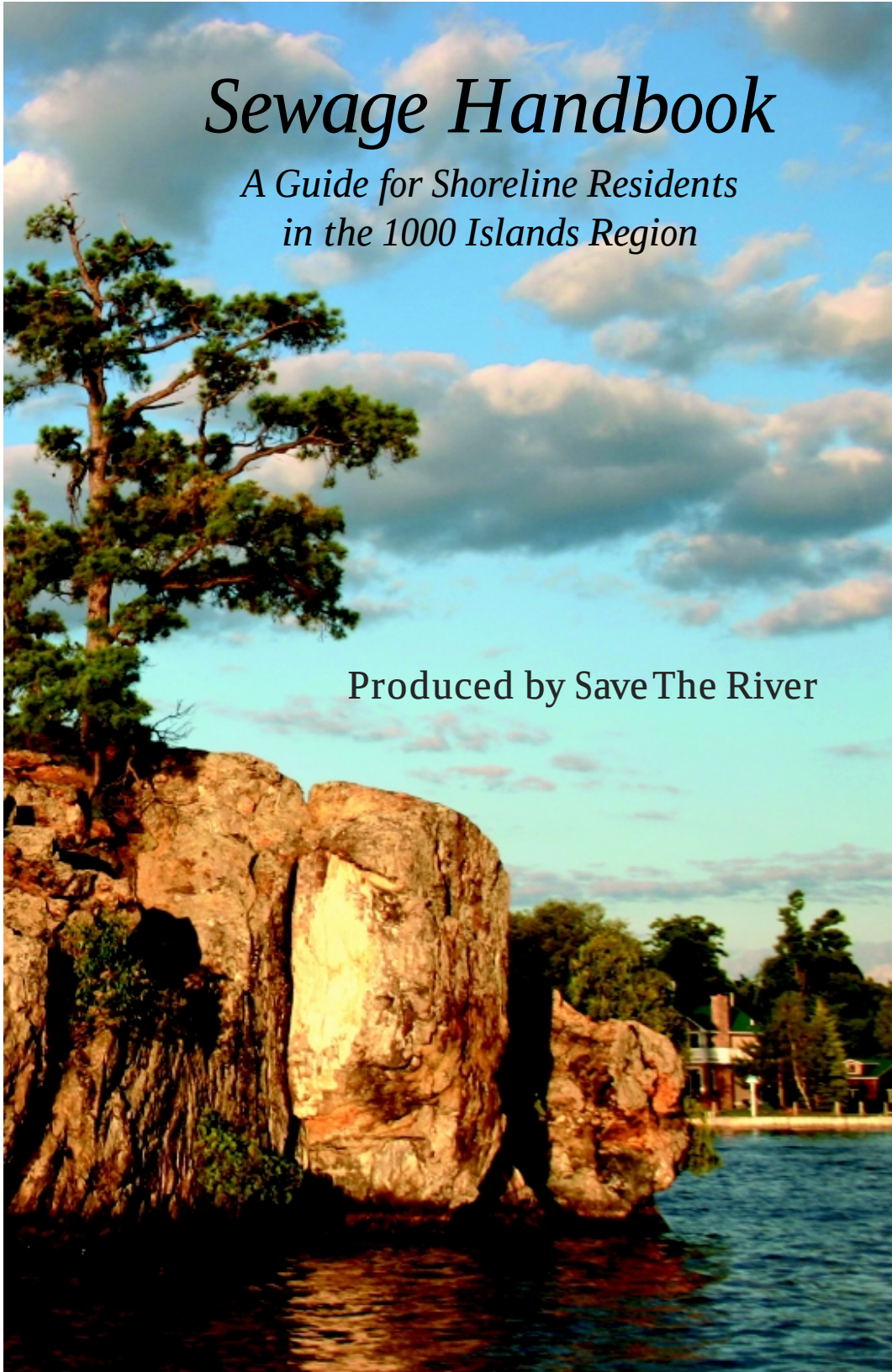

Sewage Handbook

A Guide for Shoreline Residents in the 1000 Islands Region

Produced by Save The River

funded in part by the
Jefferson County Water Quality Coordinating Committee.

Acknowledgements
Originally published in 1984 as a revision of the Alternative On-Site Systems Handbook, prepared by the Madison County Planning Department in 1978. Revised and reprinted in 1989, 1995 and 2004 by Save The River, Inc. This handbook was prepared for the New York State Department of State, Division of Coastal Resources and Waterfront Revitalization, with financial assistance from the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, provided under the Coastal Zone Management Act of 1972, as amended, November 1989. Federal Grant No. NA-82-AA-D-CZ068. Save The River would like to thank Hilary Grimes-Casey, Bill Grater, Tom Boxberger, Ryan Palmer, Ann Rice, Shirley Carpenter, Mark Green and Brian Wohnsiedler, who spent many hours reviewing this booklet prior to publication, Joyce Cattelane for desktop publishing, and Susie Wood for graphic design help.
Cover photo: Sarah Ellen Smith

Save The River — It's Not a Sewer!

Save The River originally produced this handbook as part of the Kingfisher Water Quality Program, which in 1984 surveyed sewage disposal methods of riverfront property owners and investigated problem areas of sewage disposal in the 1000 Islands region. In 1988-89 Save The River received a grant from the New York State Department of State Coastal Management Program to expand the Kingfisher program. This initiated free on-site sewage disposal system surveys for riverfront property owners, to pinpoint sewage disposal problems, help devise cost-effective solutions for property owners, and eliminate direct discharge to the river.

Under the auspices of the Department of State grant, the handbook "Save The River! It's Not a Sewer" published in 1989 outlined the changing environmental concerns, regulations and sewage disposal options (since 1984) that led to the Kingfisher "septic system surveys" program. Local and state laws, recommendations, technology and costs continue to change and necessitate revisions to the handbook. A 2004 mini-grant from the Jefferson County Water Quality Coordinating Committee provided support for another update and reprint.

The specific manufacturers and products listed here represent a sample of the options available to property owners, and are in no way endorsed by Save The River. Save The River would like to thank the many people who contributed time and effort to the reproduction of this booklet and to the Kingfisher Water Quality Program over the years. Call Save The River at (315) 686-2010, stop in or write us at 409 Riverside Dr., Clayton, NY 13624, or visit our website at www.savetheriver.org for more information on sewage disposal methods.

Save The River is a non-profit, member-based environmental organization whose mission is to preserve and protect the ecological integrity of the Thousand Islands Region of the St. Lawrence River through advocacy, education and research.

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Who Needs This Handbook?

- Is your island or riverfront lot too small for a conventional septic system with secondary leach field?
- Is the land around your home too rocky or soggy for proper sewage effluent drainage?
- Do you have problems with high water around your home or leach field?
- Is your system nearing the end of its useful life and you need updated information?
- Are you unsure of where your system is located on your property? Are you contemplating a riverfront property purchase?
- Are you building or renovating a cottage or home? Do you have any direct pipes going into the water?
- Is your island or waterfront property lacking electricity, making a regular toilet difficult to use?
- Are you considering upgrading your sewage system for full-time summer or late fall/winter occupancy?
- Are you concerned that you are wasting water with a conventional toilet? Is there an odor of sewage around your home?
- Has your family experienced skin disorders or sickness related to river or lake water usage?

Whether you are a long-time owner of an existing system or a prospective buyer of island or waterfront property, if you have any of the above concerns, this handbook may offer ideas for possible solutions.

Why Worry about Sewage in Your Water?

