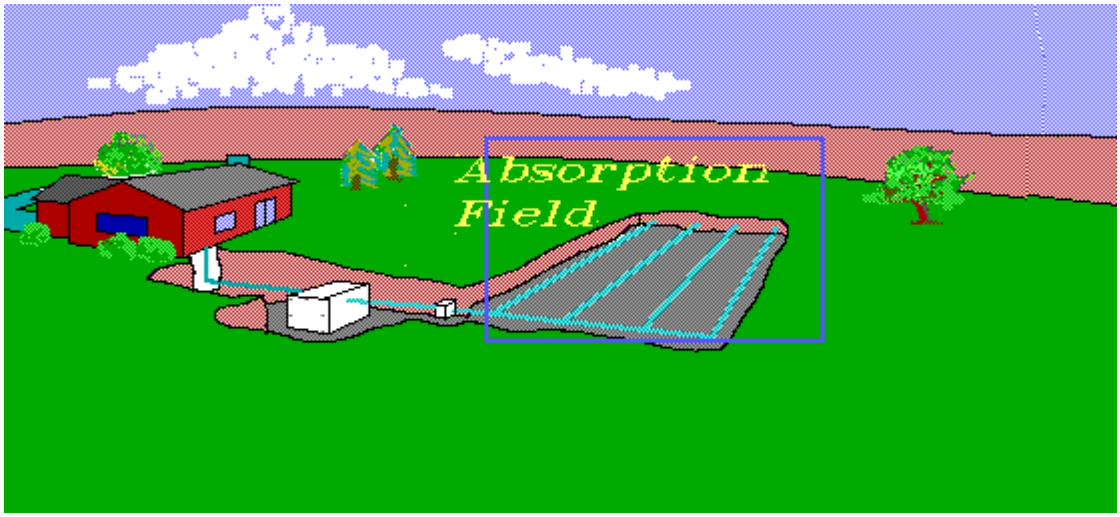
NUTRIENT REDUCING ALTERNATIVE SEPTIC SYSTEMS



DEFINITION

The cumulative impact of onsite wastewater disposal systems (OWDS), mostly septic systems, in the Nanticoke watershed has become a major concern. The pace of development increases with population and many residential developments are located outside the service area of sewer.

At present, approximately 15,000 homes in the watershed are served by OSDS. Of these 15,000 systems, **78%** are conventional gravity systems; **19%** are pressurized systems (mounds and low pressure pipe (LPP)) designed to operate in shallow water table soils; **2%** are permanent holding tanks (which are not treatment systems but must be emptied on a regular basis); and **1%** are designed specifically to reduce nutrient loading to the groundwater.
(Nanticoke numbers are not available. Percentages presented are for Inland Bays.)

WATER QUALITY IMPACTS & TYPICAL LOADINGS

Each septic system in the Nanticoke watershed contributes nutrients to the groundwater: about 0.05 lbs of total nitrogen (N) and 0.002 lbs of total phosphorous (P) per day (18.25 of N and 0.7 lbs of P per year). This means that the following quantities of N and P from septic systems could enter the Nanticoke:

- 16% of the total nonpoint N load (785 lb per day)
- 25% of the total nonpoint P load (29.3 lb per day)

These loads were calculated using a model published by several researchers (see Septic System fact sheet). The model used hydrogeological conditions in the watershed, septic system numbers and other various parameters.

MANAGEMENT TECHNIQUES & TYPICAL REDUCTIONS

Alternative septic systems are used to overcome site limitations or to provide additional treatment that cannot be achieved using a standard septic tank and drain field system. They are or can be equipped with components that remove nitrogen from the wastewater before being discharged into a drainfield. Alternative onsite wastewater treatment systems use biological activity to treat the wastewater. The biological activity is controlled by either the elimination or the introduction oxygen and/or adding an additional carbon source to the effluent. Some alternative systems are mentioned below**. The description of a commercial system is not an indication of DNREC's endorsement of the product.**

BIOCLERE*

The Bioclere is a modified trickling filter designed for the secondary treatment of wastewater. It converts ammonia to nitrates and then the nitrates to nitrogen gas. The self-contained unit is designed to work with both gravity flow and pressurized systems.

CLEARSTREAM WASTEWATER TREATMENT SYSTEM*

The Clearstream Wastewater Treatment System is an "extended aeration" sewage treatment plant. Designed to provide a proper environment for aerobic bacteria and other microorganisms, the aerobic unit is compact and easily installed. The unit requires additional accessories to reduce nitrogen.

CONSTRUCTED WETLAND SYSTEM*

Wastewater that enters a typical constructed wetland first enters a septic tank. Then the wastewater flows beneath the surface of the ground and into a gravel bed before entering the constructed wetland. Wetland plant growth enhances the wastewater treatment process. Usually, the water from the wetlands is discharged into an elevated sand mound, another type of pressurized disposal system, a conventional gravity septic system or, in very rare situations, into a water body.

FAST WASTEWATER TREATMENT SYSTEM*

FAST is a fixed film, aerated system utilizing a combination of attached and suspended growth media capable of nitrification /denitrification in a single tank. The unit is designed to mount inside a septic tank. FAST needs no other filters or pumps.

