Chapter 9
Wastewater

NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

Overview

About two-thirds of existing New Hampshire homes and the vast majority of new homes are served by individual onsite wastewater treatment systems (septic systems). The effectiveness of septic systems has improved over the years and the New Hampshire Department of Environmental Services has a comprehensive program to ensure the proper design, siting and construction of new septic systems. Older, sub-standard systems are gradually being replaced as properties change hands. Approximately one-third of the state's homes are served by centralized wastewater treatment facilities (WWTFs), many of which are small, old, and approaching their design capacities. Most WWTFs discharge treated wastewater to rivers or streams, although some discharge "onsite" to groundwater. Increased surface water monitoring and revisions of water quality standards will mean future requirements for advanced nutrient removal treatment at many WWTFs. The U.S. Environmental Protection Agency has estimated that it will take more than $570 million to address existing needs for wastewater collection and treatment upgrades and replacement, while New Hampshire estimates the need for treatment upgrades alone at $1 billion (USEPA, 2004a; Commission to Study the Publicly Owned Treatment Plants [Commission], 2007). It is not clear how that need will be met, since the federal grants that helped build the existing wastewater infrastructure are no longer available.

9.1 Description and Significance

Societies have managed and consolidated domestic wastewater to prevent disease for centuries, but the necessity for reducing wastewater pollutants in the environment was not realized until the 19^{th} century. In 1892 only 27 American cities provided wastewater treatment (USEPA, 2004b). Since then, the number of WWTFs has grown to over 16,000 (USEPA, 2004b). The passage of the 1972 Clean Water Act fueled great improvements in wastewater treatment with the availability of grants to support sewer and WWTF construction and upgrades to meet new minimum wastewater treatment standards.

Currently, approximately two-thirds of all New Hampshire homes are served by individual onsite wastewater treatment systems, typically septic tanks and absorption fields that serve single-family residences (NHDES, 2008a). The remainder are served by larger cluster, community, or regional facilities that treat much larger quantities of wastewater.

Today's domestic wastewater contains many pollutants that can negatively affect the environment and public health and safety. In addition to human pathogens, wastewater also contains high levels of nutrients such as nitrogen and phosphorus that can trigger surface water algal blooms, low dissolved oxygen, and fish kills. Industrial wastes can also contribute toxic pollutants as byproducts of manufacturing.

Centralized treatment facilities involve major capital, operations, and maintenance costs, and the collection system of sewer lines and pump stations also requires regular maintenance and upgrades to prevent public health hazards caused by discharge of untreated or inadequately treated wastewater.

9.1.1 Onsite (Decentralized) Wastewater Management

Onsite individual wastewater treatment systems, usually referred to as septic systems, are the most common treatment systems for domestic wastewater in New Hampshire. These systems over time have evolved from the pit privies used widely throughout history to installations that are highly capable in suitable soils. Once viewed as a temporary wastewater solution for areas that had not yet been sewered, onsite systems are now a viable long-term solution for the vast majority of new homes in New Hampshire, with the added benefit of returning water to the local hydrologic system.

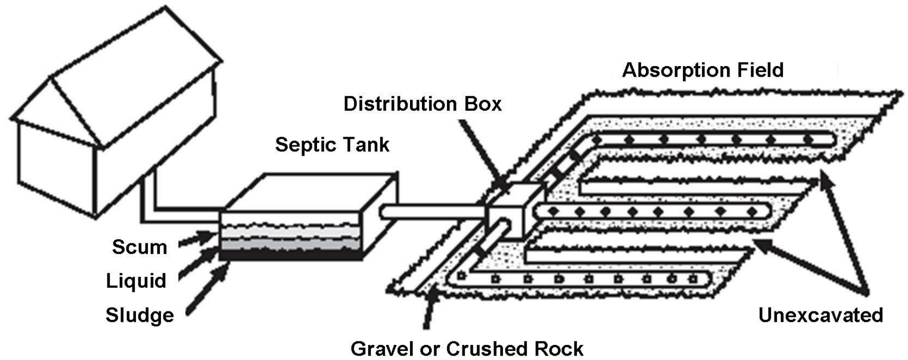

Figure 9-1. Basic components of an onsite septic system.
Source: USEPA, 2002.

According to data submitted during the 2000 census, nearly 65 percent of the homes, full time and seasonal, in New Hampshire rely on septic systems for wastewater treatment[1] (NHDES, 2008a). Most individual onsite systems consist of a septic tank and a soil absorption field that removes settleable solids, floatable grease and scum, nutrients, and pathogens from wastewater discharges when sited and maintained correctly (Figure 9-1). The septic tank removes most floatable material and provides partial digestion of organic matter through an anaerobic process. The effluent that leaves the tank may still contain significant pathogens and nutrients that are further treated in local soils, sands, or other media absorption fields. For larger onsite commercial or cluster systems, or for individual systems in critical areas, higher levels of treatment can be achieved through more complex multiple treatment steps including recirculating sand filters and nitrification/denitrification steps. DES estimates that between 20 percent and 25 percent of new onsite systems provide wastewater treatment for commercial facilities or residential facilities with more than two families.

Innovative/Alternative Onsite Systems

Over the past several years, DES has approved many innovative technologies for the treatment and disposal of wastewater to subsurface systems. New technologies, such as large-diameter gravel-less pipe and anaerobic treatment systems, enable development to take place on more difficult sites, e.g., steep slopes or a high water table, with less required site disturbance than if conventional onsite technology were used.

[1] This does not differentiate between cluster and individual septic.

