Community Septic System Workshop
Septic Systems – Safe in the Long Run?

A 1999 study by the DEP and the Maine Geological Survey found that 99.6% of all well samples on lots using septic systems met the drinking water standards for nitrates. The lots surveyed were located in 18 different subdivisions, and sizes in the sample ranged from 0.3 acres to 33.8 acres, with a median size of 1 acre (i.e., half were smaller and half were larger than 1 acre).
Septic Systems – Safe in the Long Run?

Current standards for design and installation of systems ensure that most pollutants are removed in the leach field and will not contaminate local drinking water supplies. Modern septic systems are in fact designed to treat the effluent, not simply convey it underground. In one study in Addison County, Vermont, a system was shown to have removed 99% to 100% of fecal coliform and 89% to 99% of phosphorus within three feet from its discharge from the field.
The required separation distance (100 feet) between leach fields and drinking wells appears to be adequate for health and safety. A 1999 DEP-Maine Geological Survey study concluded that “…the Maine Subsurface Wastewater Disposal Rules are adequately protecting residential wells from NO$_3$-N contamination caused by conventional septic systems.” This separation distance (plus offsets from water bodies and property lines) can be met on 20,000 square foot lots in most instances.
Typical Septic System with Tank and Leach Field

Source: Infiltrator Systems, Inc.
Conventional vs. Pump vs. Advanced Treatment Septic Systems
Reasons for Septic System Failures

Hydraulic overloading, which occurs when too much water enters the septic system at one time, resulting in wastewater backing into drains or effluent surfacing on top of the field.
Reasons for Septic System Failures

**Organic overloading** occurs when a septic system is not pumped regularly, allowing solids from the tank to escape and settle in the disposal field, clogging the stone-soil interface. It also occurs when the septic system is asked to accommodate too many organic materials, such as when a garbage disposal is routinely used in a household.
# Reasons for Septic System Failures

**Neglected tank maintenance**

## Suggested tank pumping interval (years)*

<table>
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<th>Tank Size in Gallons</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>9</td>
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<td>4</td>
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<td>3</td>
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</tbody>
</table>

* Source “Barnyards and Backyards”
Reasons for Septic System Failures

Other factors contributing to septic system failure include poorly sited landscaping that allows tree roots to grow to closely to a septic system, driving or parking over the system and excessive use of household chemicals including salts from a malfunctioning water softener.
Impacts from Septic System Failures

Improperly managed onsite septic systems can significantly degrade the water quality of surface waters such as rivers, lakes, and coastal waters.

- Phosphorus loading from onsite systems contributes to lake eutrophication, which is a natural process caused by nutrient enrichment of aquatic systems, but it can be greatly accelerated by agricultural practices, soil erosion, and wastewater disposal from both onsite and centralized systems.

- Bacterial contamination from failed or failing onsite septic systems has also been cited as a significant cause of impairment of Maine’s marine and estuarine waters.
Impacts from Septic System Failures

Although the reasons for any single onsite system failure may be attributable to errors or shortcomings at any point in the wastewater treatment process – siting, design, construction, operation, or maintenance – it is ultimately the absence of comprehensive management programs with oversight over all of these processes that prevents onsite and clustered systems from reaching their full potential as effective and reliable wastewater treatment strategies.
Alternatives to Traditional Lot-by-Lot Septic Systems

Many of Maine’s village communities were first developed during in the 18th and 19th centuries, when sanitary sewage disposal as we understand it today was rarely even considered; most homes and businesses on waterways used “straight pipe” plumbing to dispose of their household sewage, and residents also swam and fished in those same waterways.
Some villages with environmental constraints eventually grew large enough to support centralized wastewater treatment systems.
Others have never reached the threshold size or density for centralized wastewater treatment systems but may be candidates for community septic systems that would allow future growth.
Alternatives to Traditional Lot-by-Lot Septic Systems

Another potential candidate for community septic systems that could allow future growth.
Alternatives to Traditional Lot-by-Lot Septic Systems

Newer Maine communities that wish to replicate the look and feel of these early American compact villages within their growth areas can use community septic systems to achieve this goal. However, systems in more densely populated areas must be managed especially carefully to avoid the potential for failures that can lead to unhealthy nutrient and bacterial loading in the soil, particularly near or over important water resources, aquifers, and recreational or shellfish waters.
Why Community Septic Systems?

