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Study of Community Wastewater Disposal Alternatives for the Town Center, Westford, Vermont

Final Report

Stone Project Number 061854-W

Prepared For:

Town of Westford,
Wastewater Committee
1713 VT Route 128
Westford, Vermont

Prepared By:

Stone Environmental, Inc.
535 Stone Cutters Way
Montpelier, Vermont 05602
Phone / 802.229.1884
Fax / 802.229.5417
E-Mail / amacrellis@stone-env.com

Green Mountain Engineering, Inc.
1438 South Brownell Road
Williston, Vermont 05495
Phone / 802.862.5590
E-Mail / ahuizenga@gmeinc.biz

Yellow Wood Associates, Inc.
228 North Main Street
St. Albans, Vermont 05478
Phone / 802.524.6141
E-Mail / shanna@yellowwood.org

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EXECUTIVE SUMMARY

The Town of Westford, Vermont used a grant from the Vermont Department of Environmental Conservation to hire the consultant team of Stone Environmental Inc. (Stone) Green Mountain Engineering (GME), and Yellow Wood Associates (YWA) to conduct a wastewater feasibility study for the Town Center area, located along Route 128. Westford's Town Center is a rural residential community located between Essex Junction and Fairfax. The study area includes 78 properties, most of which are developed with single-family residences. Property sizes range from less than 0.1 acre to over 250 acres. The entire study area covers about 1,000 acres.

The Town Center's natural features pose both opportunities for and limits to the construction and successful operation of onsite wastewater disposal systems. The closeness of the Browns River to many properties is an attractive natural feature that significantly limits where nearby onsite systems can be located. The soils that underlie the study area also pose significant limitations for onsite systems, including areas of shallow groundwater and shallow bedrock. Only about 7% (70 acres) of the soils in the study area is suitable for conventional on-site wastewater treatment systems. Properties in the study area are served by individual onsite water supplies, consisting of shallow springs or drilled wells. In order to protect the drinking water, no onsite systems can be constructed within a protective buffer zone surrounding each well or spring.

The Town Center's residences and amenities are all served by individual onsite sewage disposal systems. Information on the existing sewage disposal systems was gathered from Vermont Department of Environmental Conservation (DEC) Regional Office files, property owner survey questionnaires, interviews, and area site visits.

The consultant team conducted a needs assessment for the Town Center study area to determine whether each individual property could support an onsite septic system under the current local zoning ordinances and state wastewater disposal rules. **The assessment was conducted using planning level information; no access to private property was requested or granted during the study, and no private properties were entered upon to gather data or confirm study results.** This assessment combined spatial information, such as topography and soils information, with local information like parcel boundaries, building footprint areas, locations of water supplies, and building uses, to determine what constraints each property might contain for onsite wastewater treatment and disposal. The needs assessment results were confirmed by reviewing other sources of information collected during the study. This review resulted in an overall recommendation for each property of either maintaining and upgrading a system onsite, or connecting to an offsite solution.

Of the 78 parcels in the study area, there are 42 parcels that can support an onsite wastewater disposal system under the assumptions used in this report and under current zoning ordinances and State wastewater disposal rules. These parcels met all the environmental setbacks required by the Town and the state, as well as depth to groundwater and bedrock criteria. The GIS analysis estimated that 36 parcels could not support an onsite wastewater disposal system. Of these parcels, 5 were constrained by only environmental setbacks and 19 parcels were constrained only by shallow groundwater. The remaining 12 parcels had a combination of setback and groundwater constraints. Although water supply setbacks had the greatest impact on onsite systems' suitability that was related to the area available on a parcel, many area-limited parcels also had shallow groundwater restrictions. Thus, a community wastewater treatment solution that maintains existing septic systems and replaces individual water supplies with a community well is unlikely to alleviate wastewater capacity issues in the study area.

Slightly less than half (46%) of the properties within the study area could benefit from an offsite wastewater treatment solution. Parcels with both groundwater and available area limitations are clustered primarily in the immediate vicinity of the Town Common. Some form of small community system may be needed in the future to meet the needs of these properties. However, comparing the results of the GIS assessment to wastewater permits issued in the study area indicates that property owners are already taking steps to responsibly dispose of wastewater on their own properties.

Six areas were identified within the Town Center zoning district that appeared to have some potential as sites for community wastewater disposal systems. Upon closer investigation, however, all of the sites have significant limitations. Some sites have good soils for wastewater treatment but are located in floodway fringe areas, while others require stream crossings that are prohibited by the Town's current zoning ordinance. The remaining site with good potential is located half a mile away from the Town Common and the route for the wastewater pipe would go through areas of shallow bedrock, necessitating significant and expensive ledge removal.

In light of the limited feasibility that a community wastewater disposal solution could be designed at a cost that the Town would find reasonable, several alternative strategies for managing wastewater and supporting the Town's land use goals in the Town Center zoning district are offered, specifically:

- Encourage the proper maintenance of existing wastewater treatment systems in the study area;
- Encourage creative solutions, like easements or water supply relocations, between neighboring landowners to solve problems related to available-area related restrictions; and
- Investigate sharing existing wastewater treatment capacity, both for Town owned properties and between individual landowners.

1. INTRODUCTION

The Town of Westford, Vermont received a grant from Vermont Department of Environmental Conservation to conduct a wastewater feasibility study for the Town Center area located along Route 128 near the center of the Town (Figure 1).

The objectives of the study are to:

- Determine whether each parcel can support an onsite wastewater system that conforms to Town and State regulations;
- Identify areas where construction of new onsite or offsite systems are needed, or would be necessary if new development occurs;
- Identify potential cluster system sites;
- Develop and analyze engineering system and/or management alternatives;
- Prepare preliminary conceptual plans and cost estimates;
- Develop preliminary funding and user fees;
- Make recommendations on structural or management options; and
- Provide information to the residents and local officials on current and potential future conditions.

Stone Environmental Inc. (Stone) and Green Mountain Engineering, Inc. (GME), with Yellow Wood Associates (YWA), were hired to conduct this study. This report provides information on each of the objectives above.

1.1. Education and Outreach

Education and outreach efforts are important in this study for several reasons. Many owners with onsite water supply and sewage disposal systems are typically aware of what type of system they might have, and what they may need to know about how to properly use and maintain it. Beyond that, they may not understand that since older properties were developed, scientists, engineers, and regulators have learned more about how these systems function and about how, if installed in the wrong conditions or under the wrong design specifications, they can negatively affect groundwater and surface water quality.

An initial public meeting was held (September 20, 2007) on the basics of how systems work, how to maintain them, and how they can impact the environment and water supply wells. A handout describing this study and some basic information was developed and distributed at the meeting. (Appendix B). A property owner survey questionnaire was also developed and distributed to the study area property owners along with the handout. The results of the survey are summarized in Table 1. The response rate for the surveys was 52% or 32 out of 61 surveys mailed (so 3% approximately equals one response). Besides collecting important information on sewage disposal systems and water supplies, we asked whether property owners had any questions or concerns about the Town Center's wastewater needs. Most of the respondents left the question blank or had no comment (74%); 9% support development of a small community system to support current and future land use around the Town Common; 6% supported the use of approved alternative technologies; and 3% expressed concern about the cost of a possible municipal system. A second public meeting to present the results of the study will be held on April 30, 2008.

Another approach to outreach and education is a wastewater advisory committee. The committee includes a member of the Selectboard, a member of the Planning Commission, and four local residents. The members of the Westford Wastewater Committee are listed in Appendix A. The committee met several times during the course of the project to take part in more detailed discussions on the study scope and results.

2. STUDY AREA DESCRIPTION

The study area includes parcels within the Town Center zoning district, located near the center of the Town of Westford. Westford is located in Chittenden County in the northwest portion of the state. Figure 1 shows the Town and the study area in their wider geographical context. Table 2 includes a list of properties within the study area including parcel identification numbers, street addresses, owner names, property uses, and approximate parcel sizes.

2.1. Community Profile

Westford is a rural residential community located between Essex and Fairfax in northwest Vermont. The Town is bordered by Fairfax to the north, Underhill to the east, Essex to the south, and Milton to the west. The Town Center is primarily residential, with a few small businesses, and is surrounded by woods and agricultural land.

The Town of Westford's population has grown from 1,740 in 1990 to 2,086 in 2000 (US Census). There was an approximately 20% increase in Westford's population in this ten year period. While Westford's rate of population growth may be slowing somewhat, it appears that the Town's population will continue to grow into the future. The current population is an all-time high for the Town.

The Westford Town Center study area includes 78 properties and a total of about 1,000 acres. Forty-six properties contain single-family residences, 1 property contains a camp, and 16 properties are undeveloped. There is also a store with an apartment, two small apartment units, and there are several public buildings including the post office, Town offices, library, the Old Brick Meeting House, the Westford United Church, and the elementary school. Property sizes range from less than 0.1 acre to over 250 acres.

2.2. Natural Resources

Natural features can pose both opportunities for and limits to the construction and successful operation of decentralized wastewater disposal systems. These features, such as topography, surface waters, and soils, are described below with particular attention to their impact on the potential for onsite wastewater disposal in the Town Center. Figure 2 identifies environmental sensitivities within the study area.