Sub-Standard and Failed Systems

A substantial, but unknown, number of existing onsite systems do not function properly because they were installed before current standards were in effect or because they were not properly designed, sited, constructed or maintained. Although sub-standard or failed systems are often suspected of impacting surface water or groundwater, their impact is not well understood. However, these systems are being gradually addressed as properties change hands and buyers require evaluations and subsequent repair or replacement and as complaints by neighbors or local health officers bring failed systems to DES's attention. DES estimates that between 8 percent and 10 percent of its current septic system approvals address repair or replacement of existing systems. In New Hampshire, evaluation of systems within 200 feet of a great pond is required before the property changes hands.

9.1.2 Centralized Wastewater Treatment Facilities

There is no single distinction between centralized WWTFs and large onsite systems, but in terms of the need for regulatory oversight, some onsite wastewater treatment facilities belong in the same category as centralized facilities. Characteristics that merit a greater level of oversight of the facility and different permitting requirements include the sophistication of the treatment processes, the complexity of the sewage collection system, and the potential environmental impact if the facility does not perform as intended. Among the centralized or complex onsite facilities, there are 91 publicly owned treatment works (POTWs) and 30 private WWTFs (Table 9-1). The capacities of these facilities range from 3,500 gallons per day to 34 million gallons per day (mgd). Thirty-two of these facilities have design flows of 1 mgd or more, 38 have flows of between 0.1 and 1.0 mgd, and 51 have design flows of less than 0.1 mgd. Of these 121 facilities, 74 require a National Pollutant Discharge Elimination System (NPDES) permit (NHDES, 2008b).

New Hampshire's WWTFs range in age from 10 to over 40 years, with the typical age being around 30 years. However, the age of a facility does not tell the whole story, since increasingly stringent limits imposed by discharge permits have driven the upgrading of many treatment plants over the years.

Table 9-1. Discharge destination and flow rate of POTWs and private WWTFs in New Hampshire. ***Source: NHDES, 2008b.***

	Groundwater	Surface Water	Groundwater and Surface Water	Total
POTWs	15	59	17	91
Private WWTFs	28	2	0	30
TOTAL	43	61	17	121

Flow Rates	Groundwater	Surface Water	Groundwater and Surface Water	Total
> 1.0 mgd	1	27	4	32
0.1 to 1.0 mgd	6	26	6	38
< 0.1 mgd	37	8	6	51
Total	44	61	16	121

Primary and Secondary Treatment

Wastewater may contain multiple classes of pollutants that demand various treatment methods. Primary treatment refers to the removal of larger particles and solids, using physical and chemical processes that coagulate and settle particles from the wastewater to eventually create a sludge that is disposed of separately. Secondary treatment, which is currently the minimum treatment required for all New Hampshire wastewater facilities, addresses oxygen-demanding pollutants and suspended solids (Figure 9-2). Secondary treatment relies mostly on natural biological processes in which microorganisms digest the organic matter in sewage to create less environmentally harmful byproducts. Wastewater treatment facilities contain and accelerate these processes to optimize the removal of "conventional" pollutants such as biochemical oxygen demand, total suspended solids, and pathogens. Some facilities in New Hampshire use aerated wastewater lagoons, allowing algae and bacteria to use sunlight and oxygen to break down these pollutants. These wastewater lagoons account for more than 25 percent of the secondary treatment methods used by WWTFs in the U.S. (USEPA, 2004b). This technology is also popular in New Hampshire, where there are 30 municipal wastewater treatment lagoons (Figure 9-3). Other facilities employ activated sludge treatment, which requires greater energy input, requires a smaller footprint, and suits larger facilities. In this type of treatment, aeration tanks mix and inject oxygen into wastewater to support a population of microorganisms that treat water.

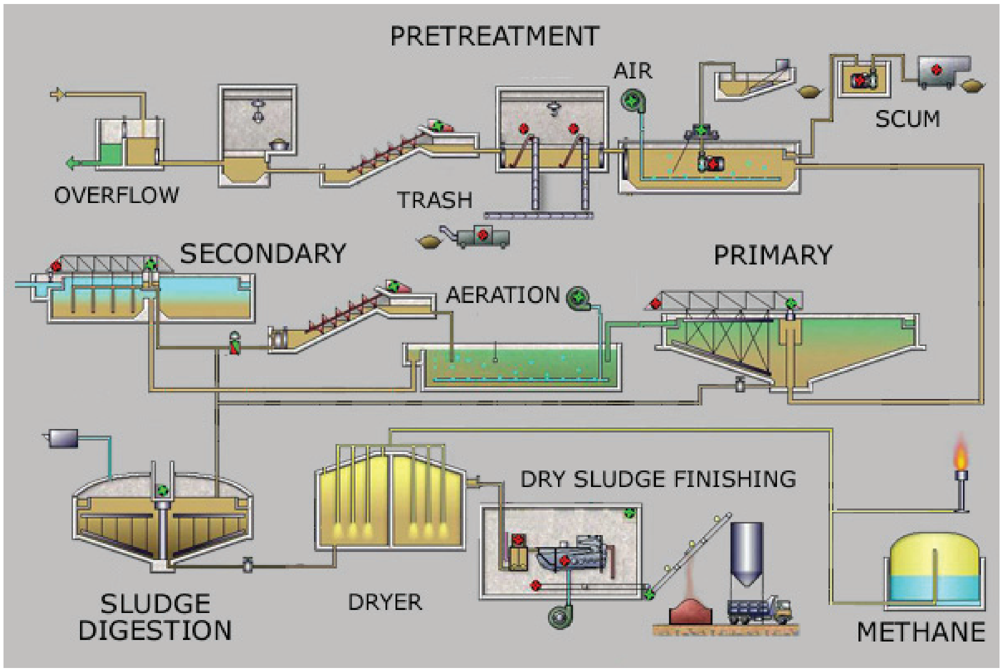

Figure 9-2. Steps of primary and secondary treatment. ***Source: Leonard, 2006.***

Disinfection

The disinfection process, which typically occurs after secondary treatment in municipal and regional WWTFs, eliminates or deactivates the microorganisms and pathogens that have the potential to cause human diseases. Products used for disinfecting wastewater include various forms of chlorine and ultraviolet radiation. Disinfection as part of wastewater treatment provides pro-

Figure 9-3. Lagoons in Pittsfield, N.H.. *Source: Town of Pittsfield, 2008.*

tection of public health where people engage in water-contact recreation or where shellfish are harvested.

