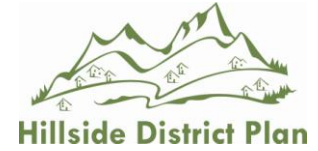


HILLSIDE DISTRICT PLAN – White Paper

ONSITE WASTEWATER SYSTEMS (OWS) ADVANCED TECHNOLOGY

September 14, 2007

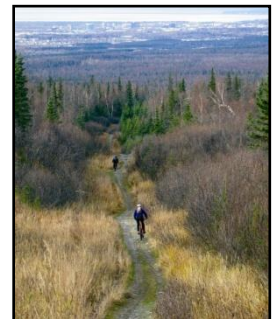


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OWS ADVANCED TECHNOLOGY

“Proper siting, installation and maintenance are the keys to keeping a septic system functioning well. Virginia Water Resources Research Center”

Summary

Advanced onsite wastewater technology has made significant strides in the past 25 years toward providing improved equipment and methodologies that treat onsite wastewater to higher levels with lower costs. However, advanced technology in this area should not be considered a cure-all for problems that may exist outside the capability of these technologies to affect, such as application, setbacks, operations & maintenance.

Overview

There is general agreement among Hillside residents that viable options for Onsite Wastewater Systems (OWS), within suitable locations, be maintained by application of sound regulatory policy and good engineering practice to protect and maintain the quality of the Anchorage-area groundwater environment (Glass, 2001). Considerations in maintaining a high quality OWS environment that have been voiced to date include:

- Improved Monitoring and Maintenance (M&M) of Systems
- Education of Residents

This white paper provides a brief examination of OWS Advanced Treatment Unit (ATU) technology that may be applicable to the Anchorage Hillside environment, and discusses monitoring and maintenance in the framework of all Hillside systems. It will discuss the education of Hillside residents, and describe the benefits of having a knowledgeable population served by OWS.

Background

When ATU technologies first appeared on the residential scene in the early 1980's, they were advertised as being able to match sewage plant secondary treatment levels, require low maintenance and little electrical power to operate. The early systems essentially met their claims, but there was one major requirement the manufacturers and supplier's of these innovative technologies did not consider well enough: monitoring and maintenance.

ATU's were delivered, installed and brought on line. The homeowner was given a cursory review of the system, monitoring and maintenance literature was reviewed, and the manufacturer's and installer's were off to the next project. After a few years of use, with little or no homeowner maintenance occurring, ATU's began to fail and needed to be replaced. The warranty periods were typically expired, so the homeowner was left to resolve the issue. The result was that ATU's earned a bad reputation in the minds of the public, even though they performed as they had been advertised, at least for a while.

The problem was that many homeowners were not capable of performing the monitoring and maintenance required to keep the early ATU systems operating properly, or they simply ignored the systems altogether until failure occurred. The ATU industry quickly recognized the problem, and changed their sales methodology to compensate. ATU's were then sold with a required period of monitoring and maintenance by a manufacturer trained O&M technician. Homeowners were counseled on the requirements for continuing monitoring and maintenance, and some states, such as Washington, began mandating that monitoring and maintenance was required for the life of the system. In addition, lots that had ATU systems often had notations placed on the title of the property indicating that maintenance of the ATU was a requirement.

Currently, there are hundreds of 'advanced' OWS products on the market in the United States. In general, states require that before a system can be accepted, it must pass a testing regimen designed to determine its proficiency at treating a defined set of wastewater characteristics. The National Sanitation Foundation is the main testing entity for onsite treatment products in the United States. Washington State has one of the most extensive registries of approved proprietary onsite treatment systems. They catalog 16 manufacturers that each list between one and three different treatment processes for their units.

Advanced Treatment Units

This section discusses the basic types of ATU's for individual wastewater treatment and provides an example of each, understanding that there are many more proprietary treatment units for each category. This white paper discussion is focused on individual onsite treatment units only, and does not consider larger package type treatment plants intended for community uses.

ATU's are different from basic septic tank treatment systems in that they use an aerobic treatment process rather than the anaerobic treatment of the septic tank. Aerobic treatment uses air to increase the oxygen levels in the treatment unit to support aerobic bacteria that perform the actual treatment. Aerobic treatment is about five times more efficient than anaerobic treatment. Advanced treatment is generally defined as achieving an effluent wastewater quality having both a biochemical oxygen demand (BOD₅) and total suspended solids (TSS) of ≤ 30 mg/L.

