Subsurface Systems

Background

According to the 2000 census, 65% of New Hampshire's housing units, or about 400,000, relied on septic systems for wastewater disposal. For new development, the figure is higher; about 80% of new housing units have septic systems. (DES, 2008a)

When onsite systems do not function properly it is likely that either they were installed before current standards were in effect (1967) or they were not properly designed, sited, constructed or maintained. DES estimates that between 8 and 10 percent of current septic system approvals address repair or replacement of existing systems (DES, 2008a). As a result of a law (RSA 485-A:39) passed in 1993, evaluation of systems within 200 feet of a great pond or fourth order or higher river is required before the property changes hands; however, upgrading substandard systems is not required.

While directly observable impacts of septic systems on water quality are difficult to quantify, several watershed studies have modeled the impact of septic systems with respect to nutrient contamination. According to the Great Bay Nitrogen Nonpoint Source Study (DES, 2014) septic systems contribute 29% of the nonpoint source nitrogen load to Great Bay. This calculation was determined from a detailed analysis of the number of septic systems in the watershed, a nitrogen generation rate of 10.6 pounds per person, and the distance of septic systems from the estuary.

Several recent watershed-based plans estimated phosphorus contributions from septic systems based on a count of septic systems in the watershed, number of people per housing unit, seasonal occupancy, pounds of phosphorus per person using the system, and soil retention rates. It found the following percent contributions of phosphorus from septic systems:

- Baboosic Lake 43% (NHDES, 2008b.)
- Cobbetts Pond 22% (Cobbetts Pond Improvement Association, 2010.)
- Pawtuckaway Lake 27% (NHDES, 2008b.)

DES is responsible for both subsurface system regulation (RSA 485-A:29) and licensing of designers and installers (RSA 485-A:35 and 36). Septic system installation has been regulated since 1967; licensing of designers and installers since 1979. The state's controlling role in subsurface systems has made for consistently high standards in force throughout the state.

Since 1994, RSA 485-A:29 has provided a regulatory process for innovative/alternative septic systems, which allows for review and approval of designs that are not specified in the subsurface system rules. The review process entails submittal of detailed technical specifications and operational data which DES reviews to determine whether the technology will be at least as protective of the environment and will function as reliably as or better than a conventional septic system.

There has been increased attention nationally on nitrogen loading from septic systems, particularly on Cape Cod due to groundwater contamination and the Chesapeake Bay watershed due to eutrophication of the Bay. In 2013, EPA produced a model program for septic system management in the Chesapeake Bay watershed (http://executiveorder.chesapeakebay.net/130627_Ches_Bay_Tech_Assist_Manual.pdf) that quantifies some of the options for alternative septic systems in terms of nitrogen reduction and costs.

The model program recommends a tiered, risk-based approach for nitrogen management, where nitrogen reduction goals are recommended based on the proximity of a site to a water body of concern, recognizing that there is a greater potential for attenuation of nitrogen for septic systems located farther from the nitrogen-limited water body. Table 15, reproduced from the EPA model program, describes the tiered management system approach. Table 16, also from the EPA model program, compares conventional systems with advanced treatment systems in terms of nitrogen removal and costs.

With each model, the complexity of requirements and management options increases. The first model is roughly equivalent to the current system of management in New Hampshire. The second model introduces nitrogen removal goals and system maintenance requirements. The third model includes operating permits with operation and maintenance provided by a qualified service provider. The fourth and fifth models require a responsible management entity to operate or own the system, respectively.

Table 15. Summary of septic system management approaches*

Model #	Description	Comments
1	Homeowner Awareness	Homeowner management of existing systems is promoted through outreach and education programs. Appropriate for conventional systems which provide limited nitrogen removal.
2	Maintenance Contracts	A property owner contracts with a qualified service provider to ensure O&M is conducted and nitrogen removal goals are met.
3	Operating Permits	The regulatory agency issues a limited-term operating permit to the property owner that requires sustained performance levels for nitrogen reduction. O&M is performed by a qualified service provider with regular monitoring. This provides a greater level of oversight and accountability compared to Model #2.
4	Responsible Management Entity (RME) O&M	Frequent and highly reliable O&M is the responsibility of a management entity, further increasing the level of accountability. This approach is appropriate for clustered systems or complex treatment systems providing high levels of nitrogen reduction.
5	RME Ownership	Ownership passes to a management entity which is responsible for all management aspects, similar to publicly owned treatment works, providing a high level of assurance that nitrogen removal goals are met.