2.2.1. Topography

The topography of the study area consists mostly of gently rolling terrain (Figure 1). Most of the developed portion of the Town Center lies in a north-south lying valley formed in part by the Browns River. Generally, elevations range from around 380 feet above mean sea level (AMSL) where the Browns River leaves the Town Center area to 800 feet AMSL on an unnamed hill west of the Town Common.

2.2.2. *Surface Water*

Most of the properties in the study area are near the Browns River, which runs from south to north through the Town Center (Figure 2). Morgan Brook runs from northeast to southwest along the eastern boundary of the study area, then turns back to the north and empties into the Browns River near the Town Common. Several small, unnamed streams run primarily from south to north through the study area, all of which discharge to the Browns River. The Browns River is listed as a "Class B" water in Vermont's Water Quality Standards, meaning that its waters should be managed to achieve and maintain a level of quality that fully supports uses including:

- Aquatic biota, wildlife, and aquatic habitat
- Aesthetics
- Public water supply (with filtration and disinfection)
- Irrigation of crops and other agricultural uses
- Swimming and other primary contact recreation
- Boating, fishing and other recreational uses

The river is not listed on the state's impaired waters list (also known as the "303(d) list"), meaning that it is likely currently meeting the standards required of a Class B water.

2.2.3. *Soils*

There is a range of soil types in the study area. Soils vary based on geologic material, slope, hydrology, human disturbance, and other factors. The best generalized source of soils data for this area is the Soil Survey Report of Franklin County prepared by the Natural Resource Conservation Service (NRCS). The NRCS data was derived by mapping the landscape with spot field checks to arrive at an approximate level of resolution of 3 acres, with acknowledged inclusions of other soils. This report describes the soil series, or groups of soils with common properties, found in the study area.

The NRCS soils information is planning-level data, and the 3-acre resolution means that it is not very precise for small parcels of land. Site-specific testing, including backhoe test pits and/or percolation tests, would be required to determine the proper wastewater treatment options for an individual property.

For the purposes of this assessment, we are primarily concerned with the properties of the soils that determine suitability for the siting of onsite septic systems: depth to seasonal high groundwater, depth to bedrock, soil permeability, and slope. Figure 2 shows the soils in the study area and vicinity. Soil characteristics are summarized in Table 3.

There are significant portions of the Town Center study area that have limited suitability for conventional subsurface wastewater disposal systems. Based on the NRCS soils information, it appears that only about 7% (or about 70 acres) of the land in the study area is suitable for a conventional disposal system under current State rules. Given that a football field is about an acre in area, 70 acres seems like a lot—but some of this suitable area is already used for wastewater disposal, while other parts may have slopes too steep to be used for wastewater treatment (see Section 5.4 for more discussion of these land areas).

Approximately 1% of the study area would require either mound systems or mounds with curtain drains due to the high groundwater table. A significant proportion of the land in the study area (47%) would require both some form of advanced pre-treatment and a mound disposal system, primarily to overcome limitations due to high seasonal water tables. About 38% of the land in the study area would require some form of 'best fix' solution. 'Best fix' means that if the property is already developed and its wastewater treatment system fails, it may not be possible to construct a replacement system that meets all of the conditions of Vermont's current wastewater treatment rules. If a property with these difficult soils is undeveloped, it may not be developable.

2.3. Water Supplies

Onsite wells can limit onsite wastewater capacity because of the required protective setbacks between water supply wells and wastewater disposal systems. Most properties in the study areas are served by individual onsite water supplies, consisting of shallow springs or drilled wells. The locations of water supplies in the study area were gathered from property owner surveys, from state permits, and from a walking tour of the study area. These individual water supplies with their 100 foot or 150 foot protective buffers are shown on Figure 2. Water supply information from the sources described above is also summarized on Table 5. Approximately 7 of the properties are served by shallow water supplies; at least 40 of the developed properties are served by drilled wells; and a shared drilled well serves the library and Town offices. A public drilled well serves the elementary school.

The water supply information currently available does not account for all of the developed properties within the study area. Water supply information was not available for 13 of the developed properties.

2.4. Zoning Districts

The study area is defined by the boundary for the Town Center zoning district. The purpose of the Town Center District is “to provide for a community center, a place of civic pride, and a focal point for development in the Town” (Westford zoning bylaws, January 2006). Minimum lot sizes in this district are 1.0 acre for each family dwelling unit of principal structure, or 0.5 acre for units in an elderly housing development—significantly smaller than in other districts in the Town.

The Flood Hazard District, shown on Figure 2, is meant to encourage maintenance of flood hazard areas for open space uses that complement the use and development of adjacent areas. Floodway fringe areas along the Browns River and Morgan Brook that are within the Town Center zoning district are included in this overlay district. Of potential importance to this study is the requirement that “on-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding. The lowest elevation of the wastewater distribution field shall be located at least 1 foot above the base flood elevation.”

Significant land in the study area is also located within the Water Resources Overlay District. This district is meant to protect the quality and character of Westford's water related resources, including wetlands, rivers, streams, and ponds. The overlay district creates a 100-foot buffer zone around all these water resources within which new development, including placement of septic system components, is not allowed. This requirement is stricter that what is required by the state’s rules for individual septic systems.

3. HISTORIC AND CURRENT WASTEWATER TREATMENT

Westford's Town Center is served by individual onsite sewage disposal systems. There are no wastewater treatment plants or sewers in the study area. Information on the existing sewage disposal systems was gathered from state Regional Office files, the property owner survey questionnaires, interviews, and area site visits.

This section includes some general information on onsite sewage disposal systems, how they function and need to be maintained, and some information on newer components, including advanced treatment systems, which can improve wastewater treatment where soils contain limitations. We will then discuss the information gathered from permit files and other sources, as well as the information collected from the surveys.

3.1. Onsite System Components and Maintenance

Onsite sewage disposal systems, when properly sited, installed, and maintained, can be a long-term effective means of wastewater treatment and disposal. However, they can negatively impact surface waters and groundwater when they malfunction or when they are placed too close to the groundwater table or surface waters.

3.1.1. Wastewater Treatment and Distribution

The traditional onsite septic system in the study area (and around Vermont) includes a 1,000 gallon concrete **septic tank**, a concrete distribution box, and a leach bed or leach trenches. The septic tank settles out the solids and provides some treatment; the distribution box splits the flows evenly between pipes or trenches, and the leach bed or trenches (made out of crushed stone or alternative materials with perforated pipe covered with filter fabric) along with the unsaturated soils below the system provide the final distribution and treatment.

Effluent filters can now be added to the outlets of septic tanks, and are required on new tanks. These filters screen solids from the effluent when it leaves the tank. If the tank is full of solids, the filters will plug and the system will slow or back up before solids leave the tank and enter the disposal field. The filters need to be hosed off usually once a year.

Pump stations can be added after the septic tank if the disposal field is higher in elevation than the building outlet, or for mounds and advanced treatment systems. Pressurizing the disposal field also allows for improved distribution of the effluent, making more efficient use of the entire field.

Advanced pre-treatment components can be added after the septic tank to improve wastewater treatment prior to disposal. Pre-treatment components may also allow for increased capacity of onsite systems, which maximizes available soil resources, or may allow for the use of sites not previously approved under the Rules. Since August 2002, the Vermont Environmental Protection Rules (Rules) have contained a process through which pre-treatment technologies can be approved for use in the state. Since the revised Rules were implemented, several different technologies have been approved by DEC and are available for designers to consider (a list of all approvals can be found at http://www.anr.state.vt.us/dec/ww/innovative.htm). A designer should think about the availability of component parts, local service providers, and ongoing operation and maintenance costs when considering or recommending any particular component. Pre-treatment technologies can add $5,000-$10,000 to the construction cost of a system, and because they need to be maintained regularly in order to operate properly, their ongoing costs are often higher than those of a conventional septic system.

3.1.2. Wastewater Dispersal Options

Traditional wastewater dispersal options in Vermont include drywells, in-ground leachfields, and mound systems. The survey responses indicated that approximately 3% of the respondents had drywells, which typically follow septic tanks and consist of concrete cylinders with open bottoms and holes in the sides, surrounded by stone, which holds the wastewater until it disperses into the ground. Two concerns with drywells are that they typically contain a small volume and can be undersized for their intended uses, and that they are usually quite deep in the soil profile, sometimes close to 10 feet. For drywells to comply with current regulations, the soil conditions must be suitable at a depth of four feet below the system. These conditions are rather unusual on many Vermont sites, including most of the soils identified in the study area.

Most people are familiar with in-ground leachfields and mound systems. These dispersal options both provide treatment within gravel trenches (or gravel beds) and in the unsaturated soil beneath the trenches. A traditional **leachfield** is usually dosed by gravity, where effluent flows from the septic tank to the leachfield based on how much water flows into the septic tank from the structure. An in-ground leachfield requires 36 inches of unsaturated soil between the bottom of the leachfield and groundwater, and 48 inches to bedrock. Since the trenches are usually 24 inches deep, this means at least 5-6 feet of good soil are needed for an in-ground leachfield to work properly.