Tertiary Treatment For Nutrient Removal

Although secondary treatment removes a measurable portion of the nutrient pollutants in wastewater, the discharge of a secondary-treated effluent may still affect aquatic life in receiving waters. Other advanced treatment methods can remove additional organic matter, nitrogen, phosphorus and toxins.

Land Application Methods

In addition to conventional WWTFs that discharge to surface waters, there are also several wastewater treatment methods that involve the application of wastewater to land or discharge into groundwater for further treatment or groundwater recharge. These methods include land treatment, wetlands treatment and wastewater infiltration.

Land treatment consists of the controlled application of wastewater to soil. As gravity pulls the wastewater downward through the soil, several physical, chemical, and biological processes help filter and treat excess nutrients. Wetlands also provide an opportunity for using the natural environment to enhance wastewater treatment. Constructed wetlands support vegetation that readily absorbs excess nutrients from wastewater-saturated soils. Wetlands also host a variety of microbial populations that can degrade pollutants in wastewater if application rates are controlled to allow healthy microbiological populations. Wastewater infiltration methods typically involve spraying, flooding, or irrigating land with partially-treated wastewater. Soil naturally filters wastewater as microbes and plants digest or take up nutrients from the soil (Figure 9-4).

Septage consists of material removed from septic tanks, cesspools, holding tanks, or other sewage treatment storage units such as septage lagoons, waste from portable toilets, and grease trap waste that has been co-mingled with wastewater. Land application, lagoons, septage treatment facilities, and several innovative and alternative waste treatment methods may process, treat, or dispose of septage. In New Hampshire more than 75 percent of septage generated in the state is transported to wastewater treatment plants for disposal (Gordon, 2006).

Residuals

Often the main focus of wastewater treatment is ensuring that the effluent, or the water discharged to the environment, meets permit requirements. The process of removing pollutants from wastewater inevitably creates an additional waste to address. Biosolids, which are solids left over from the treatment of wastewater, have a considerable capacity as fertilizer or fuel. Prior to applying biosolids to land area, biosolids are treated to reduce pathogens and vector attraction, and are analyzed for 177 constituents. If biosolids meet the standards required in Env-Wq 800, the biosolids receive state certification for beneficial reuse and may then be applied to land. Dewatered or dried biosolids also contain fuel potential and may be incinerated at waste-to-

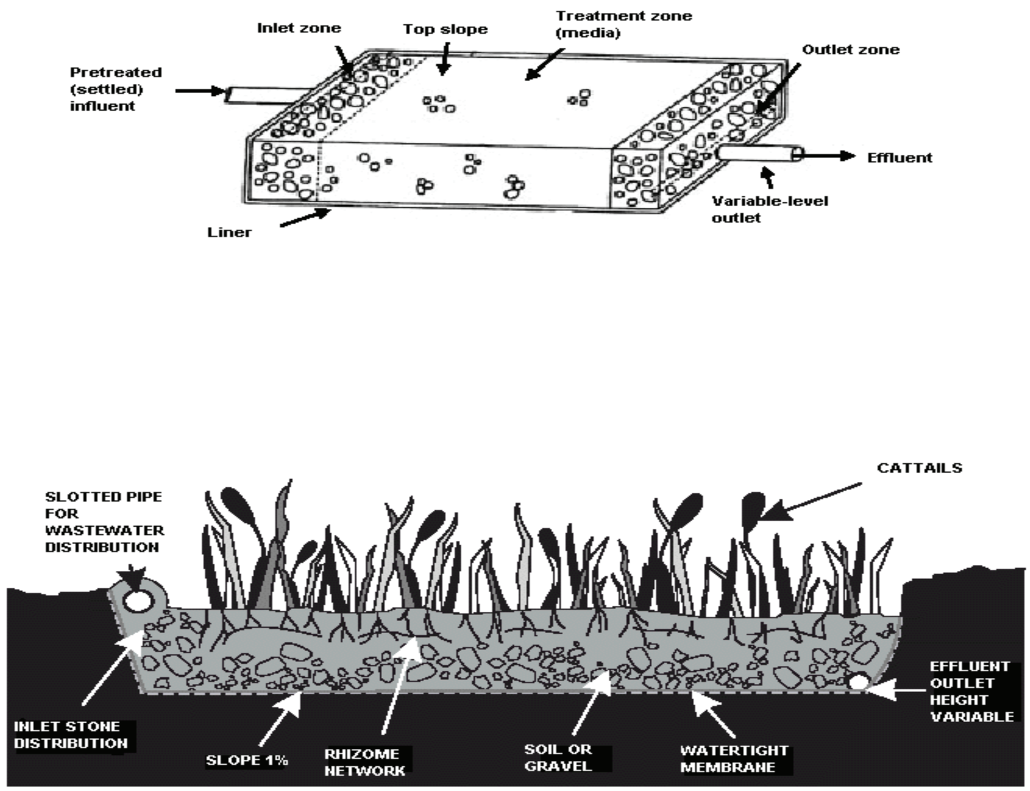

Figure 9-4. Elements of wetland wastewater treatment. ***Source: USEPA, 2002.***

energy facilities. There are also methods of anaerobically (without oxygen) digesting biosolids to generate methane gas. The methane can be captured to create heat and electricity, which may yield a significant source of power that does not require extra energy inputs from facilities.