There are three basic types of ATU treatment processes in service in the United States:

- Suspended Growth
- Attached Growth
- Packed Bed Filters

All of these systems rely on different process pathways to route the wastewater through the treatment system. Some use an initial septic tank and transport the wastewater to the treatment unit by a pump or gravity, others are self contained, where the wastewater from the building enters the unit, is treated and exits to the dispersal element (drainfield)

without passing through other units. All of these units provide advanced treatment by increasing the amount of oxygen available for use by the treating bacteria.

Suspended Growth systems bring the wastewater into a tank, separate solids and scum, and route the effluent to a chamber where an air pump or propeller agitator introduce air to the effluent from vents extending above ground. The treated effluent is then routed to a clarifying chamber and has gravity or pumped flow to the dispersal element. The option for disinfection through chlorination or ultraviolet light (UV) is available.

Advantages- Small footprint, moderate power consumption, high effluent quality, system monitored by trained technician, low site impact.

Disadvantages- Initial cost, requires warm air in winter, susceptible to chemical/wastewater strength upset, low blower life, maintenance costs.

Example of Suspended Growth Unit:

Biocycle Model 5800

BOD₅ < 10mg/L

TSS < 10mg/L

Fecal Coliform < 400/100ml

As claimed by the manufacturer

Attached Growth systems are essentially the same as suspended growth systems, but instead of circulating air through the effluent in an open chamber, they use a media, that can be artificial or natural. The media is submerged in the effluent, and the material used is intended to provide the maximum surface area for attachment and growth of the treating bacteria. Air is blown or bubbled over the surface of the media to furnish the bacteria with oxygen. The treated effluent is then clarified and discharge to the dispersal element. The option for disinfection by chlorination or UV is available.

Advantages- Small footprint, moderate power consumption, high effluent quality, system monitored by trained technician, low site impact.

Disadvantages- Initial cost, requires warm air in winter, susceptible to chemical/wastewater strength upset, low blower life, maintenance costs, media replacement.

Example of Attached Growth Unit:

JET Model J-500

BOD₅ < 15mg/L

TSS < 12mg/L

As claimed by the manufacturer

Packed Bed Filter systems utilize An oversized septic tank which pumps to a receptacle containing a media for the bacteria, but instead of immersing the

media in the effluent, the effluent is sprayed over the media, and allowed to trickle over the bacteria covered media to be collected at the bottom for recirculation to the media or discharge to the dispersal element. Modern packed bed filters use either a synthetic media such as foam cubes or geotextile sheets. An intermittent sand filter and a Recirculating gravel filter are also a packed bed filter. Air for the bacteria growth is provided inside the media container from an exterior source.

Advantages- Small footprint, low power consumption, high effluent quality, system monitored by trained technician, moderate site impact, no blower, less susceptible to wastewater upset.

Disadvantages- Initial cost, requires warm air in winter, maintenance costs, filter and media cleaning.

Example of Packed Bed Filter:

Orenco Advantex AX-20	BOD ₅ < 6mg/L
	TSS < 6mg/L

As claimed by the manufacturer

Climatic Limitations on ATU's

The performance data for ATU's is typically collected in more temperate parts of the country that do not have the colder, subarctic environment that Anchorage contends with. The performance of ATU's in Anchorage will, in general, be lower than the same treatment units operating in warmer locales with more tropical conditions.

Aerobic bacteria treating wastewater require at least moderate temperatures to be able to perform well. A general rule of thumb is that an increase or decrease in temperature of 18°F will raise or lower the performance of the bacteria by a factor of 2.

Anchorage experiences winter temperatures that drop below -20°F. Under these conditions, any ATU that relies on ambient air needs a source of warmed air to maintain the biological treatment activity in the unit. To maintain temperatures, ducted air from a crawl space or mechanical room would most likely have to be directed into the ATU.

In addition, year round cool soil temperatures reduce the soil treatment of the discharged effluent relative to dispersal elements in the Lower 48, so published treatment levels may not reflect the normal treatment level for Anchorage.

Benefits of Advanced Treatment Units

Groundwater Protection

By treating wastewater effluent to a higher level, the discharged effluent contains lower contaminant levels and fewer contaminants than Septic Tank Effluent (STE). In other regions, such as British Columbia, a three-tiered treatment quality design system allows

effluent to be discharged to within 12-inches of seasonally high groundwater. While State of Alaska and local regulatory authorities are unlikely to accept this type of effluent discharge program, it does indicate that the additional treatment received by the effluent in the 4-feet between the bottom of the drainfield and the seasonally high groundwater can ensure that a very high quality effluent is created.