A **mound** system is used where site conditions are more difficult. Unlike in-ground leachfields, they are dosed using pressure, usually from a pump tank or siphon placed between the septic tank and the disposal field. The "mound" is built out of sandy material, which provides additional unsaturated soil for wastewater treatment between the gravel bed or trench and the limiting condition (groundwater or bedrock). To be used without any additional pretreatment, a mound system needs at least 18 inches of undisturbed, unsaturated soil between the ground surface and the groundwater or bedrock.

Some newer wastewater dispersal options in Vermont include **at-grade systems** and **subsurface drip irrigation**. At-grade systems are dosed using pressure, like a mound system, but the gravel trenches or bed are built on the existing soil surface and then covered with native soil from another part of the site. Since the trenches are built on top of the existing ground surface, they need 4 feet of good soil (less than is needed for an in-ground system). Subsurface drip irrigation was approved in Vermont in 2007, and uses small-diameter, flexible tubing with widely spaced "emitters" to distribute treated wastewater effluent. Because of the small diameter of the emitters, wastewater must be pre-treated using an advanced treatment technology if subsurface drip dispersal is to be used. However, this technology can be installed without the use of gravel beds, making it a viable option in small spaces where earth-moving equipment cannot gain access. Since pre-treatment is required, subsurface drip irrigation can be used as a filtrate system (see below).

If advanced pre-treatment technology is used on a septic system, Vermont's Rules allow the use of a dispersal system called a **filtrate system**. The term "filtrate" acknowledges that the pre-treatment component has already done much of the work that the soil would normally do in a traditional septic system, and so less treatment is required of the soil. Filtrate systems may consist of any approved wastewater disposal technology, but smaller sizes are allowed (up to ½ the area of traditional in-ground leachfield, at-grade system, or mound system), which can be important on small lots. Pre-treatment may also eliminate the need for a mound system in situations with shallow groundwater or bedrock limitations, since reductions in the vertical separations to limiting soils are also gained when pre-treatment is used.

Vermont's Rules also allow for the design and permitting of **performance based systems** on sites with 18 inches of soil above bedrock and as little as 6 inches of soil above the seasonal high water table. These systems almost always involve advanced pre-treatment and a mound wastewater dispersal system, and the Rules require significant monitoring and reporting to ensure that the systems operate properly.

3.1.3. Operation and Maintenance of Wastewater Treatment Systems

Operation and maintenance of conventional sewage disposal systems is quite simple. Operation or use of the system can be greatly enhanced by the use of water conservation devices and developing appropriate habits, such as only doing one load of laundry a day and eliminating in-sink garbage disposals. Keeping records of the locations of buried components, tank pumpouts, and repairs can be crucial during a system inspection and is invaluable information for future owners of the system.

Maintenance on conventional systems consists of having someone check the levels in the septic tank and pumping it out when necessary. For the homeowner, this usually means calling the septic tank pumper and always paying for a pumpout, whether it is really necessary or not; homeowners can avoid this unnecessary expense by checking the tank themselves. Depending on the use of the system, it may need to be pumped every year to every seven years. The condition of the tank, particularly its baffles and access, should also be inspected. If there are multiple tanks or pump station tanks, these should be inspected regularly and pumped when necessary. Any electrical parts should be inspected yearly. The effluent filters also need to be checked and cleaned on a yearly basis.

Maintenance of tanks is a lot easier when access to the tank is not a problem, as when the tank is buried under a couple of feet of soil. If the top of the tank is deeper than 12 inches below the surface, access risers should be installed on the tank. In the past the risers were constructed of thick heavy concrete, but lightweight plastic and fiberglass materials for risers are now available, although child safety must be considered.

Another maintenance item is to check the **distribution box** and make sure all of the outlet pipes are level. If this box is not level (which can easily happen in Vermont's freezing climate), one portion of the disposal field may be overloaded while other parts go unused. There are plastic devices available that can easily be installed to make the outlet pipes level.

The disposal field itself should be checked for seepage or surfacing of effluent, or for water loving plant growth. If there is untreated wastewater surfacing or discharging into a ditch or surface waters, there is a real public health hazard that should be addressed immediately. Although not typical in Vermont, some disposal fields (leach fields) include monitoring pipes so that the stone in the disposal field can be checked for ponding. Some ponding of treated wastewater in the field can be acceptable, but if the system has a thick clogged mat or is being hydraulically overused the wastewater system may surface or back up.

As septic systems become more complex, it becomes even more important to make sure that they are operating properly. Since the more complicated systems are often installed to overcome difficult site conditions, like shallow groundwater, there is less of a ‘margin of safety’ if the system malfunctions before sensitive resources such as shallow groundwater are negatively impacted. Systems that use pumps to distribute wastewater effluent, like at-grade or mound systems, should be checked at least once a year to make sure that the pumps are cycling and operating properly. The maintenance requirements for pre-treatment systems vary with the individual technology, but should include at least one inspection per year. Most technology manufacturers sell maintenance contracts with their systems to ensure that the pre-treatment units keep functioning properly after they are installed.

3.2. State Permit Programs & File Reviews

Given the age of most structures in the Town Center study area, there was a surprising amount of information in the State Department of Environmental Conservation (DEC) permit files. Several properties have received permits for subdivision, or for renovations that included changes to the septic systems. Permits were found for all public buildings in the study area, except for the United Church and the general store. Stone conducted a review of the files at the District 6 Regional Office in Essex Junction. A summary of the available permit information is shown in Table 4.

3.2.1. Town Permits

The Town of Westford records State (DEC) permits in their paper files and land records. Since Town permits essentially duplicate information available in the State permits, the Town’s permit files were not reviewed further.

3.2.2. State Permits

Stone reviewed the DEC permit files in the Essex Junction Regional Office for permits for public buildings (almost any occupied building except a single family residence) and for subdivisions that are less than 10 acres in size (since 1969). A total of 27 permits were found for 19 parcels in the study area. Most of these permits were for subdivisions or new construction. Several of the permits reviewed were for upgrades to existing systems, and at least one appeared to represent a “best fix” situation.

3.3. Property Owner Survey

The main goal of the property owner survey was to obtain information regarding existing water supplies and septic systems. The survey was mailed to Town Center area property owners in mid-August 2007. Of the 63 surveys sent, we received responses from 32 owners (52%). Table 1 contains a summary of the responses.

The data collected from the individual surveys were very useful to the project consultants during the assessment process. The survey provided information about ages and types of septic systems, when septic tanks were last pumped, and repairs or plans on file.

Information about types and locations of water supplies and indications of water quality were also collected.

Approximately 13% of the respondents' onsite systems were constructed prior to 1982, when the first major technical design standards for Vermont were published. Sixty-eight percent of the properties contained leach fields, and one respondent (3%) had a drywell. Five mound systems and two advanced treatment units were identified in the study area. About half of the septic tanks were two or more feet below grade, which means they are difficult to access unless they have access risers on the tanks, and it means that the leach fields may be deeper in order for gravity flow to reach the field. More than half of the responding property owners (58%) said they have a copy of the sketches, plans, or permits for their system.

Three questions were directed towards maintenance of septic tanks and system repairs. Approximately half (48%) of the respondents indicated they pumped their tanks every 1 to 5 years. Eighty-six percent indicated they pumped their tank since 1995, with 73% pumping since 2000. Twenty percent of the respondents indicated upgrades or repairs to their systems within the last ten years.

Seventy-four percent of the owners rely on individual drilled wells, 23% on a shallow well or spring, and one respondent (3%) uses a shared or community water well. Many indicated always having good quality (84%), but a small number (10%) indicated that they had problems with their water quality in the past, mostly due to bacterial contamination of shallow wells or springs.

4. NEEDS ASSESSMENT

The needs assessment portion of this study includes a data-driven Geographic Information System (GIS) analysis that combines spatial information, such as USGS topography and NRCS soils information, with local information such as parcel boundaries, building footprint areas, and building uses, to determine what, if any, constraints a property may contain for onsite wastewater treatment and disposal. The results of the GIS analysis are indicated on Figure 3 by colors summarizing the key constraint(s), if any, for each property.

The results of that analysis were confirmed by including all other sources of information collected and described in Section 3. This review resulted in an overall recommendation for each property of either maintaining and upgrading a system onsite, or potentially connecting to an offsite solution. The property-specific recommendations do not reflect the current actual conditions of the individual wastewater treatment systems in the study area, and no access to private property to inspect individual systems was requested or granted for this study. A recommendation of "connecting to an offsite solution" simply means that, if an individual system were to fail in the future and need replacement, it may be difficult to site a replacement system on the property that meets all of the setbacks and separation distances that are required by the current local zoning ordinances and State wastewater rules. The results of this assessment are summarized on Table 5 and on Figure 3.

Following is a detailed description of the Needs Analysis and a summary of the results for the study area.

4.1. Data-Driven GIS Needs Analysis

The Needs Analysis was performed to identify parcels that may not be suitable for onsite septic systems. There are two main components to the needs analysis: an "available area" analysis and a "required area" analysis, each of which is described below.