Household sewage is managed either by collection and treatment in a municipal wastewater treatment system, or by treatment in individual sewage treatment systems where municipal sewer systems are not accessible. Improperly treated sewage can cause health risks and create environmental problems. Health risks may arise when pathogens or pharmaceutical chemicals in human sewage enter the water supply. Environmental problems result when excess nutrients and high Biochemical Oxygen Demand (BOD) associated with waste is added to the river ecosystem.

Health Risks: The waste of healthy humans may contain disease-causing bacteria or viruses, which can cause illnesses such as tuberculosis, dysentery, cholera and typhoid fever, or eye infections, diarrhea, and infectious hepatitis. Human sewage may also contain traces of prescription and non-prescription pharmaceuticals such as steroids and antibiotics, whose effects on human and aquatic health are still unknown.

Biochemical Oxygen Demand: Biochemical Oxygen Demand (BOD) of sewage is associated with the amount of oxygen that microorganisms consume when breaking down the organic matter in the sewage. If large amounts of sewage are added to a body of water that does not rapidly flush itself—such as a bay—oxygen levels in the water will be significantly reduced as the microbes use the oxygen to break down the organic material.

$$[CH_2O] + O_2 \xrightarrow{\text{Microbes}} CO_2 + H_2O$$

Organic Material — Oxygen — Carbon Dioxide — Water

If high BOD persists, game fish that are sensitive to lower levels of oxygen will leave the area, while fish tolerant of the low dissolved oxygen levels, such as carp and bullhead, move in. If the water goes anaerobic (dissolved oxygen is effectively zero), the methane and hydrogen sulfide gases produced by decomposition will cause a noxious smell.

Nutrient levels: Sewage that has not been properly treated can increase nutrient levels when entering the river system, especially in densely populated areas. Human waste and some household cleaners or detergents contain nitrogen and/or phosphorus, nutrients whose usually low levels control aquatic weed and algae growth in the river. The addition of these nutrients through sewage discharge can provide the conditions needed for increased growth of aquatic plants, algae and phytoplankton, especially in river areas that are not well flushed. The weeds create a swimming and boating nuisance, and their decomposition and nighttime respiration can consume large amounts of oxygen, causing conditions similar to those described under “Biochemical Oxygen Demand.”

Site Conditions and Your System

The conventional septic tank/leach field system used for sewage treatment relies on primary settling, microbial digestion, and secondary treatment of effluent through a soil 'filter.' The following factors hinder the ability of this system to work properly, and can be common to the 1000 Islands region.

SOIL CONDITIONS

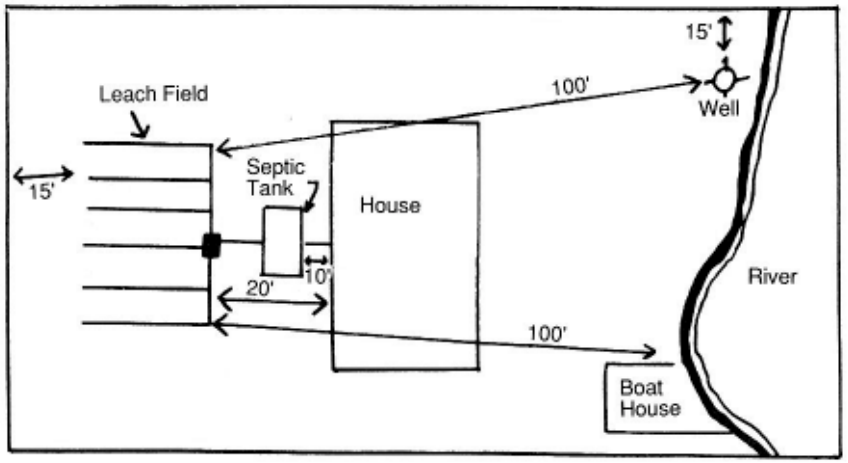
- *Dense soil* with clay may prevent percolation, causing the leach field to back up into the septic tank
- *Excessively wet soil* (seasonal flooding or high water table) may allow septic tank effluent to flow directly to river or groundwater without secondary treatment
- *Sand, gravel or cobble soil* may drain too fast to purify the effluent, potentially contaminating adjoining water bodies or groundwater

GEOLOGY AND GEOGRAPHY

- *Shallow bedrock* will cause problems in positioning the septic tank and leach field, or may cause the effluent to pool on the surface soil, leading to potential health risks
- *Steep slopes* can cause the effluent to run out and over the ground surface instead of percolating into the soil
- *Lots that are too small* may not meet minimum setback distance requirements of the state or provincial regulatory agencies (see diagrams, next pages), or have adequate area for an acceptable leach field. Generally, a leach field should allow 60-166 feet of trench length per bedroom depending on soil conditions and use; more specific information is available in local town requirements or from the New York State Department of Health.
- *Lots that do not maintain the recommended separation distance* between leach field and wells or the river may be contaminating the water, rendering its use for drinking, bathing and recreation questionable.

Percolation Requirements A minimum of four feet of soil above groundwater, bedrock or other impermeable substrate is required for effluent percolation, two feet minimum from the bottom of the leach trench to bedrock, seasonally high groundwater or impermeable layer (clay). The soil percolation rate is the time in minutes needed for the soil to absorb one inch of water. The preferred "perc rate" is between one and 60 minutes, but more specific information is available from the New York State Department of Health or local health or zoning officer. If these requirements are not met by the site's natural conditions, septic tank and leach field installation may involve considerable costs.

New York State
Minimum Distance Requirements



* Your sewage system must be a minimum of 100' from any bordering neighbor's well

Sewage Disposal Laws

New York State

The State of New York Official Compilation of Codes, Rules and Regulations (10NYCRR75), Section 75A, establishes guidelines for approved sewage disposal methods. The New York State Department of Health published a revision of its *Waste Treatment Handbook for Individual Household Systems* in 1996, which explains New York sewage disposal rules in simple terms. It can be obtained by contacting Health Education Services at (518) 439-7286, and costs $12.00.

The enforcement of these standards for new construction or renovations is carried out locally by a codes officer or zoning officer, or in some cases by county building inspectors. Anyone thinking of constructing or revising a sewage disposal system should contact any building codes department to find out what regulations apply to his or her particular area. Any new residence or expansion of an existing residence requires a building permit.

The New York State Department of Environmental Conservation also has regulations governing the discharge of sewage to surface waters as noted in Article 17 of the Environmental Conservation Law (Water Pollution Control and Enforcement Laws).

In New York State sewage must be treated and disposed of so that:

- Drinking water supplies are not contaminated
- A breeding place for insects and rodents is not created
- A health hazard through sewage exposed on the ground is not created
- State and local regulations regarding water pollution or sewage treatment are not violated
- Waters of any bathing beach or recreational area are not polluted
- Odor and sight nuisances are avoided.

There are a number of accepted treatment methods:

1. Septic tank with
   - Absorption Field
   - Seepage Pit
   - Raised or Mound System
   - Subsurface Sand Filter and approved effluent dispersal method.

2. Aerobic treatment with National Sanitation Foundation Class 1 compliance label and approved effluent dispersal method.

3. Alternatives such as non-waterborne systems, chemical, recirculating and incinerating toilets, composters and holding tanks.

Some of these alternatives may not be approved for new construction, or require Department of Health, Department of Environmental Conservation, or local town/village approval. Holding tanks are only approved as an interim measure for new construction (or additions) when municipal sewage service will be available within one year.