* Source: U.S. Environmental Protection Agency. *A Model Program for Onsite Management in the Chesapeake Bay Watershed*. June 2013

Table 16. Examples of Nitrogen Load Reductions Achievable Through Advanced Treatment.*

Type of System	Nitrogen Discharge[1] Concentration (mg/L)	Load Reduction Provided	Loading (per person/yr)		Nitrogen Reduction (per person/yr)		Approx. Total System Cost
			kg	lb	kg	lb	
Conventional System	39	0%	4	9	0	0	$8,000 - $10,000[4]
Advanced Treatment[2]	20	49%	2	5	2	4	conventional + $10,000 - $15,000[5]
Advanced Treatment with Denitrification[3]	10	74%	1	2	3	7	conventional + $22,000[5]

* Source: U.S. Environmental Protection Agency. *A Model Program for Onsite Management in the Chesapeake Bay Watershed*. June 2013

[1] This is the concentration of wastewater effluent as it enters the drainfield.

[2] Advanced treatment system refers to a system that includes a septic tank, an aeration system, and a recirculation system into the septic tank, or equivalent.

[3] Advanced treatment system with denitrification refers to a septic tank, an aeration system, and an anoxic environment separate from the septic tank, or equivalent.

[4] Source: NHDES Subsurface Systems staff (August 26, 2014). Personal communication.

[5] Source: Maryland Dept. of Environmental Protection Bay Restoration Fund http://www.mde.state.md.us/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Documents/HB347%20ranking%20data%2005162014.pdf.

The EPA model program recommends varying approaches to septic system management depending on the distance from the septic system to the bay or to the tidal portion of tributaries to the bay. For septic systems within 200 meters (about 650 feet) of the Great Bay Estuary or large rivers (5th order or greater), the Great Bay Nitrogen Nonpoint Source Study (GBNNPS) (DES, 2014) assumes that there is too little space for nitrogen losses in groundwater to occur. Therefore, the GBNNPS assumes that all of the nitrogen discharged from septic systems within 200 meters is delivered to Great Bay. Therefore, any programs developed to promote or finance installation of denitrifying systems should consider this area to be the highest priority for such systems.

For freshwater bodies, phosphorus is the nutrient of concern delivered by septic systems. Phosphorus is not removed by conventional onsite systems, but rather is adsorbed to varying degrees by the soil and plant roots through which the treated effluent passes on its way to surface waters. When the adsorption capacity of the soil is reached, phosphorus export will occur. This problem is typical of densely developed shoreland areas near lakes and ponds. Increasing the distance from the leach field to the water body will provide greater adsorption of phosphorus by the soil.

Many of New Hampshire's shorelines were developed prior to regulations requiring septic system setbacks. Dense development of small, waterfront lots provided room for cess pools, dry wells, or other disposal systems that were often inadequate in treating waste. Many of these systems remain in place because the lot sizes are too small for a septic system that will meet today's standards. In this situation, where many small, waterfront lots have inadequate systems, a single community system that collects wastewater from three or more residences may be a viable solution to wastewater disposal, particularly in phosphorus-impaired lake watersheds.

Measures to Control NPS Pollution

Regulatory Programs

- Design and Installation Criteria: RSA 485-A and administrative rules Env-Wq 1000 require that septic systems be designed and installed according to criteria designed to mitigate nitrate contamination in groundwater. DES must review and approve designs and issue operational permits for all individual systems. In about 10% of cities and towns, local approval is required prior to DES approval. All subdivisions creating lots less than 5 acres in size must be approved by DES to insure that new lots can accommodate proper septic systems.
- Licensing of Designers and Installers: RSA 485-A and Administrative Rules Env-Wq 1000 require that all septic systems are designed by licensed designers and are installed by licensed installers.
- Waterfront Property Site Assessment: RSA 485-A requires a site assessment by a licensed designer prior to execution of a purchase and sales agreement for any waterfront property (developed land within 200 feet of a water body) using a septic system.

Non-Regulatory Programs

- Training: County Conservation Districts, NH Association of Natural Resource Scientists, Granite State Designers and Installers, and others provide training opportunities for septic system designers and installers.
- NH Department of Environmental Services Subsurface Systems Environmental Fact Sheets http://des.nh.gov/organization/commissioner/pip/factsheets/ssb/index.htm.

Table 17. Subsurface Systems Goals, Objectives, and Milestones

Subsurface Systems (S) Goal. Septic systems are designed, installed, and maintained in a way that allows them to function without degrading water quality.

