Vermont Legislative Research Shop

Septic System Technology

Traditional Treatment of Household Waste

Septic Systems

The traditional system used to dispose of household waste is the individual septic tank/soil absorption system. Bacteria dissolves the organic material from the household and nutrients are recycled. When using the septic system and in many cases it is safe and economically feasible. A safe septic system needs suitable land area for drainage in order to avoid problems such as leakage, overflow, and infiltration. This may degrade water quality in the household used for drinking, watering, and food preparation. One must also consider diseases, viruses, nitrate, and chemicals that may pollute the land area if the system is not efficient. Hazardous wastes (oil, paints, and cleaners) poured down the drain contaminate septic tanks (Harris, et. al). Risks of using a septic system can be decreased in many ways. If the volume of water coming from the household is minimized the septic system will treat the water better, have a longer life, and there is less chance of overflow (Harris, et. al). Homeowners should also put the system down slope and away from the well and pump their system every three to five years (Harris, et. al).

Additional treatment after the septic will reduce contamination. Aerobic systems use oxygen to produce high quality effluent that may be used for irrigation. Aerobic tanks can cost two to three times that of a standard septic tank, although this varies based on design, location, size, and installation and maintenance requirements. The aeration mechanism requires electricity and routine maintenance, and therefore is also more expensive to operate.

Sand filters will also improve the quality of the treated water after septic pretreatment. The water in this case is lower in bacteria, nitrogen, and phosphorus (Harris, et. al). A disinfections unit kills disease-causing microorganisms using ultraviolet light, chlorine, iodine or ozone. The only drawback with these additions to the traditional septic system may be the cost.

Another option is the constructed wetland. Constructed wetlands treatment systems are engineered systems that have been designed to utilize the natural processes involving wetland vegetation, soil, and their associated microbial assemblages to assist in treating wastewater (EPA, July 6th 2000). When the water is kept below the surface, odors are limited. On the other hand, when the water is above the surface a natural wetland is simulated. Either way the habitat value is maximized by the wetland and the only disadvantage may be if the property is not suitable for the construction of this alternative treatment. Constructed wetlands cost anywhere from $6,000 to $300,000 with a mean cost of $100,000 for construction costs. The operations and maintenance costs can be lower than alternative treatments generally less than $1,500/ha/year, including the cost of pumping, mechanical maintenance, and pest control (CMHC Systems, 2000).

Whether a homeowner uses the traditional septic system or the septic system with additional treatment features, they must be educated on the site selection, design, installation, operation, and maintenance in order to protect the household's health and the environment.

Alternative Treatments to Conventional Septic Systems

Composting Toilet- "Clivus Multrum"

A composting toilet creates a nutrient rich hummus after four or five years of decomposition. Advantages of this system in a household range from the reduction of organic material over time to the fact that no water is used at all. The Clivus is odor free, pathogen free, hygienic, and doesn't create any pollution (Lindstrom, Carl). Also, no leach field is necessary and the toilet lasts as long as the house. The composting system only takes personal excrement and food. Homeowners should have other means of disposing bath and gray water such as in their lawns or gardens.

The cost of composting toilets varies greatly depending on the amount of use, as well as the brand. The BioLet composting toilets range in price from $800 to $1600, the less expensive ones being for small family residential use, and the more expensive being able to handle more use (BioLet USA, 2000). The Phoenix brand of composting toilets range in price from about $3,000 to about $6,000. The lowest priced ones are for residential use whereas the most expensive are designed for much more frequent use such as at a rest area (Phoenix Composting Toilet Systems, 2000).

Soil Treatment Mounds

Soil treatment mounds are used when the soil on the property has low permeability and/or high water tables. A mound system enables use of land that would otherwise be unsuitable for in-ground or at-grade onsite systems. The elevated bed allows the treatment to take place before it contacts the soil water table. They are constructed with a layer of clean sand and leveled with a foot-deep rock layer before being covered by soil (*Anderson and Gustafson). M*ounds can fail because of improper sizing and poor construction. The design must take into account lot dimensions, local topography, the amount of sewage to be treated, and the rate at which the water flows through the soil (Minnesota Pollution Control Agency). The location of the mound may affect drainage patterns and limit land use options. The mound may also have to be partially rebuilt if seepage or leakage occurs. All systems require pumps or siphons. Mounds may not be aesthetically pleasing in some cases (Anderson and Associates).

Construction costs are typically much higher for mound systems than those of conventional systems. In a recent project to expand sewer service in Blackburg, Virginia, costs for a typical mound system were listed by the Virginia-based engineering firm of Anderson and Associates at $9,750 to build and $105 a year to maintain (Anderson and Associates).

Holding Tanks

Holding tank products produce enzymes that dissolve bacteria and solids. These enzymes work to control odor and degrade organic wastes, which can lead to objectionable odors. By reducing the viscosity of the solids very little water needs to be added at the start (Ultra Odors Gone International, 2000). This process eliminates odors and also cuts back on the amount of pumping required. Greases, fats, proteins, oil, and hair are examples of solid wastes that are broken down in this process. The costs of holding tanks vary greatly averaging about $10,000 (Carter, Jerry. 1998).