Separation Distances (in feet)

From wastewater sources to...	Well/intake line (a,c)	River/water-course (b)	Dwelling	Property boundary
House sewer	*	*	3	10
Septic tank	50	50	10	10
Effluent line to distribution box	50	50	10	10
Distribution box	100	100	20	10
Absorption box	100	100	20	10
Seepage pit	150	100	20	10
Dry well (d)	50	25	20	10
Raised/Mound system	100	100	20	10
Evapotranspiration	100	50	20	10
Composter	50	50	20	10

* 25 if cast iron pipe, 50 if not.

New York State Law specifies separation distances to be maintained between sewage disposal system components and other systems in new construction. Where these distances are not met, a formal waiver is required.

a. 200' separation from closest treatment component required in coarse gravel or when system is uphill and in a direct drainage path to the well
b. Mean high water mark
c. Special requirements when water and sewer lines are in the same trench.
d. Roof and footing.

Wastewater Laws for Ontario

In 1998, the regulations on domestic private sewage disposal systems in Ontario were passed to the Ministry of Municipal Affairs. Permitting and enforcement of those regulations remains with the Health Protection Department, with some municipalities choosing to maintain their own health officer.

A sewage disposal system in Ontario must have a certificate of approval from the Health Department for construction, installation, enlarging, or alteration. A final site inspection of the system is required.

Sewage must be disposed of in such a manner that:

- Effluent does not discharge onto the ground
- Effluent does not discharge to any body of water
- Effluent does not discharge into a water supply
- Insects and rodents cannot enter the sewage disposal system
- Gases are emitted in a controlled manner, and
- Intestinal microorganisms are not discharged into the environment in hazardous quantities.

Ontario law allows the following classes of systems (in no particular order):

Class 1	Chemical toilet, earth pit privy, composting toilet, incinerating toilet, recycling toilets (these require a greywater system as well)
Class 2	Leaching pit for greywater
Class 3	Cesspools for Class 1 systems
Class 4	Septic tank or aerobic treatment and leach field or other effluent treatment system
Class 5	Holding tank (last resort)

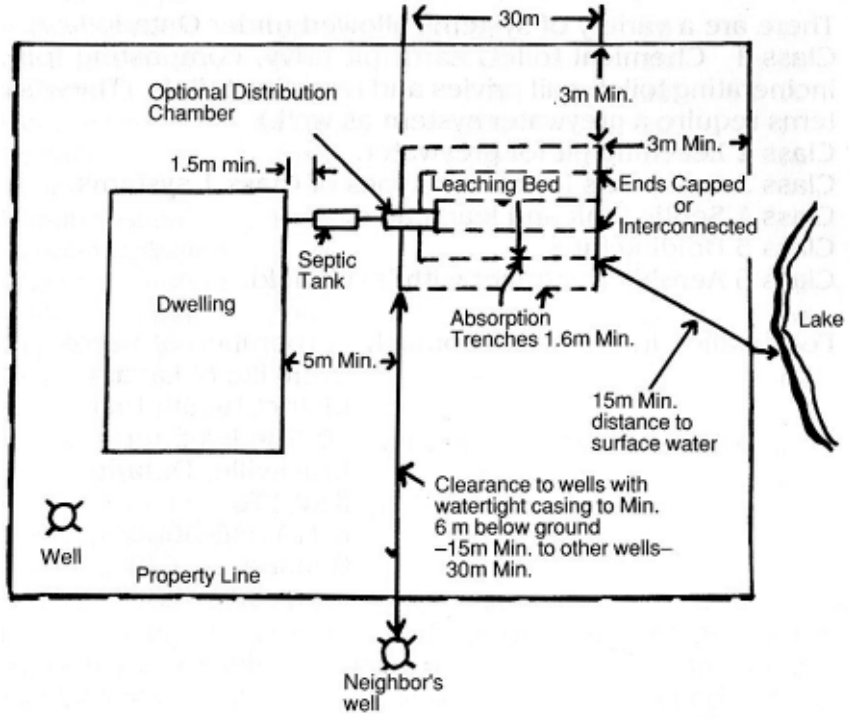
Ontario Clearance Distances Setback distances for septic tanks are as follows:

- 15m (45') to any lake, well, river or water body
- 1.5m (5') to any building or structure
- 3m (10') to any property boundary.

The distribution pipes of a leach/absorption field cannot be closer than:

- 15m (45') to a well
- 30m (100') to a drinking spring
- 5m (16') to any building or structure
- 3m (10') to any property boundary, or
- 15m (45') to any lake, river or water body not used for drinking water.

Canadian Clearance Distances

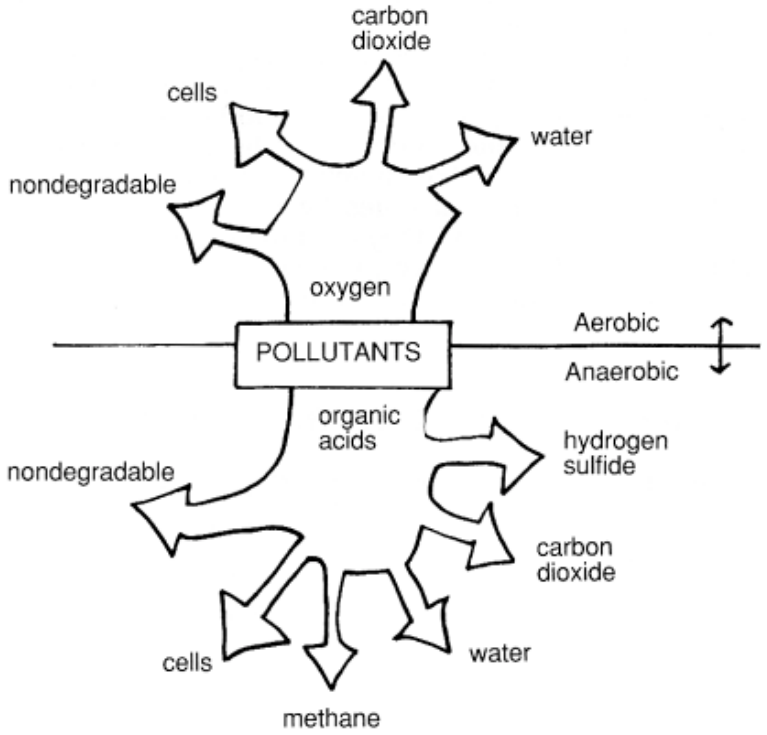


Sewage Treatment Systems

In this section, two types of wastewater treatment tanks will be discussed: anaerobic (septic tank) and aerobic. Both types of tanks treat toilet waste (blackwater) and wastewater from sinks and baths (greywater) in conjunction with a secondary treatment such as a leach field.

Both processes use "bugs" or bacteria to break down pollutants. In the aerobic process, the bacteria require oxygen to break pollutants down into carbon dioxide and water. Anaerobic processes work without oxygen and produce methane and other gases.

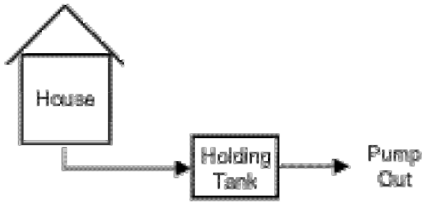
A third type of system, the holding tank, which should only be considered as a last alternative, is discussed at the end of this section.