Industrial Pretreatment

Wastewater from industrial processes often contains pollutants that disturb the effectiveness of wastewater treatment by harming helpful microorganisms. Depending on the nature of the wastewater, DES regulations (Env-Ws 904) may require pretreatment before it can be discharged into a collection system for a POTW. This industrial pretreatment also protects wastewater facilities and workers from harmful pollutants that could create hazards or interfere with operation or performance of the facility. Pretreatment reduces the likelihood that untreated contaminants enter receiving waters.

9.1.3 Combined Sewer Overflows

Combined sewers collect stormwater, industrial wastewater, and municipal wastewater or sewage. During storms, water enters storm drains (catch basins) installed in streets to minimize flooding. The stormwater combines with sewage already flowing in the pipes. With heavy rain, large amounts of stormwater can enter the combined sewer quickly and rapidly fill the pipes. If these flows exceed the capacity of the pipes then the combined sewer and wastewater will overflow, often to surface water. These wet weather discharges of untreated sewage, industrial wastewater, and stormwater are called combined sewer overflows (CSOs). These CSOs pose risks to public health, impact recreational water uses, and stress the aquatic environment (Figure 9-5).


Figure 9-5. Combined sewer overflow near a stream.
Source: USEPA, 2007.

Pollutants that are typically present in CSOs include the following: pathogens from human and animal fecal matter, which could cause illness; oxygen demanding pollutants that may deplete water column oxygen in the receiving water to levels that may be harmful to aquatic life; suspended solids that may increase turbidity or damage benthic communities; nutrients that may cause excessive algal and aquatic plant growth; toxics that may persist, bioaccumulate, or stress the aquatic environment; and floatable litter that may either harm aquatic wildlife or become a health and aesthetic nuisance to swimmers and boaters.

DES developed a CSO Control Strategy in 1990. Since then, six communities in the state addressed or developed plans to address their CSOs. The municipalities of Portsmouth, Manchester, Nashua, Lebanon, Berlin and Exeter identified a total of 47 CSOs (NHDES, 2003). In Manchester, for example, the Phase I of a CSO facility plan will reduce the average annual CSO volume from approximately 220 to 73 million gallons per year at a cost of $63.6 million (NHDES, 2003). The 220 million gallons are discharged into the Merrimack and Piscataquog Rivers from 26 CSOs. In 1997 the city of Nashua completed a CSO abatement program report that resulted in the EPA issuing an administrative order requiring the city to eliminate their nine CSOs by separating their combined sewer system by the year 2019. All nine of the CSOs will be eliminated by the year 2019 at an estimated cost of $100 million (NHDES, 2003). Although costly, the preservation of water quality, aquatic habitat, and the safety of recreational activities depend on the removal of CSOs from these aging systems.

A 2006 study conducted for the U.S. Army Corps of Engineers and five communities along the lower Merrimack River in New Hampshire and Massachusetts found that so-called Phase I CSO controls (elimination of most CSOs) combined with significant abatement of non-point sources of pollution would be more cost-effective at improving wet-weather water quality than more extensive CSO controls alone (CDM, 2006).

9.1.4 Illicit Discharges

An illicit discharge is a wastewater discharge to a municipal storm drainage system or a discharge of untreated sewage directly to a water body. Examples of illicit discharges commonly seen in New Hampshire include sanitary wastewater piping that is directly connected from a home into a storm drainage pipe or a cross-connection between the municipal sewer and the storm sewer systems. In the coastal watershed over 50 illicit discharges have been identified and removed since 1996, approximately 10 known illicit discharges are still being pursued, and another nine suspected illicit discharges are being investigated. In the Merrimack River watershed, since 2001, DES has investigated 200 miles of shoreline, documented 1,200 outfall pipes, identified and corrected five illicit discharges, and is still investigating 15 suspected illicit discharges in cooperation with local officials.

9.2 Issues

9.2.1 Facilities Approaching Design Capacity Due to Population Growth

Due to population growth, 25 percent of New Hampshire's municipal WWTFs are operating at or near 80 percent of their design capacity. These facilities will require upgrades in the near future to keep pace with projected increases in population (Commission, 2007). In the absence of adequate WWTF capacity, new development in urban fringes may instead rely on individual on-site systems and consequently shift to lower-density development, which tends to have greater impacts on water resources (USEPA, 2006).

9.2.2 Aging Infrastructure: Need for Upgrades Far Exceeds Funds

During the 1970s the federal government heavily subsidized the design and construction of the vast majority of WWTFs in New Hampshire to meet federally-mandated secondary treatment standards. Many of these facilities have surpassed their designed lifespan. Communities statewide are facing the need to build the next generation of treatment facilities to adequately meet both current and future demands for the protection of human health and the environment. The dilemma for many communities is both financial and technological since the next generation of treatment facilities must have the flexibility to remove more contaminants to achieve lower discharge levels. New Hampshire monetarily supports municipal wastewater infrastructure projects through state grants up to 30 percent of eligible costs and through State Revolving Loan Fund (SRF) loans up to 100 percent of eligible costs. Unlike the 1970s, no direct federal grants are available to fund design and construction of the next generation of wastewater facilities.