To reduce pathogenic organisms transported with the dispersed effluent, it is possible to add a disinfection unit to the system after the ATU. The two main types of disinfection are chlorination and UV light. UV light is generally accepted to be the better option because it does not use chemicals and there is no chemical residual to deal with.

Improved Monitoring and Maintenance

From the lessons learned by manufacturers and regulators during the early years, ATU's are now required to have at least an initial period of manufacturer certified M&M, and in most jurisdictions, continuous M&M by a trained technician for the life of the unit. Unlike standard septic systems that rely on the owner to provide M&M, the public has some assurance that the ATU treated system is being cared for by a trained technician. This M&M allows for early detection of problems, periodic repair and replacement of worn and broken parts and records of M&M visits that provide a chain of continuity that can be checked to ensure the system is functioning within design parameters and protecting groundwater.

Owner Education

One of the most important elements of onsite wastewater systems is the education of the system owners/users regarding how to properly use and care for the system. This is an aspect of good public policy that is often overlooked in the design, permitting, installation and use of an OWS by an owner. From past experience, it is unlikely that the education process will be significantly improved without some regulatory requirements being instituted.

Professionals in OWS design, regulation, installation and M&M see abuses of OWS, including the operation and care of an onsite system. An OWS may, at times, be looked upon as a disadvantage by some home buyers that could make developers more reluctant to include information about the OWS in the new homeowner packages. Without a mandated education program at the time of initial installation of an OWS (or at the time of sale of a property), continuity of owner knowledge may be difficult. Currently, most regulatory agencies in the U.S. rely on the professionalism of design engineers, installers, M&M technicians and local regulators to provide owners with factual information about the operation and care of their OWS. Improving owner education is an important link to enhancing the successful long term performance of any OWS. A failed onsite wastewater system can affect adjacent properties and has the potential to temporarily pollute local waterways and drainage courses as well.

The goal of any homeowner education program for onsite wastewater systems is to raise the awareness and knowledge level of homeowners to the degree that they can properly

operate the system, and know when to call for inspection and maintenance before effluent surfaces or backs into the residence.

Owning an individual OWS does not relieve the owner from the responsibility of setting aside funds to ensure regular monitoring and maintenance are conducted for their system.

Innovative Design and Regulation

Hillside residents have commented that innovative design solutions to onsite wastewater problems on the Hillside should be encouraged to minimize environmental impacts of OWS. Innovative design approaches require four key elements to succeed:

- Knowledgeable engineers and regulators willing to apply innovative approaches
- Flexible regulations written with an understanding that the OWS environment is constantly changing.
- Public trust in the professionalism of the regulators and engineering profession to work together to provide better OWS solutions.
- Owner willing to finance and implement the approach.

Even without progressive regulations, engineers and regulators who have a clear understanding of OWS technology can work together to develop innovative onsite systems that solve problems creatively, are economical and most importantly, protect the public health and welfare. In general, innovation does not take place in the public arena. OWS innovation generally occurs in an academic research environment where failures of the innovation cannot affect the public.

Monitoring, Sampling and Testing (MST) must be conducted to prove that the innovation is complying with State and local regulations. The expense for MST is normally borne by the manufacturer, design engineer or the owner. The time requirement for MST can make owners and engineers less likely to depart from traditional paths of OWS solutions. Liability resulting from failures of innovative technologies and/or designs can increase the risk and potential cost to the owner and engineer.

In general, the Anchorage OWS design community contains a number of innovative engineers who have pushed to expand and develop technologies not previously used in the State. Anchorage regulators, in general, have been open to innovative designs and have encouraged design professionals to submit manufacturer information and local test results.

The HDP allows property owners an opportunity to consider innovative design approaches to resolve OWS issues in the physically constrained areas on the Hillside. Successful implementation of these innovative methods will require cooperation between the design community, regulatory agencies and the public.

Bibliography

Washington Department of Health, Division of Environmental Health, Office of Shellfish & Water Protection, List of Registered On-site Treatment and Distribution Products

Crites & Tchobanoglous, Small and Decentralized Wastewater Management Systems, McGraw Hill

Orenco Systems, Incorporated, Advantex Treatment Systems, Design/Engineering Package for Residential Applications

EPA, CEIT, Jet Aerobic Treatment System (internet accessed)

BioHarmony, Inc(Canada), BioCycle Systems (internet accessed)

Hillside Development Plan, Workshop #1 Synopsis, March 29, 2007, Hanshew Middle School