The objective of the available area analysis was to identify which developed parcels would be constrained by inadequate lot size if required to install an upgraded onsite system. There are many factors that result in areas of a parcel being unavailable for construction of an onsite system. For example, state and local regulations require that certain "setbacks" or distances from natural or artificial features be maintained in order to protect those resources. One such setback is a required separation of 100 feet from surface waters and wetlands. It is because of setback regulations that the total area on a parcel is significantly reduced when determining which areas are suitable for onsite systems. A second and equally important part of determining if a parcel has enough suitable land area to support an onsite system is the analysis of the soil conditions on the parcel to determine the area required to treat the wastewater flows from the parcel. Both the determination of available area and that of required area for onsite systems for each developed parcel were addressed by the study team. The last step identified those properties with soil conditions where the seasonal high groundwater table was 24 inches or less or where the depth to bedrock was less than 24 inches. Both of these conditions impact the type of onsite system that may be built.

The following assumptions and criteria were used to conduct the needs analysis.

4.1.1. Available Area Analysis

The first step in the assessment of suitable areas was to determine the available area on each developed parcel. This process involved both analyses of GIS data to identify areas unsuitable for onsite system development, as well as complex database operations to identify parcel features that might further limit onsite system development. The table below lists each of the setbacks of features examined in the available area analysis. Each of these features will be briefly discussed.

Area Analysis Criteria

Feature	Required Setback (ft)
Town Water Resource Overlay District	100
Top of embankment, or slope greater than 30%	25
Bedrock Escarpments	25
Property line	25
Zone 1 Source Protection Area-School Wells	1,000
Private wells-spring, dug well	150
Private wells-drilled well	100

Source: Vermont Environmental Protection Rules, Wastewater System and Potable Water Supply Rules, 2007; Westford Zoning Regulations, 2007.
3/12/04 ANM

1. Water Resource Overlay District: The Town of Westford's zoning bylaws require a 100-foot setback from all water resources (lakes, streams, rivers, and wetlands). Septic system components are not allowed within this district.
2. Top of Embankment, or Slope greater than 30%: Areas with slopes of greater than 30% were identified from the GIS Digital Elevations dataset. These areas were spatially buffered with the indicated setback distance using GIS.
3. Bedrock Escarpments: Bedrock Escarpments were obtained from the Chittenden County soils dataset. Escarpments were spatially buffered with the indicated setback distance using GIS.
4. Property Lines: Property lines were obtained from the Westford GIS parcel dataset. Property lines were spatially buffered with the indicated setback distance using GIS.
5. Private Water Supplies: Private water supply information was collected from spatial data sources, from permit files, and from property owner survey results. All known drilled and shallow wells were included in the available area

analysis. Spatial well locations were obtained from the State Water Supply GIS dataset. Each water supply point was spatially buffered with the indicated setback distance using GIS. For parcels where spatial well data was unavailable, information acquired from the property owner survey and from wastewater permits was used to identify the type of water supply. For those properties with the location of a private water supply indicated, the well location was digitized and each water supply point was spatially buffered as described above. For parcels that are developed but have no water supply information available, a well buffer equal to half the setback distance was subtracted from the parcel area. This reduction in the well setback is equivalent to assuming that a portion of the area resulting from a standard setback would overlap adjacent parcels and other buffer areas on a small lot. It is likely that overall, this method underestimates the well shield areas required by the state's Water Supply Rules for the protection of drinking water supplies. Under these rules, a shield-shaped area that extends uphill from the circular buffer shown on the maps (250 feet uphill for drilled wells, 500 feet uphill for shallow wells or springs) is required to be set aside for groundwater protection. The GIS analysis tools are not capable of drawing such shields for each water supply, so the circular "radius" buffer is used instead. This assumption may result in some properties with private wells appearing to have more area available for an onsite system than is actually the case. For undeveloped properties without water supply information, no water supply buffer was assumed to exist..

6. Building Footprints: Building footprints were digitized from the available orthophotographs, supplemented by field observations for construction completed since the photographs were taken (in 2003). The building footprints were buffered using GIS, and their areas were included in the analysis as areas unavailable for onsite systems.
7. Available Area Calculation: The total available area for a parcel was determined by subtracting an assumed building footprint area from the area of the parcel outside the required setback buffers as calculated by the GIS analysis. In addition, private well buffer areas were subtracted for those parcels whose private wells were not located in the GIS assessment. This calculation is shown in the following equation:

Area Available = Parcel Area – Required Setback Buffer – Building Footprint – Private Well Buffer

4.1.2. Required Area Analysis

The required area for construction of an onsite system was determined from two primary pieces of information: 1) Soil properties (percolation rates and long-term acceptance rates) for each parcel, 2) Design parameters for each onsite system. Assumptions made regarding the determination of each of the inputs to the required area calculation are described below.

4.1.2.1. Soil Properties

Percolation rates and long-term acceptance rates (LTAR) were calculated for each soil type within the study area. We assigned average percolation rates using the soil textures from the NRCS soils data and the average rates listed in the Vermont Indirect Discharge Rules. Each parcel was assigned the properties of the predominant soil type for purposes of determining the required area.

4.1.2.2. Onsite System Design Assumptions

Where suitable soils existed, the onsite system was assumed to be a standard trench leach field design. The standard Vermont Wastewater System and Potable Water Supply Rules long-term application rate (LTAR) effluent loading rates were used in the sizing of the leach field. A standard three-foot wide trench, with four feet separation was used as the typical layout. This resulted in a range of areas needed for the leach field depending on the soil's assumed percolation rate. For soils where only mound systems would be feasible, an estimate of the required area for a mound disposal system was calculated using the LTAR values for mounds specified in the Rules. It was assumed that if a leach field (or mound) could be successfully sited on the property there was adequate area for other system components, such as septic tanks and distribution boxes.

4.1.3. Area Analysis Assessment

The available area for an onsite system was compared to the required area for each parcel. The required area for a system was based on the predominant soil type on the parcel. Parcels were identified as area limited if the available area was less than the required area. Parcels were identified as being unconstrained by area when the available area was greater than or equal to the required area.

4.1.4. Seasonal High Groundwater Analysis

An additional GIS analysis was conducted for parcels with potential groundwater limitations. Soils with groundwater depths of less than 24 inches would require a raised system, such as a mound, and would indicate a constraint to a typical subsurface system. A parcel was identified as having a groundwater limitation if the area of the parcel with a groundwater depth of greater than 24 inches represented an area smaller than that required for a conventional onsite system. This analysis may overestimate site limitations regarding depth to groundwater, as it does not account for filtrate systems, alternative systems, or desktop hydrogeologic analyses that may be used under the EPRs.

4.1.5. Depth to Bedrock Analysis

Depth to bedrock was assessed to identify parcels with potential bedrock limitations. Parcels with shallow bedrock, of less than 24 inches, would require additional fill to allow an onsite system to function properly. A parcel was identified as having a bedrock limitation if the area of the parcel with a depth to bedrock of greater than 24 inches represents an area smaller than that required for a conventional onsite system.

4.2. GIS Analysis Results

The results of the analysis are represented on Figure 3 and summarized on Table 5 in the section titled Environmental Assessment Results. The factors affecting the analysis results are included in the table. Of the 78 parcels in the study area, there were 42 parcels that can support an onsite wastewater disposal system under the assumptions listed above. These parcels met all the environmental setbacks required in the Area Analysis Criteria table in section 4.1.1 as well as the depth to groundwater and bedrock criteria described in Sections 4.1.4 and 4.1.5.

There were 36 parcels that the GIS analysis estimated could not support an onsite wastewater disposal system. Of these parcels, 5 were constrained by only environmental setbacks, 19 parcels were constrained by only shallow groundwater, and none were constrained by only shallow bedrock. The remaining 11 parcels had a combination of setback and groundwater constraints.

A total of 16 parcels, mostly located around the Town Common, were constrained by the area restriction of proximity to water supplies. If a property is constrained by an area restriction but has suitable soils for wastewater treatment, it can often be more cost-effective to maintain individual wastewater systems while installing a community water supply system. Eleven of these parcels were also constrained by shallow groundwater, however, so using the community water supply approach would not necessarily allow increased development or redevelopment that required increases in wastewater disposal capacity.

A total of 13 parcels were constrained by the area restriction of proximity to surface waters. Nine of these parcels were also constrained by shallow groundwater. The remaining four parcels, while not constrained by shallow groundwater, were all constrained both by proximity to water supplies and to surface waters. In all four cases, the parcels are relatively small (less than 1 acre) and have significant land within the floodway fringe areas of the Browns River or Morgan Brook. Three of these parcels, however, have wastewater permits that were issued by the Vermont DEC (see Figure 3 and Section 4.3).

4.3. Lot-by-Lot Review and Recommended Solutions

Once the results of the GIS analyses were produced, a lot-by-lot review was conducted. This review included using all of the additional information known about the properties, confirming the results of the GIS analyses, and developing recommended solutions for each parcel. Onsite solutions are recommended for most properties that did not have any constraints identified in the GIS analyses. However, approximately a quarter of the properties identified as constrained in the GIS analysis have a state wastewater permit, usually for a mound or an advanced treatment system. These properties are noted on Figure 3.