Sewer lines and, to a lesser extent, pump stations conveying sewage to treatment facilities vary in age. Because sewer lines run underground, they rarely receive consideration or draw concern unless a sewage leak becomes obvious. These leaks typically involve repairs that necessitate road closures and traffic re-routing. Aging sewer lines also carry less obvious risks, such as unwanted releases of sewage to the environment or the entry of "clean" water that can, and often does, overload treatment plants. In some cases in New Hampshire, this clean water leaking into the system, called infiltration and inflow or I/I, can account for as much as 25 percent of the treated flows, which may substantially increase the cost of treatment plant operations.

EPA Needs Assessments Identified Massive Shortfall

Through its Clean Watershed Needs Survey in 2004, the EPA collected a wealth of information to estimate funding needs for wastewater management on the state level (USEPA, 2004a). Estimated needs in New Hampshire totaled approximately $570 million including:

- $169 million for wastewater treatment facility improvements.
- $140 million for wastewater collection and conveyance system improvements.
- $261 million for the correction of combined sewer overflows.

The total was down from $900 million in the year 2000 mostly due to continuing correction of CSOs and the exclusion of some data from the 2004 survey due to a stricter protocol for documentation. It is also worth noting that since the 2004 survey was conducted, a number of NPDES permits have been calling for nutrient removal, which will substantially increase the need for facility improvements.

A more recent study conducted by a legislatively-mandated commission estimated that $1 billion will be needed for WWTF upgrades in New Hampshire over the next 10 years to meet the needs of continuing population growth and increasingly stringent treatment standards. Whichever estimate proves to be correct, the current federal and state funding of approximately $22 million per year is far short of the need (Commission, 2007).

By themselves, the statewide totals listed above do not reflect the greater struggles in smaller communities. These small community systems often need additional assistance to meet requirements set by the Clean Water Act due to a lack of adequate financing, training, and economies of scale to manage and maintain wastewater treatment systems at the same level of efficiency as larger facilities. According to the 2004 survey, small community wastewater facilities serve 39 percent of the state population and comprise $75 million, or roughly 13 percent of the total assessed wastewater treatment and collection needs (USEPA, 2004a). However, because the 2004 survey excluded information on some facilities, the reported need for small facilities is understated and is expected to be higher when the 2008 survey is completed.

9.2.3 New Requirements for Centralized Wastewater Treatment Facilities

As scientists more clearly define and quantify the effects of treated wastewater on aquatic life, treatment facilities are subject to increasingly stringent water quality limits. While part of the trend involves tighter restrictions on recognized contaminants such as nutrients, future limits will also address contaminants that may currently pass through WWTFs intact. These more recently recognized contaminants involve pharmaceuticals and personal care products, as well as certain metals such as lead, copper and aluminum. When WWTFs require expansion, state antidegradation rules require their discharges to meet a higher quality effluent standard. These rules preserve the existing quality of surface waters by restricting pollutant discharges that would further impair the water body.

The EPA is already moving toward including strict phosphorus limits for many New Hampshire discharge permits when they renew over the next five-year cycle. While some smaller facilities may avoid this requirement in the immediate future, it is likely that most, if not all, WWTFs will have to address this issue within the next five to 10 years (Commission, 2007).

The Great Bay estuary provides an example of the increasing concern surrounding nutrient pollution, which may be, in part, abated by more effective wastewater treatment. Although water quality in the Great Bay generally meets regulatory standards, monitoring has revealed a trend of increasing nutrient concentrations (New Hampshire Estuaries Project [NHEP], 2006). In addition, the potential for accidental pollution from several WWTFs in the seacoast region led to the closure of recreational shellfish beds in western Great Bay beginning in January 2005 (Metcalf & Eddy, Inc., 2005). Wastewater treatment facilities account for an estimated one-third of the nitrogen load to the Great Bay estuary (NHEP, 2006), so nitrogen removal upgrades could help alleviate the problem.

Pharmaceuticals and Personal Care Products

The latest research indicates that as people use increasing amounts of pharmaceuticals and personal care products (PPCPs), these products are being found in aquatic environments as a result of wastewater disposal. PPCPs include a wide variety of chemicals from prescription and over-the-counter therapeutic drugs including hormones, veterinary drugs, fragrances and cosmetics. They originate from human activities, residues from pharmaceutical manufacturing and hospitals, illicit drugs, veterinary use and agribusiness. While the human body breaks down some of these products, many others enter the wastewater stream intact and remain throughout the wastewater treatment process. As research furthers the knowledge related to ecological impacts of PPCPs, requirements for removing these complex substances from the wastewater stream may create a need for wastewater treatment process upgrades or supplements. The potential impacts of PPCP-containing wastewater when it is reused for recharging or supplementing drinking water sources is already being debated (American Water Works Association, 2008).

9.2.4 Landscape Change: Reliance on Single-Family Onsite Systems Promotes Sprawl

Local land use requirements such as minimum lot sizes and excessive setback distances tend to promote sprawling development, which has a number of negative impacts on water resources, as discussed in Chapter 7 – Water Use and Conservation and Chapter 10 – Stormwater. To some extent, many communities cite the need for sufficient areas of appropriate soils to accommodate single-family onsite systems as a justification for relatively large minimum lot sizes in non-sewered areas. Furthermore, local requirements, such as septic system setback requirements in excess of those required by DES, often have the effect of forcing systems onto less favorable sites without providing any additional benefits. At the same time, extending sewer service to developing areas does not necessarily discourage sprawl unless it is coupled with land use regulations that promote compact development.

An alternative to both single-family onsite systems and centralized wastewater treatment is the use of cluster systems, which consolidate the land required for individual septic leach fields into one area and effectively decrease the amount of open space consumed by each lot. Although New Hampshire’s rules (Env-Wq 1005.05) specifically provide for cluster developments, the dimensional constraints, setbacks, developers’ and municipal officials’ lack of familiarity with these systems, and increased time needed for approval may create barriers to shifting the development paradigm at the local level.