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
Objective S-1 Reduce nitrogen and phosphorus pollution from septic systems through system maintenance, system replacement, alternative technologies, and the development of community systems.	**Milestone S-1.1** Demonstrate alternative technologies that reduce nitrogen export to Great Bay. *Partners: Rockingham County Conservation District, Strafford County Conservation District, Granite State Designers and Installers*	**Measure S-1.1a** Installation of a permeable reactive barrier system within the 650 foot buffer of Great Bay or its tributaries.	■				
		Measure S-1.1b Completion of monitoring report document including two years of effectiveness monitoring data from the permeable reactive barrier system.			■		
		Measure S-1.1c Identification of candidate sites for installation of other types of de-nitrifying systems in the Great Bay Watershed				■	
	Milestone S-1.2 Allow for the evaluation of de-nitrifying septic systems within the Alternative Technology Rules. *Partners: DES, Granite State Designers and Installers, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership*	**Measure S-1.2** Complete draft rules addressing de-nitrification.					■
	Milestone S-1.3 Collect phosphorus data on Baboosic Lake (volunteer monitoring) to measure the results of a community septic system. *Partners: Town of Amherst, UNH Lakes Lay Monitoring Program*	**Measure S-1.3** Completed analysis of phosphorus trend in LLMP annual reports.	■	■	■	■	■
	Milestone S-1.4 Implement a community septic system in a phosphorus impaired lake watershed that has an approved watershed-based plan. *Partners: Granite State Designers and Installers, NH Municipal Association, NH State Revolving Loan Fund Program, NH Health Officers Association, NH Building Officials Association, watershed organizations.*	**Measure S-1.4a** Candidate community septic system sites are identified.		■			
		Measure S-1.4b Candidate community septic system sites is selected.			■		
		Measure S-1.4c Completed community septic system design.				■	
		Measure S-1.4d Community septic system installed.					■

Table 17 (cont). Subsurface Systems Goals, Objectives, and Milestones

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
Objective S-1 (cont.)	**Milestone S-1.5** Provide increased opportunities for septic system replacement and development of community systems. *Partners: DES, Granite State Designers and Installers, NH Municipal Association, NH State Revolving Loan Fund Program, NH Health Officers Association, NH Building Officials Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership, NH Housing Authority, US Dept. of Agriculture Rural Development*	**Measure S-1.5a** Annual State Revolving Fund (SRF) loans and State Aid Grants are made available for septic systems.					
		Measure S-1.5b Completed assessment of the current septic system rules to determine incentives and disincentives with respect to community systems with draft administrative rules to provide more incentives for community systems, if needed.					
	Milestone S-1.6 Evaluate the success of the Town of Meredith's septic system ordinance for Lake Waukewan. *Partners: DES, Town of Meredith, Lake Winnipesaukee Watershed Association*	**Measure S-1.6a** Completed case study report including the number of failing systems identified, number of systems repaired or replaced as a result of the ordinance, lessons learned, and information for other communities interested in pursuing similar ordinances.					
	Milestone S-1.7 Evaluate whether certain community systems should be required to have licensed operators, maintenance funds, and capital reserve funds for system replacement. *Partners: DES, Granite State Designers and Installers, NH Municipal Association, NH Health Officers Association, NH Building Officials Association*	**Measure S-1.7** Feasibility report with recommended changes to administrative rules.					
Objective S-2 Determine the feasibility of creating septic system management districts or utilities.	**Milestone S-2.1** Review existing districts or utilities in California, Connecticut, and Texas. *Partners: Granite State Designers and Installers, NH Municipal Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership*	**Measure S-2.1** Report evaluating legal structure of septic system authorities in other states.					

Table 17 (cont). Subsurface Systems Goals, Objectives, and Milestones

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
Objective S-2 (cont.)	**Milestone S-2.2** Determine authority in existing state law and whether new authority is needed. *Partners: Granite State Designers and Installers, NH Municipal Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership*	**Measure S-2.2** Report assessing current legal authority for septic system utilities and recommending new authorities.					
	Milestone S-2.3 Determine interest among stakeholders in pursuing septic system utility development. *Partners: Granite State Designers and Installers, NH Municipal Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership*	**Measure S-2.3** Interest determined.					
Objective S-3 Implement a rigorous site assessment process for waterfront septic systems.	**Milestone S-3.1** Determine the feasibility of amending the RSA 485-a:39 site assessment process to incorporate a full inspection of the existing system by a permitted designer. *Partners: Granite State Designers and Installers, NH Municipal Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership, NH Health Officers Association, NH Building Officials Association*	**Measure S-3.1a** Completed draft procedures for requiring in-ground inspection by a permitted designer of waterfront septic systems at the time of sale, if determined to be feasible.					
		Measure S-3.1b Completed report documenting the feasibility of adopting inspection procedures in rule or statute.					
	Milestone S-3.2 Improve the requirements for replacement of systems during seasonal conversions and capacity expansions, and for systems without state approvals. *Partners: Granite State Designers and Installers, NH Municipal Association, Southeast Watershed Alliance, Piscataqua Region Estuaries Partnership, NH Health Officers Association, NH Building Officials Association*	**Measure S-3.2a** Assessment report summarizing the existing process for addressing seasonal conversions and capacity expansions, and systems without state approvals.					
		Measure S-3.2b Draft administrative rule changes for addressing seasonal conversions and capacity expansions, and systems without state approvals.					