This is a planning level study and no onsite inspections or soils testing were conducted. If more detailed results are desired, additional onsite evaluations will be necessary.

The results of the needs assessment for the Town Center (Figure 3; Table 5) indicate that slightly less than half (46%) of the properties could benefit from an offsite wastewater treatment solution. Parcels with both groundwater and available area limitations are clustered primarily in the immediate vicinity of the Town Common, indicating that some form of small community system may be needed in the future to meet the needs of these properties. However, comparing the results of the GIS assessment to wastewater permits issued in the study area indicates that property owners are already taking steps to responsibly disperse wastewater on their own properties.

5. WASTEWATER TREATMENT DESIGN CRITERIA AND CLUSTER SYSTEM OPTIONS

Onsite and offsite wastewater treatment systems currently come under a number of different state regulations. Design considerations for individual onsite and small and large community cluster wastewater collection, treatment, and disposal systems are discussed. Changes in the rules and regulations are described, including key information about system designs and site conditions.

Design criteria for onsite wastewater systems are contained in two sets of regulations: The Environmental Protection Rules (EPRs), and the Indirect Discharge Rules (IDRs). Following is a summary of important rule requirements. The latest versions of the EPRs and the IDRs were used to estimate wastewater flows from the study area based on available information and the results of the needs analysis discussed in Section 4.

5.1. Environmental Protection Rules

The latest revisions to the EPRs became effective on September 29, 2007. These rules apply to decentralized wastewater disposal systems with design flows of less than 6,500 gallons per day (gpd) and to sewer connections for any design flow. Important changes were made in many areas of the EPRs, including the implementation of universal jurisdiction and the 'clean slate', an overall re-organization of the EPRs to improve readability, and the addition of several alternative technologies.

With the latest revision to the EPRs, wastewater systems and potable water supplies that were previously exempt from state regulation may be required to obtain a permit for activities such as:

- new construction (including single family residences that need sewage disposal and/or water);
- construction or modification of a wastewater system and/or potable water supply;
- new connections to an existing wastewater system and/or potable water supply;
- subdivision of land; and
- repair or replacement of a failed wastewater system and/or potable water supply.

Vermont is the last state in the nation to implement this kind of permit requirement for all properties statewide. This is often referred to as the state having "universal jurisdiction" over sewage and water.

The legislation includes a "clean slate" exemption that basically grandfathers all buildings, campgrounds, lots, wastewater systems, and potable water supplies that were in existence before January 1, 2007. A permit is now required when any action is taken on or after January 1, 2007 that needs a permit. If the wastewater system or potable water supply fails, a variance from the rules is available if no fully complying replacement can be found. (This is often referred to as a "best fix" situation, see Section 3.1.) This provides relief for a number of properties that currently are unmarketable due to non-compliance with the rules.

New, clearer definitions are provided for "failed" water supplies and wastewater systems. This is important because anyone with a failed system now needs a repair permit and also has a defect in their property title.

The EPRs now include general approvals for the use of constructed wetlands and subsurface drip distribution systems for the disposal of wastewater in addition to the different types of alternative systems allowed through product-specific approval. The general use approvals enable these innovative/alternative components to be used when designing wastewater systems.

Other changes to design requirements that may be useful to landowners in the study area include:

- Reduction in minimum design flow for a single family residence to 2 bedrooms (from 3 bedrooms). This will allow smaller wastewater systems to be built.
- If a primary disposal system is designed and constructed with pressure distribution that can handle 150% of the design flow, no replacement area is required. This change will enable some lots that were not developable (because they lacked the space and soils needed to site the required identical replacement system) to be developed.
- If a mound system is designed and constructed for 100% of the design flow, no replacement area is required. Designers and engineers have advised that, in nearly every case, failed mounds can be replaced or restored to full function on the original footprint. This also means that properties with mound systems and replacement areas that were permitted before the 2007 rule revision may be able to subdivide or redevelop property that was previously at its maximum wastewater treatment capacity.
- Composting toilets are now specifically allowed in the EPRs, and there is no longer a requirement that a project have enough area to build a septic system even though a composting toilet is proposed. The new rules also allow a smaller leachfield to be used for graywater only when a composting toilet is proposed.
- Language has been added to make clear that water and wastewater systems may not be constructed within a floodway and that construction requirements apply when constructing within the flood plain. This brings the EPRs closer in line to what the Town already requires for land within the Flood Hazard Overlay zoning district.

5.1.1. Disposal System Options

Many options are available for the dispersal of treated wastewater from decentralized systems under the EPRs. Leach trenches or seepage beds are commonly utilized under favorable site conditions (those having percolation rates of between 1 and 60 minutes per inch and at least 5-6 feet to seasonal high groundwater levels and bedrock). At-grade and mound dispersal systems are generally used where minimum site conditions are met, but the site conditions are not favorable enough for the design of subsurface systems. Finally, filtrate effluent disposal systems may be used when secondary treatment is a component of the wastewater system. Any of the previously discussed soil-based dispersal systems are permissible as filtrate systems; further, loading rates may be increased and vertical separation distances from bedrock and seasonal high water tables may be reduced if the treated effluent meets certain standards (see Section 3.1 for more detail on wastewater dispersal options).

Spray dispersal (disposing of treated wastewater into native soil by surface application, using sprinklers) may also be used under the EPRs for systems with design flows of up to 6,499 gpd. A continuous impeding layer beneath more permeable soils must underlie a spray dispersal site, and the treated wastewater must be chlorinated before dispersal. While these site conditions are likely to be found in and near the study area, there are also significant requirements for winter storage of wastewater that may be difficult to meet.

5.2. Indirect Discharge Rules

Since January 1990, wastewater treatment systems with design flows of 6,500 gpd or greater are regulated under Chapter 14 of the EPRs, commonly known as the Indirect Discharge Rules or IDRs. The IDRs are used to permit septic tanks and leach fields, and also treatment plants and spray disposal systems, which use soil as part of the wastewater treatment process. Following primary and/or secondary treatment, the soil provides final effluent polishing and renovation before it reaches groundwater and, eventually, surface water. This is in contrast to direct discharge systems, which may discharge through a pipe directly to surface waters.

Any flows directed to a cluster wastewater treatment system with design flows of greater than 6,500 gpd that is constructed to support development which was already complete as of May 17, 1986 will likely be considered an "Existing Indirect Discharge" under the IDRs. The DEC is required by statute to issue a permit for existing indirect discharges unless they find that the discharge is causing a violation of the Vermont Water Quality Standards. This application category, however, is limited to indirect discharges already occurring in 1986 and thus may not be suitable if significant new development is desired within the study area.

Any community wastewater treatment system constructed in the study area to support both existing and new development will be considered a "System with New Indirect Discharge".

If wastewater dispersal sites with design flows of greater than 6,500 gpd are located near the Browns River, they may be considered "Systems with New Indirect Discharges to Class B Waters" under the IDRs. These systems are required to obtain an indirect discharge permit before construction begins. In order for a permit to be issued, the Town of Westford must demonstrate that the new discharge:

- will not significantly alter the aquatic biota of the receiving waters;
- will not pose more than a negligible risk to public health;
- will be consistent with existing and potential beneficial uses of the waters; and
- will not violate Water Quality Standards.

The Town must also document compliance with the Aquatic Permitting Criteria, the Reliability Permitting Criteria, and the Public Health Protection Criteria as stated in the IDRs before a permit will be issued. The larger a proposed cluster system is, the more likely it is to trigger additional hydrogeological and biological testing and monitoring requirements. Permits issued under the IDRs typically include effluent monitoring and downgradient groundwater monitoring requirements.

The latest IDRs, which became effective in April 2003, represent the first significant revision to the rules since their inception in 1990. These revisions were based on a review of the data collected on indirect discharge systems and were also meant to streamline the permitting process and to increase latitude to permittees in the operation of their systems. Following is a brief description of some key changes.

A General Permit is allowed for systems with design flows of 15,000 gpd or less and that do not require a certified operator to manage the system. This change streamlines the permitting process without any loss of oversight, because the General Permit still requires annual inspections and reporting of system failures.

Significant changes were made to the Aquatic Permitting Criteria. Sampling for nutrient parameters (total dissolved phosphorus and nitrate-nitrite nitrogen) will still be required, but sampling for other parameters that did not often appear in groundwater near permitted systems (such as total chlorine, biological oxygen demand, and total kjeldahl nitrogen) is no longer required. Changes were also made to the methods by which an applicant may demonstrate compliance with the Aquatic Permitting Criteria. A new method (the Dilution Method) was added, and the applicability of the Treatment Index and Modified Site Specific Methods has been expanded to include more potential projects. These alternatives to the more complex and costly Site Specific Method provide a range of options for projects with smaller design flows that do not appear to have the potential for significant environmental impact.