Community septic systems, also known as clustered or shared systems, should be considered in cases where soil conditions, lot size, or topography complicate the placement of individual onsite systems. They can also benefit developers and land owners by permitting compact development with smaller lot sizes and reduced infrastructure costs. Clustered systems can be as simple as a conventional subsurface disposal field shared by two lots and served by individual septic tanks, or as complex as a neighborhood collection, treatment and disposal system that is comparable in size and scope to a small municipal sewer system.
Why Community Septic Systems?

Common drain field
Why Alternative Wastewater Treatment?

Many towns have identified growth areas in small villages that traditionally had have small concentrations of population but are either too small or too remote to have public sewer. Lack of sewer and reliance on septic systems can constrain future growth.
Why Alternative Wastewater Treatment?

Small coastal villages that are unlikely to grow but are too small or too remote for public sewer may now have inadequate septic systems due to age, poor soils or very small lots, conditions that also put domestic water wells at risk.
Why Alternative Wastewater Treatment?

Community septic systems may offer opportunities for these areas to preserve domestic water quality, either correct existing sewage problems or avoid potential sewage problems in the future, and provide property owners new possibilities for developing their land.
Types of Community Septic Systems?

• Centralized system with off-site disposal – includes sewer mains that by gravity or pump transport waste to off-site disposal field

• Cluster septic system with off-site disposal – individual septic tanks with effluent piped to off-site disposal field

• Cluster septic system with on-site disposal – effluent lines from homes piped to common septic tank and then to common septic field – usually associated with detached, attached or multi-housing on common lot

• Decentralized system with off-site disposal – individual septic tanks with effluent piped to individual, clustered off-site disposal fields on commonly-owned land
Individual force mains from septic tanks installed in a common trench.

Individual septic fields for each housing unit.

Commonly owned land.

Septic tank.

Individual lots.

Decentralized Cluster System with Off-site Disposal:

- Individual septic fields for each housing unit
- Commonly owned land
- Individual force mains from septic tanks installed in a common trench
- Septic tank
- Individual lots

Centralized Cluster System with On-site Disposal:

- Individual buildings
Common mains from septic tanks to a common septic field

Public or commonly owned land

Centralized System with Off-site Disposal

Decentralized System with Off-site Disposal

Individual lines from septic tanks to a common septic field

Individual lots

Septic tanks
Design of Community Septic Systems

If multi-user system is less than 2,000 gallons per day flow (based on 90 gallons per day per bedroom), it can be designed by a site evaluator.

If the design flow exceeds 2,000 gpd, it must be designed by a licensed professional engineer. Engineered systems also required if BOD (biological oxygen demand) or TSS (total suspended solids) exceeds 2000 ml per liter because these usually require pretreatment and more robust disposal fields.
Design of Community Septic Systems

Engineered systems may also require a higher level of treatment, additional soils evaluations, setbacks, hydrogeological evaluations, operating, maintenance, reporting and monitoring requirements and an identified management entity.

The smallest area for a septic system and disposal field is about 600 sf. This can increase to 1,200 sf not including fill extensions depending on soils but this can be reduced with pretreatment by up to half.
Design of Community Septic Systems

The state minimum lot size is 20,000 sf for residential lots using septic systems. The lot size may increase depending on organic loads in the wastewater.

Clustered offsite septic systems can reduce lot sizes to a size equivalent to a lot with sewer. A clustered off-site septic system with a flow of 4,000 gpd (equivalent to 14 homes) would require 0.6-1.0 ac while a 10,000 gpd flow (37 residences) would require 1.2-2.0 acres. Such septic systems can be incorporated into the development’s open space.
Options for Managing Community Septic Systems

State rule - if a septic system is to serve 3 or more parcels with structures individually and separately owned, all parts of the system beyond the discharge from the building must be owned by a single, independent entity with the authority to operate, maintain, repair and replace system components and to charge maintenance and other fees necessary to meet its responsibility.