Federal Funding

Communities can apply for funds from federal sources, and the state revolving fund program. The federal sources include EPA Nonpoint Source Section 319 Grant Program, USDA/Rural Development, HUD, and the Economic Development Administration. The State Revolving Fund is available in all states and operates as a bank does. Assets are used to make low- or no-interest loans for installing new systems; replacing, upgrading or

modifying inadequate or failing systems; or establishing onsite/decentralized wastewater management entities (Environmental Protection Agency Office of Water, *Office of Wastewater Management* 10/16/00).

Vermont Septic Systems

Currently, half of the state's population relies on septic systems to treat sewage. Half of the cities and towns do not have ordinances allowing them to regulate homeowner septic systems. There are currently regulations limiting the way that some homeowners can dispose of human waste to a few systems. There is an exception to this because certain lots that are ten acres or larger are exempt from all septic review. A suggestion made by environmentalists that is not currently favored by developers is to eliminate the ten-acre exemption (Bazilchuk, Nancy, 02/21/01).

The Environmental Protection Agency reports that failing septic systems are the third most prevalent source of groundwater contamination in the state. As a result of this, the state surveyed homeowners in high priority targeted watersheds to determine if the septic systems were faulty. The state received approximately $200,000 (in section 319 funds- mentioned in "funding" section) for this project from the federal government between 1990 and 1993 (Environmental Protection Agency Office of Water, 10/04/99).

Actions In Other States

Many states are investigating alternative septic technologies. One example is the Buzzard's Bay Project's Alternative Septic System Test Center at the Otis Air National Guard Base on Cape Cod, Massachusetts. The Buzzard's Bay project received a U.S. EPA Environmental Technologies Initiative (ETI) grant to construct and operate a testing center for alternative and innovative onsite wastewater treatment (septic systems). In Massachusetts, 40% of residences are serviced by onsite septic systems, thus interest in developing more effective technologies is high. The partners in the Test Center recognized that effluent from conventional septic systems was a major contributing factor to the decline of surface water quality, especially coastal eutrophication due to nitrogenous wastes from onsite septic systems. The center is investigating up to four alternative commercial wastewater treatment technologies as compared to a standard septic tank and leech field (Buzzard's Bay Project, 11/10/98). The four systems accepted are:

1. Bio-Microbics, Inc. FAST system, an aerobic treatment unit using the fixed, activated-sludge process;
2. the Waterloo Biofilter, Inc. Biofilter which is a single-pass aerobic biofilter;
3. the Spec Industries Inc., AIRR system which is a modification of the recirculating sand filter;
4. the Innovative RUCK System's ECO/RUCK, a soil absorption field technology with claims of advanced nitrogen removal.

Other technologies such as those not yet ready for market or non-proprietary systems such as recirculating sand filters, will likely be monitored during the upcoming year as research and development testing projects (Buzzards Bay Project, 11/10/98).

References

Anderson and Associates. *Tom's Creek Sewer Project*. "Sand Mounds." June 8, 2000. http://www.andassoc.com/tomscreek/alternative/sand_mounds.htm

Anderson, J.L. and D.M Gustafson. Residential Cluster Development. http://www.extension.umn.edu/distribution/naturalresources/components/7059-02.html

Bazilchuk, Nancy. Burlington Free Press "Lawmakers Consider Sewer Reform." February 21, 2001. http://www.burlingtonfreepress.com/local/wednesday/4000h.htm

BioLet USA. "Biolet Secure Online Ordering." 05/01/2000. http://www.biolet.com/order.htm

Buzzard's Bay Project. *The Massachusetts Alternative Septic System Test Center*. 11/10/98. http://www.buzzardsbay.org/eti.htm

Carter, Jerry. "Simple Sewage treatment System Offers Hope to Lake Lot Owners." 05/1998. http://www.alascanofmn.com/story6/html

CMHC Systems. "Alternative Stormwater Management Practices for Residential Projects." 2000. http://www.cmhc-schl.gc.ca/rd-dr/en/water-eau/storm10.htm

Environmental Protection Agency, Office of Water. July 06, 2000. http://www.epa.gov/owow/wetlands/construc/backgrnd.html

Environmental Protection Agency Office of Water. "Vermont Septic System Cleanup Discharges." October 4, 1999. http://www.epa.gov/owow/nps/Success319/VT.html

Environmental Protection Agency Office of Water. "Funding." *Office of Wastewater Management*. October 16, 2000. http://www.epa.gov/owmitnet/decent/funding.htm

Harris, B.L., D.W. Hoffman, and F.J. Mazac Jr . "Reducing the Risk of Ground Water Contamination by Improving Household Wastewater Treatment." The Texas A&M University System. http://agpublications.tamu.edu/pubs/esoil/b6029.pdf

Lindstrom, Carl. Clivus Multrum Residential Installations. http://www.clivusmultrum.com/Resid.html

Minnesota Pollution Control Agency. Individual Sewage Treatment Systems. December 10, 1996. http://www.pca.state.mn.us/water/septic.html

Phoenix Composting Toilet Systems. "Phoenix Composting Toilet Sets New Standards." 2000. http://www.compostingtoilet.com/LITRACK/Articles/ebuild.htm

Ultra Odors Gone International. Holding Tank Waste Degraders. 2000. http://www.pca.state.mn.us/water/septic.html

---

Compiled by: Sara Davies, Matthew Reed, and Sarah O'Brien. March 12, 2001