5.3. Wastewater Flow Projections and Land Required for a Community System

An estimated wastewater flow projection was developed for the properties surrounding the Town Common, in order to better understand the costs involved to provide for both current property uses and up to 10% future growth. Flow values were developed using the design flow tables in the current (2007) version of the EPRs. The design flow estimate was made for 40 housing units (at 245 gpd/unit), or a total of 9,800 gpd. With 10% growth, the total design flow was 10,780 gpd. Since this estimated flow is greater than 6,500 gpd, the system would be permitted under the Indirect Discharge Rules, and alternating disposal fields would probably be required. Thus, the disposal system would need to be designed for two times the design flow, or about 20,000 gpd. This design flow would translate to an estimated required in-ground leachfield area of about 80,000 square feet (roughly 2 acres). A community wastewater dispersal system using a mound would require a larger land area, but the exact area needed is dependent on the slope of the individual site and a number of other factors. Thus, the land area needed for a community mound system was not estimated.

5.4. Potential Suitable Areas for Offsite Cluster Wastewater Disposal Systems

Several areas of land within and near the Town Center study area were considered as potential cluster system sites (Figure 4). All of these areas were at least two acres in size. Some of the criteria used in evaluating sites for cluster systems included:

- Well suited soils over an area large enough to support a community leachfield
- Relatively flat or moderate slopes
- Proximity to properties recommended for offsite solutions
- Environmental issues such as downgradient water supplies, surface water crossings, floodways and floodplains
- Physical issues such as access, bedrock depths for collection system, and bridge or river crossings
- Local knowledge of properties
- Other permit issues

No on-site evaluation of any of the potential suitable areas discussed below was conducted during this study. The permission of the individual landowners would be needed before any site-specific evaluations could occur.

Two areas with soils that are potentially suitable for offsite community wastewater disposal systems were identified north of Brookside Road. Area 1 consists of Colton and Stetson soils and Stetson gravelly fine sandy loam, suited for conventional in-ground systems, and is located on two parcels (Figure 4). Portions of the Colton and Stetson soils may be limited by steep slopes (up to 60% slope). There is a small unnamed stream located immediately to the east of Area 1. If a wastewater disposal system with design flows of greater than 6,500 gallons per day were sited here, the unnamed stream would be the 'receiving water' under the IDRs, and it may be difficult to meet the Aquatic Permitting Criteria with such a small receiving water. There are also a number of water supplies, both springs and drilled wells, located to the east of Area 1. While the unnamed stream should act as a hydrologic divide, protecting these water supplies from potential impact by a community wastewater treatment system, further hydrogeologic investigation would be required to confirm this finding. Since this area is located at a higher elevation than most of the properties that would be served by a community wastewater solution, it would be necessary to pump the wastewater up to the disposal field. Additionally, a stream crossing would be necessary in order for the sewer line to cross the unnamed stream.

The second potential area along Brookside Road, Area 2, has similar soils to those underlying Area 1, but with gentler slopes (Figure 4). There is a mapped wetland overlying part of the soils in this area, suggesting that the wastewater treatment capacity of at least some of the soils here may be more limited than what is shown in the soil survey data. The water supply serving the house down-slope from Area 2 is unknown, so it is difficult to determine whether it would be impacted if a community wastewater disposal system were to be constructed at this site. Area 2 is located at a higher elevation than most of the properties which would be served by a community wastewater treatment system at this site, so it would again be necessary to pump the wastewater up to the disposal field. While a stream crossing would not be necessary, Area 2 is almost half a mile from the Town Common, so the costs for installing pressurized force-main to transport the wastewater to the disposal site would be high. There are also several areas of bedrock outcrops along Brookside Road between the Town Common and Area 2, indicating that significant ledge removal may be necessary in order to accommodate the line.

Area 3 is located on open land immediately south of the Town Common. Although this area has the advantage of being located very near the area likely to be served by a community wastewater disposal system, and is at a similar elevation to much of the potential service area, it is underlain by Munson and Belgrade silt loam soils with shallow groundwater limitations, meaning that a mound system (and possibly advanced pre-treatment) would be necessary to construct a community system on this site. A portion of Area 3 is also located in the Flood Hazard Overlay zoning district, so any wastewater system constructed in that portion of Area 3 would need to be modified to be above the base flood elevation. If the community wastewater treatment system had a design flow of greater than 6,500 gpd, the Browns River would be the 'receiving water' under the IDRs, so the Town would need to prove that any system constructed here could meet the Aquatic Permitting Criteria before the system was constructed.

The Town Common (Area 4) initially seemed a good site for a community wastewater dispersal system, since it was centrally located and undeveloped. However, the soils underlying the Common are extremely limited, and an underdrain system was recently installed beneath the entire area to improve drainage. Since the entire area has underdrains installed, the construction of wastewater treatment systems would not be allowed.

An area of open land located southeast of the Town Common (Area 5) was also initially considered as a potential community wastewater dispersal site. The site consists of gently sloping Agawam fine sandy loam soils suitable for conventional in-ground wastewater dispersal, and has an elevation lower than much of the likely service area, so much of the wastewater could be transported to the site by gravity. However, Area 5 is bordered on three sides by the Browns River, so it is located almost entirely within the Flood Hazard Overlay zoning district and significant portions of the site are within the 100-foot Water Resource Overlay zoning district. Both these districts limit the area available to locate a wastewater treatment system on this site. The landowner advises that a portion of the site is already being used to treat wastewater from the home on this property.

An area of open field located southeast of the Town Garage (Area 6) also holds potential as a community wastewater treatment site. This land is underlain by Stetson gravelly fine sandy loam soils, which are likely suited for conventional in-ground wastewater disposal. In order to use this site, wastewater would need to be collected from around the Town Common area, probably by gravity, and then transported across the Browns River and up to the site through a force main. The soils along the probable route of the force main do not appear to be constrained by shallow bedrock, but without a more detailed assessment it is difficult to say how much ledge removal might be needed for this option.

Of the six sites which were initially considered, the three areas closest to the Town Common (Areas 3, 4, and 5) are not suitable for a community wastewater system. The remaining three areas have soils and site conditions that are potentially suitable, but have other attributes that make their use difficult. Areas 1 and 6 would require a stream crossing as part of the construction project, which is not allowable under the current zoning bylaws. (If the Town wishes to move forward with a project in the future, it may be prudent to revisit this provision in the zoning bylaws, since directional drilling and other less invasive technologies can now be implemented to reduce or eliminate disturbance to streams during installations that require stream crossings.) Area 2 would not require a stream crossing, but its distance from the Town Common and the presence of shallow bedrock along the Brookside Road force main route both would significantly increase construction costs.

5.5. Investigating Constructing a Community Wastewater Treatment Solution

An alternative to sharing solutions between property owners or encouraging changes in property use (see Section 6) is to encourage new homes and businesses in the Town Center zoning district by constructing a community wastewater collection and treatment system to serve properties around the Town Common. In order to understand what the costs of such a solution might be, we estimated that the collection and treatment system would serve approximately 40 existing residences and businesses in the Town Center, and allow 10% capacity for future growth (the basis for flows was described in Section 5.3). For costing purposes, we assumed that the system would include approximately 3,600 linear feet (l.f.) of gravity sewer collection, a pump station and river crossing, approximately 1,600 l.f. of sewer force main to a nearby (+/- ¼ mile) mound disposal system. A total project cost for a system of this nature may be on the order of $ 2.2 million, including construction costs, land costs, design and construction phase engineering, and legal and administrative costs.

A more detailed feasibility study, including site-specific testing of the potential wastewater dispersal sites discussed in Section 5.4, would be needed in order to further refine this cost estimate. The final project costs could be lower if, for example, a suitable site very close to the Town Common was found, or it was learned that the wastewater flows could be split between several smaller disposal sites. However, costs could also shift higher if, for example, site-specific monitoring were needed to comply with the Indirect Discharge Rules or if extensive pre-treatment was needed in order to utilize a particular disposal site.

Deciding to move forward with a community wastewater treatment solution is a major decision that should be made by the entire interested community, after careful consideration of all possible options. A needs assessment, like the one provided by this study, is a good first step and provides important facts for the community decision making process.

6. COMMUNITY WASTEWATER MANAGEMENT ALTERNATIVES, RECOMMENDATIONS, AND RESOURCES

Given the limitations of the range of potential community wastewater disposal sites, the Committee decided not to move forward with a traditional engineering alternatives analysis. Instead, they asked the consultant team for information on a range of alternatives to the construction of larger community systems that would still support development or redevelopment in the Town Center study area, and that might also be transferable to other areas of the Town.

Information about several different alternatives for community wastewater management in the Town Center study area are provided in this section, as well as some recommendations for next steps that the Town could take if a decision is made to pursue the construction of a community wastewater treatment solution. Even without a "construction solution", there are still several ways that the Town can encourage growth and creative development in the Town Center.

6.1. Encourage Proper Maintenance of Existing Systems

The answers provided to the survey conducted for this study (Section 3.3) showed that respondents were generally knowledgeable about how to operate and maintain their wastewater treatment systems. However, not all owners responded to the survey, so it is hard to know whether all property owners in the study area understand how to care for their wastewater treatment investment. Several brochures (prepared by National Small Flows Clearinghouse) are included in Appendix C detailing the components, operation, and maintenance of on-site wastewater systems. While the operation and maintenance of conventional sewage disposal systems is simple, it is crucial that property owners are aware of necessary maintenance procedures to maximize the useful-life of the system and avoid costly repairs. We recommend that property owners be supplied with these three brochures, as they prove to be valuable resources. At a minimum, the brochures can be made available for interested parties in the Town Offices.