9.2.5 Nutrient Loading Is a Concern with Onsite Systems

Of the many pollutants found in domestic wastewater that is processed by onsite systems, nutrients – nitrogen and phosphorus – are both found in concentrations of concern and are not substantially removed by onsite systems. While onsite systems facilitate the conversion of more harmful forms of nitrogen, e.g., ammonia, to less harmful compounds, e.g., nitrate, conventional systems do not remove the nitrogen, discharging it instead to the ground, where it is presumably diluted in groundwater to concentrations that are not harmful to humans or the environment. While required setbacks from property lines and water supply wells are designed to ensure adequate dilution to protect water supply wells, nitrate loading remains a concern where older systems have not been properly sited, designed, installed or maintained and where elevated levels of nitrogen reach freshwater or estuarine ecosystems. While nitrogen may contribute to over-enrichment of fresh water ecosystems, estuarine systems and coastal embayments are even more susceptible to the adverse effects of nitrogen enrichment (see section 6.2.3 in Chapter 6 – Coastal and Estuarine Waters).

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. Phosphorus is not a generally human health concern, but it is usually the limiting nutrient in freshwater ecosystems. Consequently stream, rivers, and especially lakes and ponds are susceptible to the effects of phosphorus over-enrichment (see section 3.1.3 in Chapter 3 – Lakes and Ponds).

9.2.6 Septage Disposal

Since many New Hampshire residents rely on septic or onsite wastewater management systems, the disposal of residuals from the maintenance of septic tanks, commonly known as septage, must be done at local or regional WWTFs. New Hampshire, however, currently does not have enough capacity to treat all of the septage generated within the state. At present, out-of-state WWTFs dispose of approximately 19 percent of septage generated within the state (NHDES, 2008c). This out-of-state disposal subsidizes facilities outside the region with at least $1.5 million annually that could otherwise fund local facilities serving New Hampshire communities (Gordon, 2006). In 2007 approximately 58 million gallons, or 61 percent, of New Hampshire's septage was disposed at in-state WWTFs, while 6 percent went to septage lagoons, 7 percent to land application, and another 7 percent to innovative or alternative "septage only" facilities (NHDES, 2008c).

This situation may worsen in the future since about 80 percent of new development in recent years has occurred in non-sewered areas (NHDES, 2008a). For example, The Seacoast Wastewater Management Study estimates that annual septage volume in that region will increase by about 33 percent by 2025, based on a population projection in non-sewered areas of the seacoast region (Metcalf & Eddy, Inc., 2005). Future increases in the volume of septage will present problematic situations for treatment plants that have reached or will soon reach their design capacity.

9.3 Current Management and Protection

9.3.1 Centralized Wastewater

State Aid Grant Program for Wastewater Treatment Facilities

The State Aid Grant (SAG) program provides financial assistance in the form of grants for 20 percent of eligible costs related to planning, design, and construction of certain sewage disposal facilities by municipalities. The enabling statute (RSA 486:1,III) sets minimum requirements for project eligibility. The SAG program has granted over $878 million ($442 million federal and $436 million state) to New Hampshire municipalities since the 1960s, when it was established, and continues to provide an average of $13.6 million annually to communities.

The SAG Plus program aims to develop regional septage capacity throughout New Hampshire. The program provides an additional 10 percent of eligible costs associated with expanding, upgrading, or developing new WWTFs to provide for septage disposal. The grant increases by 2 percent for each written agreement the host community holds with a municipality to provide for its septage disposal needs. With the additional capacity for in-state septage disposal driven by this new funding initiative, septage exports to out-of-state facilities dropped by 19 percent (or 18.3 million gallons) in 2007 (NHDES, 2008c).

State Revolving Loan Fund Program

The SRF Loan program provides low interest loans to assist communities with the design and construction of eligible wastewater projects. Requirements for obtaining SRF loans are generally similar to those for the SAG program; however, obtaining an SRF loan for construction also requires solicitation of minority- and women-owned business enterprises for project participation. The SRF Loan program also requires that DES prepare an environmental assessment to present to the municipality for public comment.

Design Standards

The rules contained in Env-Wq 700 outline state standards for the design of sewers, sewer pumping stations, sludge handling, treatment processes, and the structural design of wastewater treatment plants. Amendments to the regulations in 2005 addressed changes in technology that occurred since the rules were previously readopted in 1997.

Wastewater Treatment Facility Operator Training Requirements

DES requires licensing of all operators who are responsible for the operation of a WWTF. The operator in charge oversees the daily operation of the WWTF and is accountable for all plant operational duties, record keeping and reporting. Each facility must also designate and have a certified backup operator. To become a certified wastewater operator, individuals must apply for eligibility to sit for one of the four grades of examinations or apply for a reciprocal license. Continuing education is also a requirement for licensed wastewater operators.

Federal NPDES Permit Program

In 1972 the National Pollution Discharge Elimination System (NPDES) was established under the federal Clean Water Act. NPDES prohibits discharges of pollutants from any point source into water resources without a NPDES permit. NPDES permits include municipal and industrial categories, which include major (large dischargers) and minor (small dischargers) permits. In addition to meeting effluent limitations, WWTFs must conduct monitoring programs to document continued compliance.

Capacity, Management, Operation, and Maintenance Regulations

The EPA's recently proposed revisions for the federal NPDES permit regulations may require POTWs to develop and implement capacity, management, operation, and maintenance programs, which would affect wastewater collection system owners required to obtain a NPDES permit. The main goal of these revisions is to ensure that wastewater collection and treatment systems have the capacity to convey base flows and peak flows to prevent sanitary sewer overflows.