Holding Tank*

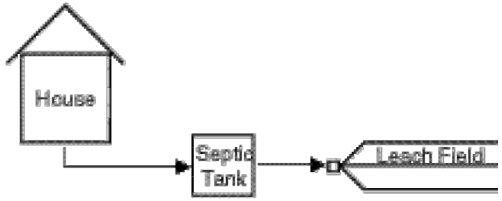
For: existing houses with inadequate or non-existent on-site wastewater treament systems.

** Not legal for new construction in New York State*



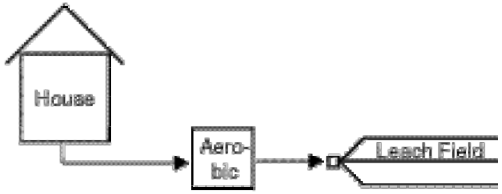
Conventional

For: new and replacement installations where setback and perc requirements can be met.



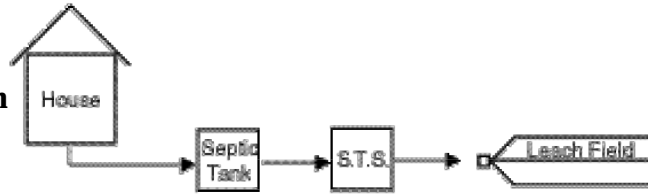
Aerobic System

(see below)



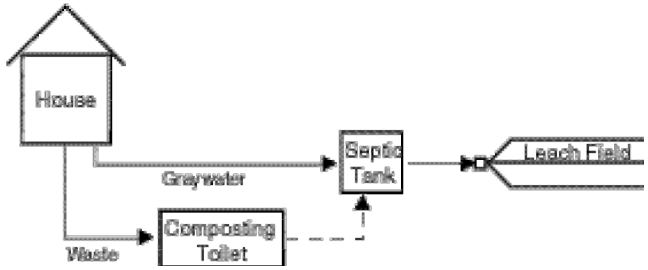
Conventional & Secondary Treament System (STS)

(see below)



Composting Toilet

(see below)



Aerobic, Conventional & STS, Composting toilet

For: new and replacement installations where conventional-sized leach fields are not possible and/or where proximity to water table, open water, wells or personal bias dictates the maximum treatment of effluent.

Four options that will improve your system's performance:

1. Low flush toilets
2. Biomat leach field systems
3. Leach field pre-filter
4. Aerobic septic tanks

Septic (Anaerobic) Tanks

In a septic tank system, wastewater is treated in two steps. In the first step the wastewater flows into a watertight tank, where heavier solids settle to the bottom while the lighter material floats; anaerobic bacterial decomposition of the sludge on the bottom then takes place. In the second step, the liquid wastes flow through an outlet at the top of the tank into some type of leach field. The leach field filters the effluent through the soil. If the septic tank is used without this filtration system it is considered direct discharge and the effluent may contain increased levels of bacteria, higher even than those in un-treated sewage.

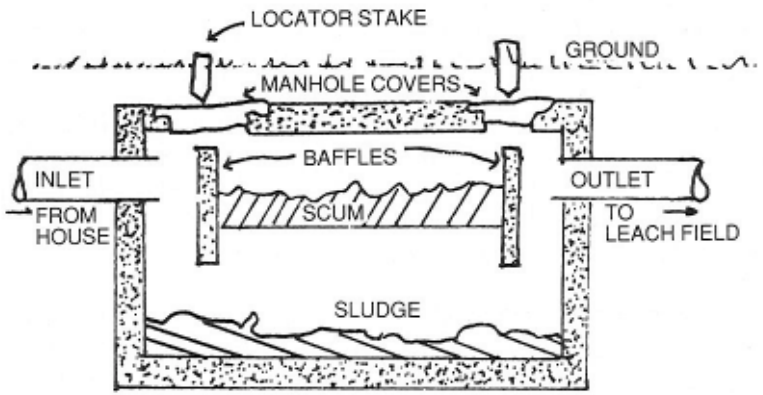
The septic tank system is the most common on-site treatment device now in use for homeowners. Septic tanks do, however, require periodic inspection and pump out. Poor soil conditions in the 1000 Islands region can sometimes make location of a tank and leach field difficult and expensive.

Dishwashers, showers, toilets, etc., should not be added to existing septic tank systems until the tank is checked to make sure it is large enough to handle the additional wastewater load. Separate greywater systems can be designed to avoid this overload. For existing marginal systems, it is recommended that washing machines be diverted to a separate greywater system because they tend to clog leach fields and inhibit septic action. However, in new construction, the system should be adequately sized to handle greywater.

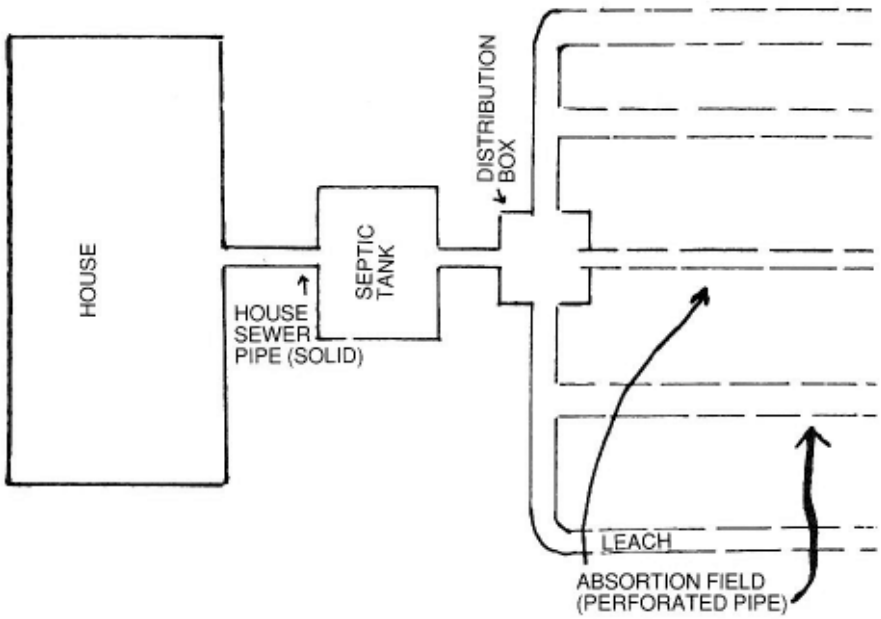
MINIMUM SEPTIC TANK CAPACITIES

Number of Bedrooms	Tank Capacity (Gallons)
1, 2 or 3	1,000
4	1,250
5	1,500
6	1,750

Septic Tank



Septic System Plan



Advantages: In some cases the septic tank system is the least costly sewage treatment method. It requires little maintenance. Treatment is highly effective and if maintained, highly reliable. The system has no moving parts.

Disadvantages: Performance depends on soil percolation rate, texture, structure, absence of high groundwater or bedrock areas, and owner maintenance, including regular inspection. Many areas of the 1000 Islands do not have the proper physical conditions for a septic tank or leach field, making installation very expensive. Lots must be large enough so that the tank is not located within 50 feet of wells or the river. Tanks and distribution systems are susceptible to clogging.