If there is no existing municipal or regional sanitary district that can assume this responsibility, a private, public, or quasi-municipal management authority will need to be established early in the development process.
Options for Managing Community Septic Systems

- Municipal department

- Quasi-municipal agency organized as a sanitary district under the Maine Sanitary District Enabling Act for newly formed or existing agencies or as a sewer district formed under the private or special laws of Maine (for existing agencies only)

- Private organization representing the owners of the community system such as a unit owners association for condominiums or a homeowners association for lot owners.
Case Study #1 - Community with limited public sewer infrastructure (Brownville)

Problem – two village areas with small lots and failing septic systems.
Alternative solutions

- Install individual septic systems – lot sizes too small in village areas
- Extend public sewer – would require substantial expense for sewer lines and expansion of treatment plant
- Install community septic systems – found to be a viable option and 1 system serving 60 properties and 11 systems serving 5-15 properties each were installed beginning in 1989.
Case Study #1 - Community with limited public sewer infrastructure (Brownville)

Town served by 12-acre, town-owned leachfield complex
Case Study #1 - Community with limited public sewer infrastructure (Brownville)

• Town has easements to service septic tanks on individual lots
• Funded by loan from State Clean Water Revolving Fund
• Operated by town’s Water and Sewer Department
• Self-financed with rate of $31 per month per property set to cover operating costs and debt retirement
• Half of the principal leachfield is “rested” every other year
• Unless commercial and industrial users can pre-treat wastes to achieve residential wastewater quality, they are not allowed to use the system
Case Study #2 - Community with no public sewer infrastructure

Problem – town has designated a growth area around a thriving village. How can higher density development be accommodated given the town’s existing large minimum lot size and provide incentives to developers and landowners to help “grow the village”? 

Traditional Village Overlay Growth Area

Ingraham Corner, Rockport
Case Study #2 - Community with no public sewer infrastructure

Solution –

• Minimum lot size of 20,000 square feet for individual subsurface sewage disposal systems but the minimum lot size is reduced to 5,000 square feet if served by sewer or a community wastewater disposal system

• The reduced minimum lot size available with sewer or a community wastewater disposal systems results in lot sizes compatible with the village’s historic development pattern
Case Study #3 – *Hypothetical* Community with no public sewer infrastructure

Future development pattern with individual subsurface sewage disposal systems and large minimum lot size

2-Acre Zoning
Case Study #3 – *Hypothetical* Community with no public sewer infrastructure

The Goal

Conservation Development and Clustered Treatment
Case Study #3 – Hypothetical Community with no public sewer infrastructure

Solution

• Revise land use ordinance to allow lot sizes much closer to state minimum if served by community septic systems. A 139-acre growth area could serve 6-10 businesses with parking, 25-50 apartments, 80-100 single family homes and 20-25 acres of open space.
• Create a sanitary district to own and operate two community septic systems – one for business and one for residences.
• The district would acquire sufficient land for the septic systems and finance the common leach fields.
Solution (con’d)
• Developers would install septic tanks, connect them by sewer lines to the leachfields and repay the sanitary district for its costs based on a per-lot assessment
• When completed the sanitary district would assume ownership and maintenance of the collection systems, including tanks, and leachfields.
• Property owners would pay monthly fee to cover the districts operating and maintenance costs
Case Study #4 – Pretreatment

Problem
• The Town of Milbridge was facing a major wastewater disposal problem.
• EPA informed the town that its waiver allowing the small wastewater treatment plant to discharge directly into the Narraguagus Bay following primary treatment would be disallowed.
• The town would need to develop a plan to improve the discharge, which historically exceeded federal water quality standards for organics and suspended solids.
Case Study #4 – Pretreatment

Problem (con’d)

• The primary sources of high organic and suspended solids loading are two restaurants and a nursing home with most other public sewer users residential customers or small commercial operations.

• Several secondary treatment alternatives and add-on processes were considered for the wastewater treatment plant, including the use of ultraviolet light for disinfection and open treatment lagoons to remove nutrients. All were deemed too expensive both in initial capital and operating costs.
Case Study #4 – Pretreatment
Case Study #4 – Pretreatment

Solution

• The town’s engineering consultant recommended the use of proprietary onsite pre-treatment technology at each of the commercial facilities.

• Pre-treatment would significantly reduce both suspended solids and heavy organic loading in the commercial wastes, and produce an effluent with a negligible (possibly a beneficial) effect when combined with wastewater from the town’s other generators in the sewer main.

• The town was able to secure $500,000 through a Community Development Block Grant plus $125,000 in supplementary funding from the Clean Water State Revolving Fund to install the new equipment.
Case Study #4 – Pretreatment

Solution

- The town has received its new EPA license and the Town Manager states that the commercial effluent emerging from the pretreatment tanks was almost as clean as drinking water, and it had actually improved the testing results at the treatment plant since it had a diluting effect on the rest of the wastewater stream.
For More information:

Decentralized Wastewater Systems: A Resource Manual for Municipal Officials and Developers

http://www.gro-wa.org/wastewater-resource-manual