Prevention of Water Quality Degradation or Water Quality Standards Violations

Wastewater treatment facility discharges must not cause or contribute to water quality standards violations and NPDES permits must include effluent limitations that are protective of water quality. Where water quality is currently good, the New Hampshire antidegradation regulations aim to prevent the degradation of water quality. New WWTFs or facilities that propose to increase their design flow are subject to anti-degradation review. Where water quality is impaired and a Total Maximum Daily Load (TMDL) has been developed, NPDES must include permit limits that reflect specific waste load allocations required by the TMDL. For more information on water quality standards, antidegradation, and TMDLs, please see Chapter 2 – Rivers.

Clean Watershed Needs Survey (Infrastructure Needs)

Every four years, the EPA conducts a comprehensive assessment of the capital needs to meet water quality goals set in the Clean Water Act (USEPA, 2008). The assessment, called the Clean Watershed Needs Survey, includes information about:

- Publicly owned wastewater collection and treatment facilities.
- Stormwater and combined sewer overflows.
- Nonpoint source pollution control projects.
- Decentralized wastewater management.
- Estuary management projects.

The surveys contain information regarding the types of WWTFs and the associated population served by each. The reported needs include the estimated financial needs to improve wastewater treatment plants and collection system and wastewater management within the state.

9.3.2 Decentralized Systems

Subsurface Systems Program

The DES Subsurface Systems Bureau relies on licensed designers and installers, as well as system design reviews and installation inspections through the Subsurface Systems Bureau. While state rules require monitoring and maintenance of onsite systems by owners, there is no state program to ensure compliance with these rules. The Subsurface Program provides educational flyers regarding septic system use, maintenance and inspection with each approved system permit. With innovative or alternative systems, however, vendors may be required to provide monitoring and maintenance to ensure the proper operation of these systems.

New Hampshire rules for Subdivisions and Individual Sewage Disposal Systems (ISDS) set requirements for lot subdivisions as well as the design and placement of onsite wastewater management systems (Env-Wq 1000). The rules also include provisions for open space or conservation subdivisions and innovative or alternative onsite wastewater treatment technology.

The Subsurface Systems Bureau also reviews applications for repair and replacement of "failed" onsite wastewater systems. However, a vague definition of "failure" creates difficulty to consistently address failed systems. Legislation passed in 2008 (Senate Bill 384) defines failed systems in terms of hydraulic failure: when the system fails to contain sewage or causes discharge of sewage on the ground surface or into adjacent surface waters.

The Subsurface Systems Bureau works cooperatively with local health officers to respond to complaints regarding septic systems that are suspected of failing. In many cases, DES conducts dye tests where systems are suspected of discharging to surface waters. When hydraulic failure is evident, DES typically requires immediate and continued pumping of the septic tank and an evaluation to determine the necessary corrective action. Health officers play a vital role in protecting public health in these situations, since their statutory authority enables them to require immediate action under the threat of issuing a notice to vacate. Corrective action for failed systems may range from partial replacement to design and installation of a completely new system. DES is currently working with Granite State Designers and Installers Association to standardize the practice of evaluating systems suspected of failure.

Waterfront Property Site Assessment Studies

Before signing a purchase and sale agreement, property owners selling any developed waterfront property must have a site assessment completed as required by the Subdivision and ISDS rules (Part Env-Wq 1025) in order to determine whether the existing onsite system is DES-approved and whether the property can accommodate an onsite system meeting current standards. A permitted septic system designer must conduct the on-site assessment. The requirement applies to any property within 200 feet of tidal waters or a great pond (more than 10 acres in area), but not to property on rivers or stream shorelines. Legislation passed in 2008 (SB 384) will extend the requirement to rivers affected by the Comprehensive Shoreland Protection Act (fourth-order rivers).

Groundwater Discharge Permits

Any WWTF that discharges 20,000 gallons per day or greater to groundwater must have a groundwater discharge permit. Groundwater discharge typically applies to rapid infiltration of wastewater in shallow basins and slow rate irrigation (usually spray irrigation). The permit program requires applicants to show that discharged water remains within a designated groundwater discharge zone, and that this water meets quality standards applicable to various waters of the state. In addition, applicants must create detailed plans for a groundwater monitoring well network and outline all potential public health and environmental impacts of the system. The permit also requires that the groundwater discharge be located a sufficient distance from property lines, water resources, public water supplies and well intakes to meet applicable buffers and groundwater travel times.

Septage Management and Coordination Efforts

In 2005 DES modified the state's Septage Management Rules (Env-Wq 1600) in order to provide incentives for innovative and alternative septage disposal facilities. The incentives include decreased buffer distances to property lines and increased permit terms (10 years as opposed to five years) so that private entrepreneurs would have an easier time finding financing options.

DES also added a full time position to provide technical assistance to municipalities and raise awareness of the importance of septage management issues. The septage coordinator also helps to facilitate opportunities for public and private partnerships in order to create new facilities.

Innovative/Alternative Onsite Systems

All innovative/alternative systems for on-site treatment or disposal of wastewater below the ground need approval from DES under the provisions of New Hampshire Administrative Rule Env-Wq 1024, which allows general and provisional approvals. In 2006 DES's Water Division established an Innovative/Alternative Subsurface Technology Committee consisting of various technical and legal staff to oversee the evaluation and approval process.

DES Outreach

Wastewater infrastructure and wastewater, in general, do not typically draw the same passion at municipal meetings as a debate on building a new school or buying new fire vehicles. Communities tend to look upon wastewater as a necessary nuisance and wastewater infrastructure is taken for granted. DES outreach aims to increase awareness of the need for proactive measures to address local wastewater and septage needs. Fact sheets and seminars discuss the status of aging plants and pending permitting requirements for the WWTFs. The outreach also helps communities extend the useful life of their existing WWTFs and plan for the next generation of wastewater treatment.