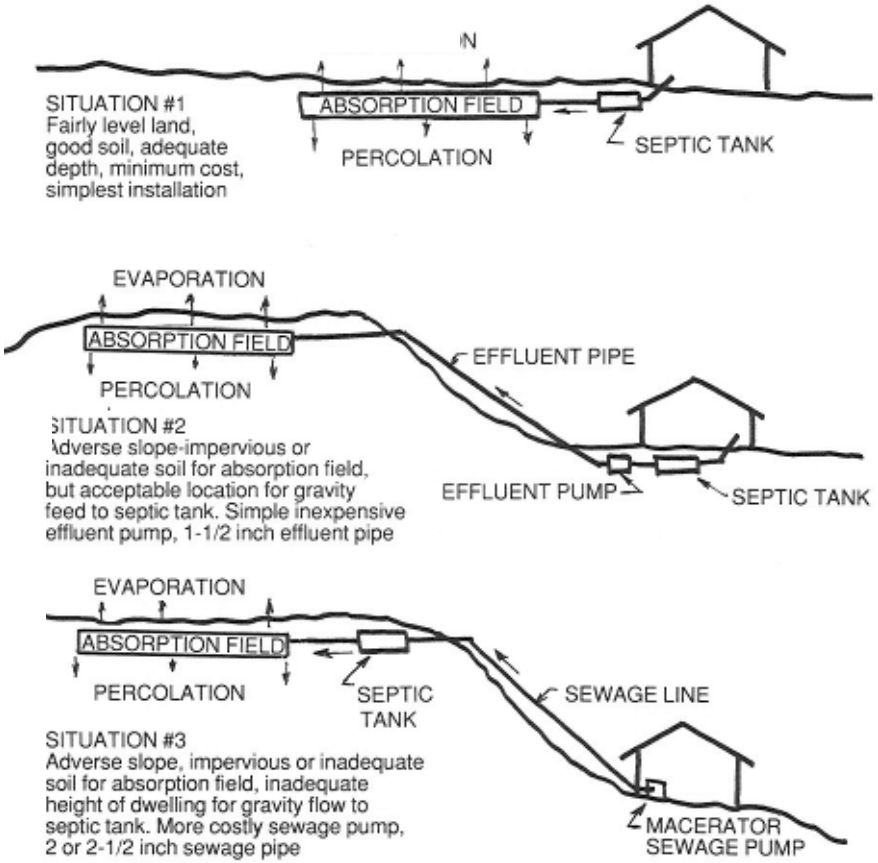
Operation and Maintenance: There will be few problems if the system is properly maintained and a non-corrodible material such as concrete or fiberglass is used for the tank. A seasonal tank should be inspected every five years, and pumped out when the depth of the scum crust and the bottom sludge is more than one-third of the total liquid depth. Pump out costs are dependent upon the location and company used, but getting together with nearby property owners who also need the service can reduce them. Care should be taken to maintain a lawn over the leach field and to prohibit driving or parking over the area.

It is recommended to install an effluent filter to remove fine suspended particles on the outlet end of the septic tank to reduce the potential for clogging the effluent treatment system.

Cost: For septic tank and leach field installation, the cost can range from $2,000 to $5,500 and up, depending on site conditions and installation difficulties.

Alternative Locations for Septic Tank and Leach Field

Even though in some cases it may not be possible to locate either a septic tank or the leach field near the house because of lack of soil or space, it is still possible to use a septic system if there is suitable land remote from the house. Several options are shown below.



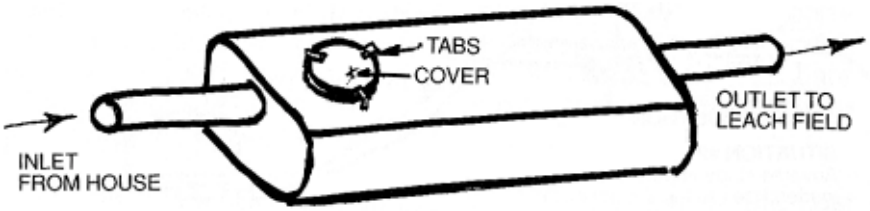
How to Check a Septic Tank

Septic tanks should be checked at least once every five years. The homeowner can easily do this; the simple procedure is outlined below. ***A septic tank should never be entered by the homeowner. Poisonous gases are present., and individuals who have entered septic tanks have died from gas asphyxiation.***

1. Remove the septic tank cover. The cover of the tank will be at the end nearest the house. If the location of the tank is unknown, check the direction of the large wastewater pipe coming from the toilet. The tank is usually in that direction, about 10 feet from the house. On most waterfront lots the top is less than a foot below the surface of the ground; many are at ground level or above.

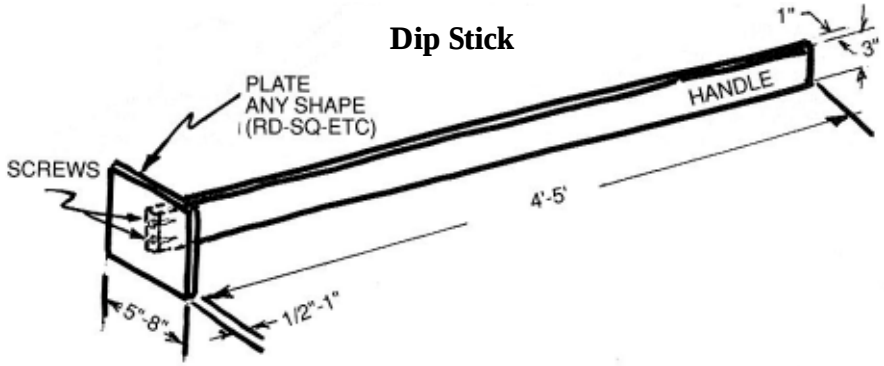
The typical steel tank is shaped like a flattened oval. The cover is held in place by several tabs that must be bent back before removal. Fiberglass tank covers may be bolted in place. Concrete tanks usually have a metal lifting handle on the access cover.

Typical Oval Steel Septic Tank



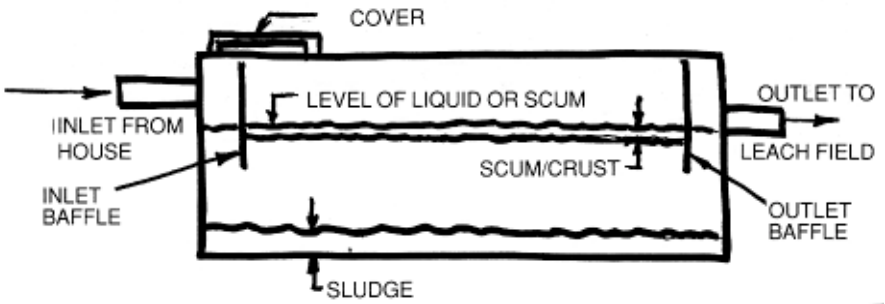
2. Preparing a dipstick. A dipstick is required to check the sludge depth. An effective stick can be made by fastening a flat piece of wood about six inches wide to the end of a long stick. The purpose of the flat piece of wood (plate) is to get a “feel” for the sludge. A plain straight stick will easily push through the sludge and make evaluation of the depth difficult.

Dip Stick



3. Evaluation of Tank Contents. After the cover is removed, note the level of the liquid in the tank. It is normal to have a scum or crust on top of the liquid. Sometimes this will be over an inch thick and appear almost solid. The level of the liquid or crust should be below the inlet baffle. If it is above the inlet baffle, there is a problem with the outlet of the tank or leach field. If the level of the liquid is very low (more than four inches below the inlet pipe) there may be a leak in the tank. If you find either of these situations, have the system checked by a service contractor.

Cross-Section Septic Tank



4. Sludge Evaluation. After breaking through the crust, if there is one, slowly push the plate end of the stick down toward the bottom. Keep the stick nearly vertical. When the plate reaches the top of the sludge, a resistance will be felt. Put a mark on the stick at the top of the tank or note the approximate depth of the stick. Then, push the stick down through the sludge until the plate hits the bottom of the tank. That extra distance is the sludge depth.