6.2. Encourage Creative Solutions for Area-Related Restrictions

It is sometimes possible to work with neighboring landowners to overcome area-related wastewater treatment restrictions, such as separation distances from property lines or water supplies. The Westford Planning Commission has in the past required applicants to replace or relocate water supply wells already installed on neighboring properties, so that an applicant could build a wastewater disposal system that would otherwise be located within the isolation distance of the pre-existing well. The result is that a previously restricted parcel can be developed, and the neighbor gets a new well. Similarly, it may be possible to locate a septic system less than 25 feet from a property line if an easement on a neighboring property is acquired.

6.3. Investigate Sharing Existing Wastewater Treatment Capacity

The wastewater needs analysis conducted for this project indicated that up to 46% of the properties in the Town Center study area may not be able to meet current regulatory requirements if, in the future, property owners need to repair their systems or want to do something with their property that requires additional wastewater treatment capacity. Therefore, it may be beneficial for the Town to investigate the option of shared treatment systems between neighboring property owners. For example, the consultant team understands that the Brick Meeting House has additional wastewater treatment capacity that is currently not being utilized. Review of the approved Wastewater permit indicates that as much as 420 gpd may be available for use by adjacent property owners. This un-committed capacity would be suitable for a three bedroom single family residence.

Alternately, the un-committed wastewater treatment capacity in the Brick Meeting House's system would also be sufficient to accept the wastewater currently being generated from the Town Offices and the library. The wastewater treatment system serving these two structures appears to be operating properly, but the in-ground disposal system is located beneath the parking lot to the east of the Town Offices. While the system does appear to be operating properly now, driving cars or heavy equipment over in-ground wastewater disposal systems is discouraged, as this can cause crushed pipes, compaction, and premature failure of the disposal system. Additionally, if the parking lot is re-graded or paved in the future, the disposal system could easily be destroyed, necessitating expensive repairs.

Although a wastewater disposal permit was not located for the Westford United Church, the parcel contains some soils that are suitable for conventional wastewater disposal (Figure 2). There may be some opportunity for sharing of wastewater capacity on this property similar to that discussed for the Brick Meeting House.

7. OTHER CONSIDERATIONS FOR INCREASING DEVELOPMENT DENSITY IN THE TOWN CENTER

One way to create a more diverse range of property uses within the Town Center area without constructing new wastewater treatment infrastructure is to change the use of existing buildings. Property owners can apply to the Vermont DEC for a change in use for systems that have existing "grandfathered" flows. Part of a house could be converted into a business that used a bedroom's worth of wastewater treatment capacity without any need to expand the wastewater system. By the same token, an entire single family home could be converted to a business that used a home's worth of wastewater treatment capacity without needing to expand the system. Table 6 shows several examples of the kinds of businesses that could be feasible using one bedroom's worth of wastewater treatment capacity (which is 140 gpd), and the same examples if a three-bedroom home (with 420 gpd worth of capacity) were converted to that business.

TABLE 6: Examples of Possible Home Business Ventures With Existing Wastewater Capacity

Business type	Use possible with 1-bedroom conversion	Use possible with 3-bedroom conversion
Office	9 employees	28 employees
Day care facility (no meals)	2 care providers, 7 children	4 care providers, 24 children
Day care facility (1 meal)	1 care provider, 6 children	3 care providers, 18 children
Doctor's office	2 staff, 7 patients	4 staff, 28 patients
Post office	9 employees	28 employees
Retail store	9 employees	28 employees
Tavern or café	4 seats	12 seats

Property owners within the Town Center zoning district, and in other areas of Town, may also be able to leverage recent changes in the State's septic system rules (EPRs) to increase development density on their properties. Some of the changes in the latest version of the EPRs may have the effect of encouraging subdivision and changes of use to a small extent within the Town Center study area. In the 2007 EPRs, both the per-bedroom and required minimum design flows have been reduced from what was required in the 1996 version of these rules. Recently permitted systems may be able to slightly increase their capacity so long as the systems comply with the other current requirements of the EPRs. For example, the design flow for a 3-bedroom house under the 1996 EPRs was 450 gpd; under the 2007 EPRs the same house would be permitted for 420 gpd. The resulting increase in wastewater capacity (30 gpd) would be enough to support an additional two employees in a 1-bedroom office conversion.

With the 2007 rule revision, properties with mound systems that were permitted with fully complying replacement areas may in some cases be able to subdivide their properties without conducting additional test pits to find more wastewater treatment capacity. Replacement areas are no longer required for mound systems. Any new subdivision of land would, however, still need a permit from the Vermont DEC.

8. REFERENCES

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TABLES AND FIGURES

Study of Community Wastewater Disposal Alternatives for the Town Center
Town of Westford, Vermont
TABLE 1: Summary of Survey Responses Regarding Wastewater Needs
Surveys Mailed: 61, Surveys Returned: 32, Response Rate: 52%

Survey Question	Response	Number of Responses	% of Responses
1.	How many people live or work in the building served by your wastewater treatment system?		
	0 (vacant land)	3	10%
	1-2	11	35%
	3-4	12	39%
	5-6	4	13%
	7-8	1	3%
	more than 8	1	3%
2.	If the building served by your wastewater treatment system is a residence, how many bedrooms does it have?		
	1-2	4	13%
	3-4	20	65%
	5-6	2	6%
3.	Is there more than one septic system on your property?		
	No	28	90%
	Yes	1	3%
4.	Please indicate when your septic system was originally installed.		
	1970-1981	4	13%
	1982-1989	3	10%
	1990-1995	3	10%
	1996-2001	4	13%
	2002-present	5	16%
	Before 1970	4	13%
	Unsure	6	19%
5.	Please indicate any upgrades or repairs that have been performed on your septic system within the last ten years.		
	None or blank	23	74%
	Other repair	5	16%
	Replaced the leachfield	1	3%

Source: Property owner surveys, Stone and Yellow Wood Associates, 2007.
Date/init: 10/18/07 anm
Path: O:\Proj-06\1854-W-Westford\Data\Westford_Project_Data.mdb [rptTable1_SurveyResults]

STONE ENVIRONMENTAL, INC

Study of Community Wastewater Disposal Alternatives for the Town Center
Town of Westford, Vermont
TABLE 1 (cont.): Summary of Survey Responses Regarding Wastewater Needs
Surveys Mailed: 61, Surveys Returned: 32, Response Rate: 52%

Survey Question	Response	Number of Responses	% of Responses
6.	Please indicate the components of your septic system.		
	Advanced treatment unit	2	6%
	Concrete septic tank	28	90%
	Distribution box (d-box)	7	23%
	Dry well	1	3%
	Leachfield	21	68%
	Mound	5	16%
	Other	1	3%
	Other septic tank	1	3%
	Pump station	6	19%
	Unknown	2	6%
7.	How often is the septic tank pumped?		
	1-2 years	1	3%
	3-4 years	14	45%
	5-7 years	8	26%
	More than 7 years	4	13%
7a.	Year that septic tank was last pumped?		
	2000	2	6%
	2001	1	3%
	2002	2	6%
	2003	1	3%
	2004	2	6%
	2005	4	13%
	2006	7	23%
	2007	4	13%
	Before 2000	4	13%
7b.	What company pumps your septic tank?		
	Envirotech	3	10%
	Other	10	32%
	P & P Septic	10	32%
	Senesac	3	10%

Study of Community Wastewater Disposal Alternatives for the Town Center
Town of Westford, Vermont
TABLE 1 (cont.): Summary of Survey Responses Regarding Wastewater Needs
Surveys Mailed: 61, Surveys Returned: 32, Response Rate: 52%

Survey Question	Response	Number of Responses	% of Responses
8.	How deep below the surface is your septic tank?		
	0-1 foot	3	10%
	1-2 feet	7	23%
	2-3 feet	10	32%
	More than 3 feet	6	19%
	Unsure	3	10%
9.	Have you ever experienced any of the following conditions in or around your leach field or drywell?		
	None	26	84%
	Surfacing sewage or effluent	3	10%
10.	Have you ever experienced sewage back up into a building?		
	No	28	90%
	Yes	1	3%
10a.	If Yes, has the situation been corrected?		
	Yes	1	3%
10b.	If Yes, please briefly describe how the situation was corrected.		
	Describe in comment	1	3%
11.	Do you have a copy of any sketches, plans or permits of your septic system available for reference?		
	No	18	58%
	Yes	11	35%
12.	Do you have any plans to change the way your property is used?		
	No	26	84%
	Yes	3	10%
13.	If sewage capacity was not an issue, is there anything you would want to do with your property that you can't do now?		
	No	23	74%
	Yes, describe in comment	6	19%
14.	Do you have more than one water system on your property?		
	No	26	84%
	Yes	3	10%