9.3.3 Illicit Discharge Investigations

In 1996 DES initiated illicit discharge detection investigations in an effort to address pollution discharges to storm drainage systems. The coastal watershed communities were the first to undergo these investigations, followed by the Merrimack River watershed in 2001.

The typical procedure for conducting illicit discharge investigations includes the following steps.

1. Illicit discharge investigations begin with a meeting between DES staff and the local department of public works personnel in the municipality where the survey will take place. Storm drainage infrastructure maps are a good starting point for a discussion.
2. DES and/or Department of Public Works (DPW) staff identify hot spots and prioritize survey areas.
3. DES and/or local staff conduct dry-weather field screening to look for non-stormwater discharges in the storm drain outfalls.
4. Water quality tests are conducted to see if the non-stormwater discharges are illicit discharges.
5. DES and/or DPW staff track down the source(s) and remove the illicit discharge(s).
6. Where pollution sources are found, staff work with appropriate parties on remediation, which often requires technical and financial assistance. In some cases, regulatory compliance and enforcement is warranted.

In the coastal watershed DES's role has shifted from conducting initial investigations to assisting municipalities and other organizations in their efforts to find and eliminate illicit discharges. DES trains and assists local personnel and follows up on complaints and discharges of unknown origin that are not resolved by local programs. The New Hampshire Estuaries Project has been providing grant funds to coastal communities to eliminate illicit discharges since 2000.

As noted in Chapter 10 – Stormwater, 38 New Hampshire municipalities and non-municipal entities are required under the federal NPDES Stormwater Phase II program to develop and implement programs to eliminate illicit discharges.

9.4 Stakeholder Recommendations

This section contains key recommendations that have been developed in concert with a group of volunteer stakeholders that have reviewed and contributed to this chapter.

9.4.1 Take Action to Get the Most Out of the Existing Wastewater Infrastructure

DES should redouble its efforts to encourage the implementation of the following strategies to extend the life of existing wastewater infrastructure.

- Promote water conservation, together with control of infiltration and inflow, as the most effective means of reducing wastewater infrastructure operation and maintenance cost.
- Ensure that all wastewater utilities review capacity, management, operations, and maintenance programs to identify general areas of strength and weakness.
- Promote community on-site wastewater disposal systems.

9.4.2 Start Planning Early for the Next Generation of Wastewater Infrastructure

DES should pursue a holistic wastewater infrastructure planning strategy that encompasses a broad range of environmental considerations, employs the most appropriate technologies, and receives the necessary public support. Such a strategy would include the following components.

- Employ energy saving technologies, such as methane gas recovery, solar powered aeration equipment, etc.
- Consider how changing climate conditions may affect wastewater infrastructure.
- Consider the positive and negative impacts of wastewater treatment and discharge on groundwater and surface water. To minimize hydrologic impacts, strive to keep wastewater local to the extent practical. Where appropriate, direct some or all of the flow of treated wastewater to groundwater rather than surface waters.
- Consider the need to remove emerging contaminants from wastewater.
- Educate the public regarding the vital role of the wastewater infrastructure in protecting environmental quality and quality of life.
- Attract the next generation of wastewater treatment plant operators to the profession.

9.4.3 Promote the Use of Onsite Treatment Technology in Ways that Protect Environmental Quality

Encourage Continuing Innovation in Onsite Treatment Technology

Given that an estimated 80 percent of new development in New Hampshire is taking place in non-sewered areas, the acceptance of effective innovative technologies plays a critical role in enabling development to employ effective onsite technologies while minimizing site disturbance and returning wastewater flows to the local hydrologic system. In order to encourage continuing innovation, DES's Innovative/Alternative Subsurface Technology Committee should ensure that the approval process for innovative technologies is not overly onerous.

Create and Maintain a Uniform Regulatory Environment for Onsite Systems

DES's siting and design requirements for onsite systems are based on the latest technical information about the performance of these systems in the environment. Many municipalities impose greater setback distances with the objective of enhancing protection of water resources, but such setbacks often have unintended consequences, such as forcing septic systems onto less-than-ideal soils and slopes. To dissuade municipalities from adopting such restrictions, DES needs to do a more effective job of educating local officials about the technical soundness of DES's siting and design requirements, as well as its regulatory program. Encouraging municipalities to rely on the requirements of DES's Subsurface Systems Bureau rather than creating additional local setbacks or design requirements for onsite systems would promote a more uniform regulatory environment.

Consider Establishing a Certification Program to Evaluate Septic Systems

Practices among home inspectors and septic designers and installers vary in terms of how existing septic systems are evaluated to determine whether they are functioning as intended, either in the context of a pending property sale or a complaint regarding a system suspected of failure. While DES is working with Granite State Designers and Installers Association to voluntarily standardize such practices, it may be desirable to establish a formal training and certification program for professionals conducting septic system evaluations to ensure that appropriate standards and practices are employed.

9.4.4 Continue Efforts to Eliminate Discharges of Untreated Sewage Where Cost Effective

Both combined sewer overflows (CSOs) and illicit discharges result in the discharge of untreated sewage to the state's waters, a situation that stymies the state's goals of protecting human health and the environment. Elimination of these legacy discharges will require continued efforts by DES, communities with CSOs, and MS4s regulated under the federal NPDES program (see Chapter 10 – Stormwater). As noted in section 9.1.3, a combination of strategies to reduce pollutant loads may sometimes be more cost-effective in improving water quality than eliminating every last CSO.

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