GEOFLOW WASTEFLOW DRIP LINE*

Geoflow consists of a septic tank pump chamber and a drip irrigation soil absorption system. The technology uses biological activity in the upper soil layer to achieve a stabilization of wastewater at least

comparable to a gravity septic system. Usually the grass is very green around the irrigation lines.

KLARGESTER*

The Klargester receives wastewater from the septic tank. The Klargester uses a rotating biological contactor for biological treatment. The single unit consists of a primary settlement tank, a two-stage chamber with rotating biological rotor, and a final settlement tank. Units designed specifically for nitrogen reduction are available. These usually have small compartment added where an additional carbon source is added to the wastewater.

PURAFLO PEAT BIOFILTER*

Puraflo uses fibrous peat to treat effluent from septic tanks. Liquid from a septic tank is sent to a pump tank and then delivered to four bio-fibrous peat-containing modules. The liquid is evenly distributed over the peat where it is treated by the microorganisms that naturally exist in the effluent and percolates down through the modules into the surrounding soil.

ECO-RUCK*

The ECO-RUCK is a soil absorption system treatment technology. Clarified effluent from a septic tank enters the soil absorption system, which is divided into upper and lower soil absorption areas separated by 3 feet of medium sand. 75% of the effluent enters the upper area and 25% enters the lower area. Effluent passes from the upper area through the sand layer into the lower area. In the upper area the effluent is nitrified (ammonia is convert to nitrates) and when it enters the lower area the effluent is denitrified (converted to nitrogen gas) due to the anoxic (lack of oxygen) conditions in that zone. To increase the efficiency of the process, carbon is added to the lower treatment area.

RECIRCULATION SAND FILTER

Recirculation sand filter (RSF) systems consists of a septic tank, sand filter and pump chamber. Some variations do not require a separate pump chamber. A tricking filter directs effluent over variously textured sand on which an active community of bacteria develops to achieve nitrification (ammonia is convert to nitrates) of the septic tank effluent. After passing through the filter, the flow is split to return a portion of the nitrified effluent back to the recirculation tank for anoxic denitrification (conversion of nitrates to nitrogen gas).

*** Descriptions of units taken from manufacturer's literature, the Massachusetts Alternative System Test Center, New Jersey Pinelands Commission Ad Hoc Committee on Alternative Septic systems and EPA-840-B-92-002 January 1993. Nutrients reductions are from multitude of references.**

TYPICAL SYSTEM COSTS AND NUTRIENT REDUCTIONS

Alternative septic systems can provide additional nutrient reduction of 50-60% over the conventional septic system (Whitmyer, Apfel, Otis & Meyer 1991). Some of these systems are currently being used in the Nanticoke watershed. These advanced treatment units cost $4,000 to $10,000 more than a conventional, standard gravity system. Since some of these advanced treatment systems require additional equipment for nitrogen removal, costs will be even higher. Also, these systems require maintenance costs above those of standard systems.

NUTRIENT REMOVAL FOR VARIOUS TYPES OF SEPTIC SYSTEMS

SYSTEM TYPE	Starting Prices	% NH_4 Reduction of influent	% N Reduction of influent	% P Reduction of influent
Standard systems as defined by Delaware's Septic Regulations				
Standard Gravity	$2,900	94	28	48*
Elevated Sand	$7,500	30	38	48*
Standard Pressure	$4,900	94	43	48*
Low Pressure Pipe (LPP)	$5,200	94	66	48*
Alternative systems as defined by Delaware's Septic Regulations				
Wisconsin At-Grade	$6,900	30	38	48*
Bioclere**	$12,000+	97	20-86	-
Clearstream**	-	97	-	-
Constructed Wetland system	$10,000	-	31-90	50
ECO-RUCK	-	-	50	-
Fast**	-	95-	<70	-
Geoflow**	$4900+		42	-
Klargester**	$12,000+	-	40-80	-
Puraflo**		70-90	30-65	-
RSF**	$7600+	90	>40	80

* Requires mandatory septic pump-out once every three years
** Additional equipment is required to achieve higher nutrient reductions and in some systems, a source of carbon must be added to wastewater.

- Some property owners may only use their homes during the summer and some just on weekends. This poses a problem for the advanced treatment units that require a constant food source for microorganisms to survive. It is possible that at the time ***when the food supply is adequate for biological treatment, many of these systems would be shut down*** for the winter as the occupants vacate for the off-season.

- Systems left unattended and allowed to discharge without benefit of maintenance would be defeating the purpose. Sampling of the effluent would be needed to provide evidence that nutrient reduction is taking place. In some instances, adding carbon or alcohol may be needed to maintain the system.

- The permit is issued today and the proper***ty*** is sold tomorrow. The Delaware Real Estate Commission requires notice be given to buyers about the septic system used. However, this provision is difficult to enforce. If advanced treatment becomes required, full disclosure to the buyer would be necessary for operation and maintenance purposes.

NANTICOKE WATERSHED

This fact sheet was prepared by the Delaware Department of Natural Resources and Environmental Control's Whole Basin Team, at the request of the Nanticoke Tributary Action Team for citizens and stakeholders.

For additional information, contact the:
Watershed Assessment Section
Department of Natural Resources and Environmental Control
820 Silver Lake Blvd., Suite 220
Dover, Delaware 19904-2464
(302) 739-4590

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