Normal sludge depth is one to four inches. If greater, or if less than 10 inches of water above the top of the sludge exists, check with a service contractor about a pump out.

If there is a solid, thick (over one inch) crust on the top, it should be pumped out with the rest of the tank contents. Thick crusts may be the result of excessive soap, grease or fats put down the drain.

5. Baffle Evaluation. The condition of the baffles should be checked to be sure they are in place and not rusted out. The baffles can be checked by sliding the plate end of the stick down the edge of the inlet baffle. The lower end of the baffle is well above the bottom of the tank. On most tanks, angling the dipstick toward the far end of the tank can also check the outlet baffle.

6. Replace the cover and bend the tabs back to secure it in place.

7. CAUTION: When experiencing a septic tank problem, property owners frequently assume that the tank needs to be pumped. This may not be the case. If there is a problem with toilet operation or the septic tank overflows or smells, the real problem may be a clogged line to the septic tank or a plugged leach field. You should be very sure that your tank is overloaded with sludge and/or scum and really needs to be pumped. In fact, seasonal-use tanks seldom need to be pumped.

Aerobic Tanks

Aerobic systems are similar in construction to septic systems, but differ in one important way: the septic tank, which functions without the presence of oxygen, is replaced by an aerobic tank, which uses oxygen to break down sewage. In an aerobic tank, air is pumped to the bottom of the tank and allowed to circulate through the wastes. The solids decompose more quickly than in a septic tank, leaving fewer settled solids on the bottom and clearer effluent to be distributed into the soil. Chemicals and grease can adversely affect the performance of these systems. Aerobic systems can be used for upgrading an existing substandard system without New York State approval.

Aerobic tanks can be located above or below ground, depending on manufacturer's design (see pages 25-27), size and site considerations. The average household aerobic tank ranges from 750 to 2,000 gallons. Aerobic tanks do require a leach field or sand filter. At present, New York State requires a conventional size leach field for new construction.

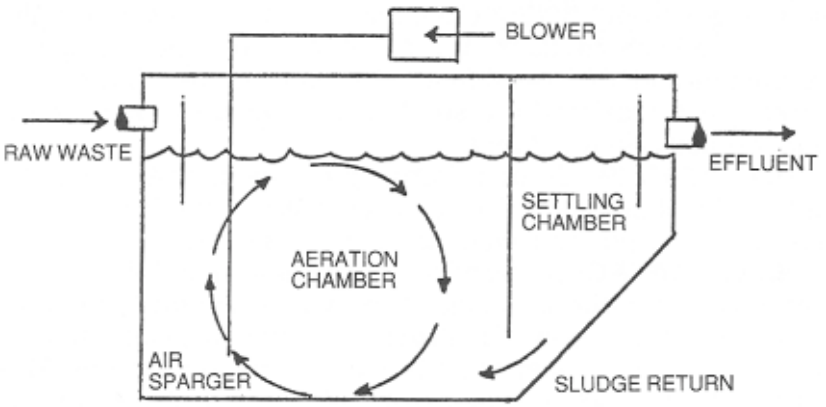
Advantages: Effluent from a properly operating aerobic tank is of higher quality than that released by septic tanks and is much less likely to clog distribution systems.

Disadvantages: Service contracts to maintain the system should be included for the life of the unit. Contracts are required for new construction, and special approval is required to use an aerobic system for new construction. Initial costs and maintenance costs are higher than those of a septic system, and this system is sensitive to grease, chemicals and power failure. Also, electric pumps require periodic maintenance.

Cost: $6,000 and up, including distribution system.

Operation and Maintenance: Aerobic tanks require greater maintenance commitments than traditional septic tanks. Pumps require electricity to maintain aeration, and pump outs of sludge are required every three to six years. Greywater from washing machines and sinks may cause sudsing problems.

Aerobic Tank



Commercial Aerobic Systems

(others are available)

Multi-Flo - Consolidated Treatment Systems, Inc. (manufacturer)
1501 Commerce Center Drive . Franklin, OH 45005
(937) 746-2727 . www.consolidatedtreatment.com

This system received the National Sanitation Foundation Seal of Approval for its performance in suspended solids removal, Biochemical Oxygen Demand reduction (BOD), and fecal coliform disinfection. The Multi-Flo works with an aeration system and filters that provide solids removal and bacterial treatment. Optimal treatment will require a six-eight month "start up" period; however, normal use is recommended from the time of installation.

Cost: $6,000 (1995). Users receive a two-year service contract with their purchase. Two inspections/year are recommended. The system must be pumped and filters cleaned (in washing machine) every two-four years. The aerator life expectancy is three-four years. Electricity is required.

Cautions: Aerobic treatment systems are permitted for upgrading existing systems, or for systems that incorporate soil or groundwater discharge. According to the New York State Department of Health in 2004, New York State Department of Environmental Conservation will not permit treatment technology relying on surface water discharge of treated effluent for new construction of individual sewage disposal systems for private residences.

Cromaglass - Cromaglass Corporation
P.O. Box 3215 . Williamsport, PA 17701
(570) 326-3396 . www.cromaglass.com

The Cromaglass systems use a batch treatment system, in which aeration, separation of large particles, and clarification (settling) occur in separate chambers within the time-controlled system. Effluent is discharged and sludge can be returned to the aeration chamber or removed. The Cromaglass systems surpass EPA and National Sanitation Foundation standards for treatment technology, with 90-95% removal of BOD and suspended solids in the effluent, according to the website. Leach field size requirements may be reduced.

Cost: Installation costs; system requires electricity. Cromaglass offers customer training and maintenance service.

Holding Tanks

Sewage should be treated on-site whenever possible, but where sewage may enter the river without adequate treatment, and no treatment technologies are feasible, a properly maintained holding tank is a last alternative for sewage disposal.

Holding tanks store untreated sewage (or sometimes greywater only) to be pumped out by a licensed contractor for treatment and disposal off-site. Holding tanks are not permitted in new construction or for long-term use in year-round residences, according to Appendix 75-A of the New York State Codes, Rules and Regulations.

Advantages: Inexpensive, easy to install.

Disadvantages: Costs of transporting and disposing of stored waste, risks associated with handling untreated sewage, and potential for improper use. Maintenance requires local pump out service, which may be limited in the 1000 Islands region, and is expensive for owners of island property.

Cost: Installation $1,500-2,500 (1995 cost); pump outs range from $200-500.

Holding Tank Guidelines:

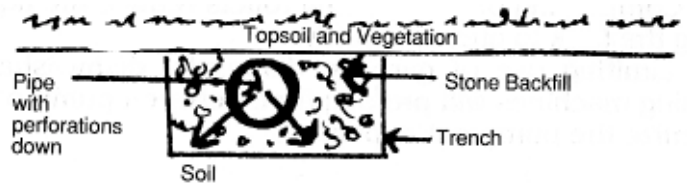
- Tank must be of sound construction, with non-corrodible material
- Water conservation devices and low flush toilets will reduce the frequency of pump outs
- Composting or incinerating toilets eliminate sewage to the tank, leaving only greywater
- Limiting use of garbage disposals, dishwashers, and washing machines will reduce frequency of pump outs and minimize pump out expense.

Effluent Treatment Systems

Effluent from anaerobic or aerobic treatment systems requires secondary treatment before it can be released to soil, groundwater or surface water. Secondary treatment incorporates adhesion and additional microbiological breakdown of waste particles and bacteria on filtering media such as gravel, soil or sand.

