 2009, p. 24.

Orengo Effluent Sewer Systems: On-lot Operational Costs (cont.)

II. Reactive Maintenance (RM) = \$1.00/month/residence

As noted in the previous section, Reactive Maintenance (RM) is affected by Preventive Maintenance (PM) schedules. However, to arrive at a “typical” RM cost, Orengo has gathered RM data from 10 Orengo Effluent Sewer Systems, totaling more than 2,700 connections, and compiled it into Table 2, below.

As you can see, these systems average 1.4 hours/month of RM per 100 EDUs. Even conservatively estimating 2.5 hours/month/100 EDUs, that comes to \$100/100 EDUs or an RM cost of \$1.00/month/residence – assuming a typical business-hour labor rate of \$40/hr. (We can apply a non-overtime labor rate because tanks have sufficient reserve capacity to allow operators to handle after-hours calls during the next business day.)

Table 2. Residential Service Call-Out Requirement per 100 Connections.

State	Community	EDUs	Screened	Hrs. / mo. / 100 EDUs
CA	Mt. Lake Estate	8	yes	1.0
CA	Villa Verona	337	yes	2.5
MT	Missoula	350	yes	1.5
OR	Elkton	135	yes	0.7
OR	Glide	700	20%	2.0
OR	Lake Side	51	yes	0.3
OR	La Pine	215	yes	1.8
OR	Tangent	180	yes	2.5
WA	Boston Harbor	166	yes	1.6
WA	Conconnully	75	yes	0.5
WA	Diamond Lake	525	yes	1.2
Average Annual				1.4

III. Equipment Repair & Replacement (R&R) = \$4/month/residence

Equipment Repair & Replacement (R&R) costs for effluent sewers consist primarily of R&R costs for pumps, floats, and various other miscellaneous components, with pumps contributing most of the cost. *These costs are low when the proper pump is used.* A high-quality multi-stage effluent pump should have run-dry capability, a UL listing, a continuous operation rating, and a 3-5 year warranty. Additionally, the pump should be corrosion-resistant and rebuildable, either by replacement of individual components or by replacement of either the liquid-end or the motor-end. Such a high-quality pump will provide, on average, more than 20 years of service.

Note that, of the four cost factors in operating effluent sewers, R&R costs are the largest. And these costs are directly related to equipment quality.

Poor quality equipment decisions almost always require frequent and costly R&R schedules and thus significantly contribute to overall operational costs.

To arrive at a typical monthly R&R cost, Orengo gathered actual costs from a number of Orengo Effluent Sewer systems and compiled it into Table 3, below. As you can see, R&R averages only \$4/month/residence, partly because Orengo’s pumps are small (10 GPM, ½ HP, 115 VAC) and relatively inexpensive.

In reality, however, costs may be even lower, since pump R&R assumes complete replacement of the pump every 20 years at approximately \$600 per event (materials plus labor). Orengo Effluent Pumps are repairable, however, and repair costs are often half as much as replacement costs. At the Orengo Effluent Sewer System in Yelm, Washington, which includes 1,700 pumps, only 28 have been replaced since 1994.⁵

Table 3. Orengo Effluent Sewer Repair and Replacement Schedule

Component	Frequency	Cost/Event (Materials + Labor)	Amortized w/o Interest
Pump Replacement	20 years	\$600	\$2.50/month
Float Replacement	10 years	\$100	\$0.83/month
Misc. Component R&R	10 years	\$75	\$0.63/month
Total:			~\$4.00/month/residence

⁵ Yelm, Washington Case Study, “Low Life Cycle Costs Keep Rates Low,” Orengo Systems®, Inc., October 2009 (NCS-7).

Oreco Effluent Sewer Systems: On-lot Operational Costs (cont.)

IV. Tank Pumping = \$3.33/month/residence

Not unlike PM and RM protocols, tank pumping costs and mandated frequencies vary widely. Based on an 8-year audit of watertight tanks in Glide, Oregon, and a 5-year audit in Montesano, Washington, Oreco established reliable pump-out intervals for households with various sizes of tanks and number of occupants, as shown in Figure 1⁶.