Leach Field

A leach field is constructed of perforated pipes buried in trenches lined with stone or gravel. Effluent from the septic tank or aerobic system is directed to the pipes by a distribution box (see Glossary), and seeps through the perforations into the gravel and soil, eventually reaching groundwater. Evaporation also contributes to the secondary treatment process, especially during warm, sunny periods when leach fields are grassy and open to the sun.



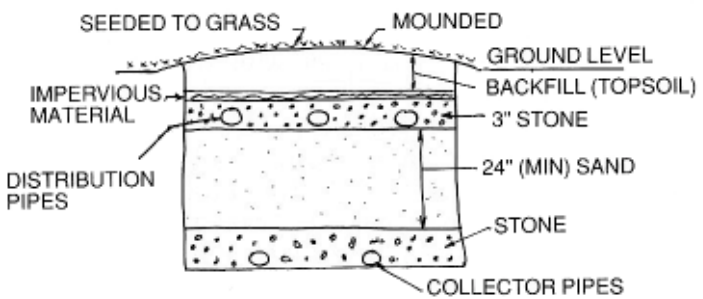
Percolation through at least six inches of dry soil has been shown to remove most coliform bacteria, although chemical constituents of wastewater such as nitrates and chlorides are not removed. Research has shown that the soil may also serve to remove and/or transform the nitrogen and phosphorus in wastewaters percolating through them.

Sizing a leach field depends on the location on site, slope, size of household and flow rate of effluent, and soil percolation rate.

Sand Filter

A sand filter is considered an alternative secondary treatment system requiring authorization by the New York State Department of Health and the New York State Department of Environmental Conservation.

A sand filter can be used when soil is "clayey" or otherwise impervious, or there is little depth of soil on site for effluent treatment. Sand grain size must be in the range 0.5 to 1.00 mm. Effluent from the filter layer must be collected and disposed of; New York State prohibits the discharge of sand-filtered effluent to the ground surface and also prohibits the discharge of sand-filtered effluent to surface water from new construction. New York State Department of Environmental Conservation may allow the discharge from an existing residence to surface waters providing it is a hardship case. The homeowner would apply for a State Pollutant Discharge Elimination System (SPDES) permit and provide final construction plans to meet the appropriate limits of the SPDES permit. The applicant must first have attempted an alternative subsurface system constructed according to applicable criteria. Engineered plans would be required for any sand filter with a discharge to the ground surface or any body of water.



This system also requires layers of crushed stone, a layer of geotextile or other material to keep fine silt and particles from entering the filter, and 6-12" topsoil. A SPDES permit from NYS DEC is required for any discharge directly into surface water.

Biofilter

A biofilter uses a substrate with high surface area to facilitate growth of microbiological communities that break down waste in effluent. A biofilter is also an alternative system, requiring special authorization by New York State Department of Health and Department of Environmental Conservation.

Other Systems

Other alternative systems may be installed for secondary treatment, although such systems are often more complex and restricted in application. Consult a local contractor or the New York State Department of Health's Individual Residential Wastewater Treatment Systems Design Handbook (1996) by contacting Health Education Services at (518) 439-7286.

Ecoflo Biofilter System - Premier Tech Environment (manufacturer)
1 Avenue Premier . Riviere-du-Loup, Quebec . Canada G5R 6C1
(877) 295-5763 . www.premiertech.com

On lots unsuited for leach field treatment of septic tank effluent, biofiltration systems provide the surface area and absorptive medium required for microbial treatment. The Ecoflo biofilter uses peat moss as the growth media for biological treatment, with a life expectancy of eight years, for 95% removal of BOD, 90% removal of solids, and 99% removal of fecal coliform. The system can be buried, partially buried, or completely aboveground, and has no electrical requirements if effluent is gravity-fed. The system can discharge to the environment if engineered plans and permits are in place, or a modification allows collection of effluent.

Cost: $3,895, including a seven-year maintenance service, for the basic Ecoflo system. The cost for replacement filter media is $850,

including new maintenance agreement (old media must be pumped out at owner's cost); $999 for effluent collection parts. Manufacturer offers additional warranties on shell and components. (Data from US Environmental Protection Agency, Region 1)

Eljen In-Drain System With 2-Stage Bio-Matt

Eljen Corporation . 125 McKee St. . East Hartford, CT 06108
(800) 444-1359 . www.eljen.com/in-drain.html

The Eljen In-Drain System uses layers of fabric to facilitate microbiological growth and aid oxygen transfer through the system. The system can be installed under a mound or in-ground, and can greatly reduce the area required for secondary treatment. Installation requires a six-inch sand layer and a layer of material to prevent siltation, but no stone or gravel.

Orenco's AdvanTex Treatment System

Orenco Systems . 814 Airway Avenue . Sutherlin, OR 97479
800-348-9843 or 541-459-4449 . www.orenco.com

Orenco's AdvanTex® Treatment Systems provide consistent, reliable onsite treatment of residential and commercial wastewater, even under peak conditions.

AdvanTex Treatment Systems are ideal for small sites, system upgrades and repairs, new installations, pretreatment, and nitrogen reduction.

AdvanTex Treatment Systems turn wastewater into clear, odorless effluent using a fiberglass basin filled with an engineered textile material. This highly absorbent material treats a tremendous amount of wastewater in a very small space.

Alternative (Waterless) Toilets

Alternative toilets handle "blackwater" (toilet waste) only, requiring manual disposal of the treated waste. Greywater from sinks and baths must be treated in a separate system. Alternative toilets, including composting, incinerating and chemical toilets, use little or no water

to operate. Save The River may be able to provide anecdotal information about alternative toilet use in the 1000 Islands.

Composting Toilets

Many composting toilets rely on controlled heat (either naturally generated by waste decomposition, or electrical/fuel-powered) and moisture to kill pathogens and break down waste in an odorless, aerobic process. Because excessive moisture and overuse (such as during parties or weekends with many visitors) can upset the microbial process, composting toilets on the market are now sized with specifications for "overload capacity" as well as regular use.

Maintaining composting toilets require control of:

- *Temperature:* Heat in the compost must be maintained for microbial function
- *Moisture*: Compost needs to be damp; however, too much moisture creating a soggy condition will inhibit aerobic activity
- *Oxygen*: Aeration needs to be ensured through turning or stirring
- *Carbon to Nitrogen Ratio*: Adequate carbon is important, as human waste is high in nitrogen. Carbon can be added with peat moss or kitchen vegetable scraps (no meat).

Examples of Large Composting Systems

These examples are not self-contained units; toilet seat must be located above the installed compost bin.

Clivus Multrum - Clivus Multrum, Inc.
15 Union St. . Lawrence, MA 01840
www.clivusmultrum.com

Clivus systems are approved by the National Sanitation Foundation and can accommodate year round or part time use. They require on-site power to operate ventilation, moistening, and liquid removal pump systems. Waste retention time is four years, and waste treatment is accomplished with microbiological activity and Multrum

Composting Worms (included). Compost material must be periodically removed from the bin. The specifications on the Clivus Multrum website assume a surrounding temperature of more than 65 degrees F, and recommend heat if temperature is lower. Liquid removed from compost must be disposed.

Cost: Model M1W/M2W (10-15 uses per day)$2,495 - $2,995; bin capacity is 248 US gallons; system includes waterless toilet seat; owner can purchase maintenance contract, or train for self-service.

EcoTech Carousel Composting Toilet
System EcoTech Composting Toilets
152 Commonwealth Ave. . Concord, MA 01741-3951
(978) 369-2484 . www.ecotechusa.com

The Carousel system is a revolving cylinder divided in compartments for batch composting as they fill, and is certified by the National Sanitation Foundation. The system must be emptied periodically, from twice per year to once every four years, depending on use, and requires power to operate. According to the manufacturer's website, wastes are reduced to 10% of their original volume.

Medium Bioreactor (four-person household, year round use, or 15 people daily for 60 days per year)

Cost: $2,700; exhaust system, $218-$382; toilet not included

Small Composting Toilets

These toilets incorporate a composting bin into the toilet design, above the floor. Because these have smaller capacity, they must be emptied frequently and carefully monitored for proper composting conditions. Most require a power source to operate, and some may require heat.

Sun-Mar Cottage Toilets - Sun Mar Corp (manufacturer)
600 Main St. . Tonawanda, NY 14150
(800) 461-2461 . www.sun-mar.com

Cost: None available, but local dealers are listed on website.

Biolet Toilets - Biolet USA Inc.
150 East State St. . P.O. Box 548 . Newcomerstown, OH 43832
(800) 524-6538 . www.biolet.com

Cost: Three-person household, full time, electric heater: $1,399 plus $30 per bag mulch (lasts three to four months); non-electric, three people full time, or four to six people seasonal: $999; need to add mulch with each use.

Envirolet Toilet - Sancor Ltd.
140-30 Milner Ave. . Scarborough, ON M1S 3R3
(800) 387-5245 . www.envirolet.com

The Envirolet comes in non-electric, electric, and battery-operated models, self-contained as well as large units with separate composting bins. The self-contained units require a periodic addition of peat moss and a startup kit for seasonal use. Compost is raked and removed periodically.

Cost: Non-electric: (two-person capacity with regular use; four-person seasonal) $1,175; 12 volt DC battery-powered version: (four-person capacity, regular use) $1,350; electric: (six-person capacity, regular use) $1,370.

Incinerating Toilets

Incinerating toilets use liquid propane, gas or electricity to burn sewage waste. The resulting ashes are harmless and can be disposed in the trash. Some incinerating toilets can be noisy, and the high heat required may increase room temperature in a small room. Save The River may be able to put potential buyers in contact with current users.

Incinolet - Research ProductsBlankenship
2639 Andjon Street. . Dallas TX 75220
(800) 527-5551 . www.incinolet.com

Cost: $1,700-1,900; the Incinolet uses an electric heating coil to burn waste. A forced vent to the outside is required.

Storburn - Storburn International Inc.
47 Copernicus Blvd. Unit 3 . Brantford, ON N3P 1N4
(800) 876-2286

Cost: No costs available; propane or natural gas fired incinerator toilet. Vent and propane tank hookup are required. No electricity required. Anti-foam agent also required. The Storburn unit operates on a four-hour burn cycle, during which the toilet is not usable.

Water Conservation Toilets

(Using less than 1.6 gallons per flush)

New York State has mandated low flush toilets in all new and replacement installations since 1992. These toilets reduce the water loading the sewage disposal system, increasing its efficiency. Their use should also extend the life of the leach field and reduce water bills for homeowners on municipal water supplies.

Where no electricity is available to pump water, an elevated storage tank and manual pump can supply the water force necessary to effectively operate low flush toilets.

Some manufacturers and models are listed below:

Manufacturer	Model	Gallons/flush	Approximate cost/unit
Eljer	Aqua Saver or Canterbury	1.6	$500-700
IFO	Flush Control Cera	1.6 or less	$100-300
Kilgore	112 ULF	1.5	n/a
Microphor	Microflush	1.6 or less	n/a
Thetford	Portable toilet + water saver spray	1.0	n/a

Greywater Disposal Systems

Systems that separate toilet wastes (blackwater) from household wastes (greywater) need a provision for greywater disposal.

Greywater contains many chemicals, bacteria and nutrients, and is technically still “sewage;” therefore, it must be treated and dispersed properly. It is illegal to discharge greywater into the river. The requirements for disposition depend on the volume; therefore, the use of water-saving devices is important.

There are two methods of greywater disposal that can be used in the 1000 Islands region:

Greywater Treatment Tank and Sand Filter

This is one of the best and most feasible alternatives for treatment of greywater. The greywater flows through a two-chambered tank much like a septic tank. The first chamber settles out solids. The second chamber contains rocks one to two inches in diameter that remove grease and allow for bacteria growth to aid in waste breakdown. From there, wastes go through a sand filter, such as that described on page 30. Engineered systems (special design) such as just described, may be commercially available, but require a waiver from the Department of Health.

Treatment/Recycle

These systems clean the impurities from greywater using reverse osmosis (see glossary) through a semi-permeable membrance. Silver-coated charcoal is then used to filter impurities. This equipment involves computer technology and has many parts that can break down. The cost is relatively high.

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Glossary

Aerobic Any chemical process requiring high amounts of oxygen (ex.: composting toilets and aerobic tanks).

Anaerobic In the absence of oxygen (ex. septic).

Bedrock Solid rock exposed or close to the surface of the ground

Biochemical Oxygen Demand (BOD) Amount of oxygen microorganisms removed from water during decomposition of organic matter

Blackwater Wastewater containing only toilet wastes

Carbon Dioxide (CO_2) A gaseous end product of the aerobic process

Compost Organic material that is the end product of complete decomposition of animal and vegetable waste by microorganisms

Composting The process of turning wastes into compost

Decomposition To break down wastes into compost

Distribution Box Separates effluent into separate trenches or leach fields

Dosing Periodic discharge of effluent to a distribution system

Effluent Here "effluent" is regularly used to refer to the outflow from sewage treatment devices such as septic or aerobic tanks

Flush Toilet A device that uses water and gravity to remove human waste

Greywater Water containing household wastes from tubs, sinks, washing machines, etc. (everything except blackwater).

Groundwater Water contained in the ground below the water table

Humus See COMPOST

Hydrogen Sulfide (H_2S) A gaseous by-produce of anaerobic processes; it smells like rotten eggs

Impervious Any material which will not allow water to pass through (impermeable)

Methane (CH_4) A gaseous combustible by-product of anaerobic processes

Microorganism Here it is used to describe microscopic organisms (either plant or animal) present in the air, soil or water, which help break down wastes. Some microorganisms do this by consuming oxygen and are therefore part of an aerobic decomposition process; others use no oxygen and are therefore part of anaerobic waste breakdown

New York State Department of Environmental Conservation The agency responsible for water pollution control laws in New York State. There is an office in the Dulles State Office Building, Watertown

New York State Department of Health The agency responsible for enforcement of public health law in New York State. There is an office in the Dulles State Office Building, Watertown

Pathogenic Disease Causing organisms such as certain viruses and bacteria

Percolation Movement of liquid downward through a porous medium such as soil, gravel or sand

Reverse Osmosis Concentration of a contaminant on one side of a membrane, holding clean water on the other. This process requires use of a mechanical devise

Scum Matter suspended in liquid which is less dense than that liquid and which therefore floats to the surface

Sewage Human wastes discharged from the home. Greywater is also considered sewage under the law

Sludge Matter which is denser than the liquid containing it and which sinks below the liquid

SPDES State Pollution Discharge Elimination System permit, required to discharge to surface waters

Surface Water Discharge Discharge into lakes, streams, rivers, ponds or wetlands

Save The River

409 Riverside Drive . Clayton, NY 13624
(315) 686-2010 . www.savetheriver.org