Assuming a 1,000 gallon tank and 2, 3, and 4 people per residence, Oreco projects a pump-out interval of ~ 21 years, ~ 11 years, and ~7 years, respectively. These figures (calculated at a 95% level of confidence) are for watertight tanks, which are required in an Oreco Effluent Sewer system.

Conservatively estimating a pump-out fee of \$400 and a 10-year frequency, the cost comes to \$3.33/month/connection. At the more typical pump-out fees of \$200 or \$300 per event, the cost/month/connection is reduced to \$1.67 and \$2.50, respectively.

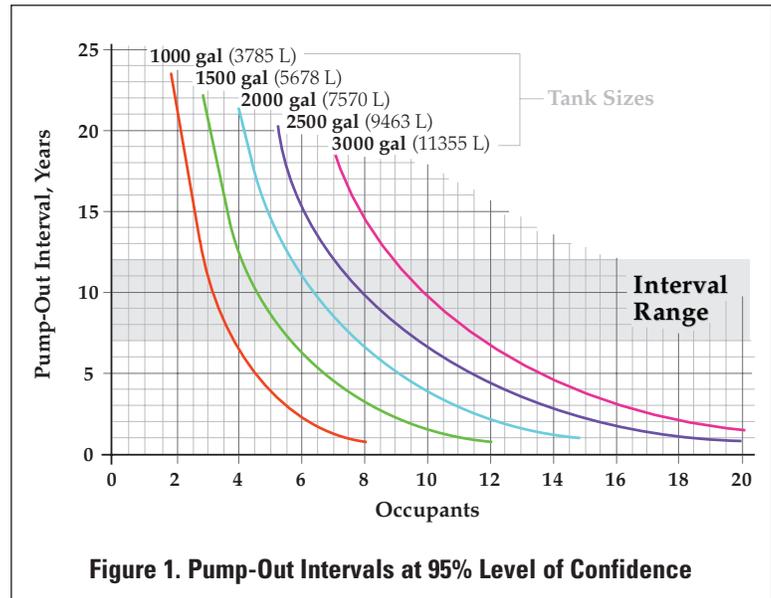


Figure 1. Pump-Out Intervals at 95% Level of Confidence

A Comment About Low Power Costs and Low Treatment Costs

The four O&M/R&R cost categories described above are the costs assumed by the utility and therefore must be calculated into rates. Please note that there are no power costs. Power costs for Oreco Effluent Sewer systems are minimal. It costs little more than \$1.50 per month to run each household's on-lot pump⁷ — and that negligible cost is part of each household's monthly electric bill, so doesn't need to be factored into utility rates.

Oreco Effluent Sewer systems also provide primary treatment, reducing solids by about 80%. Therefore, they are often followed by downsized and less costly secondary treatment facilities, such as a media filter, constructed wetland, or lagoon.⁸

Low power and treatment costs are one reason why Oreco Effluent Sewers are not just an affordable technology; they are an environmentally sustainable one.

In Conclusion

Clearly, when evaluating and selecting a sewer system, community engineers and decision-makers should ask for and then evaluate all costs — up-front capital costs, ongoing O&M costs, and recurring R&R costs — to make a financially supportable decision. Get real life data to validate all manufacturers' claims. And, if possible, visit, tour, and acquire data from sewer systems that have been operational for several years, preferably longer than ten. Contact manufacturers or your regulatory authorities to find a system close to you.

For more information on Oreco Effluent Sewers, call Oreco Systems[®], Inc., 800-348-9843.

⁶ Bounds, T.R., PE, "Septic Tank Septage Pumping Intervals," pp. 7-13 (NTP-TNK-TRB-1).

⁷ Run Time = 20 min/day, VAC = 115, A = 12.7, National Average Power Cost = \$0.1/kWh

⁸ See descriptions of secondary treatment facilities for Mobile, Alabama and Lake City, Michigan in "Affordable Wastewater Solutions that Fit Your Community," Oreco Systems[®], Inc., June 2008 (ACS-SMALLCOMM-1).