TABLE 1 (cont.): Summary of Survey Responses Regarding Wastewater Needs
Surveys Mailed: 61, Surveys Returned: 32, Response Rate: 52%

Survey Question	Response	Number of Responses	% of Responses
15. Does the second water system on your property serve you or another landowner?			
	Another landowner	2	6%
	Me	1	3%
16. Please indicate which type of water system you have.			
	Individual drilled well	23	74%
	Individual dug well	3	10%
	Individual spring	4	13%
	Shared drilled well	1	3%
17. Have you ever had contamination problems with the water supply system(s) on your property?			
	No	26	84%
	Yes (describe in comment)	3	10%
18. Have you ever run out of water?			
	Every few years	1	3%
	Never	28	90%
19. If you have ever run out of water with your current system please briefly describe the circumstances.			
	Describe in comment	2	6%
20. Do you have any comments regarding wastewater management in Westford?			
	No or blank	23	74%
	Yes (describe in comment)	6	19%
21. Sketch of property included, with locations of septic system and well?			
	No sketch	2	6%
	Sketch completed	27	87%
22. Contact information provided?			
	No	6	19%
	Yes (add in comment)	23	74%

Study of Community Wastewater Disposal Alternatives for Westford Town Center

Town of Westford, Vermont

TABLE 2: Study Area Description

Parcel ID	Property Location	Owner or Contact Name	Acres	Property Description
05CU004.	21 BROOKSIDE RD	UNITED CHURCH OF WESTFORD	2.5	Church
05BS001.	22 BROOKSIDE RD	MATTHEW COBB & ROSEMARY SHEA	2	Single Family
05BS002.	29 BROOKSIDE RD	JASON & PAMELA HOOVER	1.34	Single Family
05BS004.	33 BROOKSIDE RD	FRANCIS & CAROL BARKYOUMB	1.27	Single Family
05BS003.	36 BROOKSIDE RD	RICHARD & JANET GOLDEN	3.55	Single Family
05BS004.A	37 BROOKSIDE RD	FRANCIS & CAROL BARKYOUMB	1.27	Single Family
05BS006.	41 BROOKSIDE RD	PAUL ROBERGE	1.3	Single Family
05BS005.	42 BROOKSIDE RD	EDWARD & JULIETTE HORTON	8.1	Single Family
05BS007._1	62 BROOKSIDE RD	PATRICK & AMBER HALLER	7.2	Vacant Land
05BS007._2	62 BROOKSIDE RD	PATRICK & AMBER HALLER	7.2	Single Family
05BS010._1	123 BROOKSIDE RD	ROBERT JACKSON	201.3	Single Family
05BS010._2	123 BROOKSIDE RD	ROBERT JACKSON	201.3	Vacant Land
05BS009.	146 BROOKSIDE RD	TOWN OF WESTFORD	77.6	Town-Owned: Elementary School
05BS009.A	146 BROOKSIDE RD	TOWN OF WESTFORD	20.3	Town-Owned: Vacant Land
05BS012.	167 BROOKSIDE RD	DAVID & SANDRA ASHLEY	77	Single Family
05BS018.	201 BROOKSIDE RD	JAY LEONARD & BARBARA THURSTON	0.9	Single Family
05CM003.	2 CAMBRIDGE RD	CHARLOTTE VINCENT & KATHLEEN SAWYER	1.7	Single Family
06CM005._1	18 CAMBRIDGE RD	ARMANDO & LINELL VILASECA	3	Single Family
06CM005._2	18 CAMBRIDGE RD	ARMANDO & LINELL VILASECA	3	Vacant Land
06CM004.	35 CAMBRIDGE RD	TOWN OF WESTFORD	14	Town-Owned: Town Garage and Fire Dept.

Source: Town of Westford Grand List, 2006.

Notes: Parcel acreage is from the Assessor's list. If data was unavailable, the value was left blank.

Path: O:\Proj-06\1854-W-Westford\Data\Westford_Project_Data.mdb [rptTable02_StudyAreaProperties]

Date/init: 10/18/07 anm

TABLE 2 (continued): Study Area Description

Parcel ID	Property Location	Owner or Contact Name	Acres	Property Description
06CM007.	42 CAMBRIDGE RD	LAURENT & DORIS LAVALEE	77.9	Single Family
05CC001.	16 CHACE LANE	STUART & CHRISTINA ASHLEY	10	Single Family
05VL014.	4 COMMON RD	DAVID & SUSAN ADAMS	0.3	Single Family
05VL012.	10 COMMON RD	KEVIN & SUZANNE KEARNS	0.5	Vacant Land
05VL010.	16 COMMON RD	BETH ALLEN	1	Single Family
05VL008.	20 COMMON RD	BERNARD & SHERYL FLEURY	13.8	Single Family
05VL006.	26 COMMON RD	NORMAN SPILLER	1.7	Single Family
06HU001.	4 HUNTLEY RD	HUGH & PHOEBE CLARK	1.1	Single Family
06HU003.	12 HUNTLEY RD	HUGH & PHOEBE CLARK	11.5	Camp
06CM006._1	2 OLD #11 RD	KENNETH & CHRISTINE O'DONNELL	7	Single Family
06CM006._2	2 OLD #11 RD	KENNETH & CHRISTINE O'DONNELL	7	Vacant Land
06EL004.	39 OLD #11 RD	RICHARD LAVALLEE	2.45	Single Family
06OS006.	1246 OSGOOD HILL RD	ALEXANDER & ALLISON WEINHAGEN	0.7	Single Family
06OS004.	1248 OSGOOD HILL RD	THOMAS WOLFE & JANET JAFFE	0.65	Single Family
05PO001.	2 POST RD	CHERYL , EMIL & JEAN AHOKAS	1	Single Family
05PO002.	5 POST RD	EDWARD & FRANCIS VONTURKOVICH	10.06	Apartment and Post Office
05PO004.	6 POST RD	DAVID & PATRICIA KUHFAHL	31.2	Single Family
05PD001.	1760 VT Route 128	Paul Birnholz	5.4	Vacant Land
05PD003.	1760 VT Route 128	Paul Birnholz	6.2	Vacant Land
05TW056._1	1478 VT RT 128	DONALD & DALE POULIOT	265.5	Vacant Land
06OS001.	1601 VT RT 128	THEODORE LAVALLEE	3.49	Single Family
05TW054._1	1602 VT RT 128	ELAINE LAVALLEE REVOCABLE TRUST	102.7	Single Family

Source: Town of Westford Grand List, 2006.
Notes: Parcel acreage is from the Assessor's list. If data was unavailable, the value was left blank.
Path: O:\Proj-06\1854-W-Westford\Data\Westford_Project_Data.mdb [rptTable02_StudyAreaProperties]
Date/init: 10/18/07 anm

TABLE 2 (continued): Study Area Description

Parcel ID	Property Location	Owner or Contact Name	Acres	Property Description
05TW054._2	1602 VT RT 128	ELAINE LAVALLEE REVOCABLE TRUST	102.7	Vacant Land
06TW065.	1613 VT RT 128	PHILIP GUARE & SUSAN HOULE	3.9	Single Family
05TW063.	1621 VT RT 128	SHIRLEY & MADELINE MINOR	1.7	Single Family, 1 apartment
05TW054.B	1630 VT RT 128	DAVID MARK LAVALLEE	4.7	Vacant Land
05TW052.A	1640 VT RT 128	CHRISTOPHER & JESSICA SIMAYS		Single Family
05TW061.	1641 VT RT 128	BARTLETT & LINDA WILLEY	0.62	Single Family
05TW052.	1650 VT RT 128	CHRISTOPHER HOWARD & JOY ATWOOD-HOWARD	2	Single Family (rental)
06EL002.	1650 VT RT 128	ROGER LAVALLEE REVOCABLE TRUST	85	Vacant Land
05TW057.	1659 VT RT 128	RAYMOND BELAIR	0.79	Single Family
05TW050._1	1670 VT RT 128	TOWN OF WESTFORD	1.3	Town-owned: Vacant Land
05TW050._2	1670 VT RT 128	TOWN OF WESTFORD	1.3	Town-owned: Vacant Land
05TW055.	1671 VT RT 128	GREGORY & LESLEY LARSON	0.7	Single Family
05TW053.	1677 VT RT 128	PATRICIA INDOE	7.4	Single Family
05TW048.	1678 VT RT 128	SHIRLEY & MADELINE MINOR	1.2	Apartments: 3 units
05TW051.	1681 VT RT 128	IRA & LIVONA ALLEN	0.9	Single Family
05TW049.	1685 VT RT 128	BRICK MEETING HOUSE	0.056	Brick Meeting House
05TW047.	1689 VT RT 128	RICHARD & CHERYL SWANSON	0.9	Single Family
05TW045.	1691 VT RT 128	KEVIN & SUZANNE KEARNS	0.06	Store and Apartment
06CM002.	1693 VT RT 128	DOUGLAS FRINK & NORA SABO	0.5	Single Family
05CM001.	1695 VT RT 128	THOMAS & CHERYL DUNKLEY/ CHRISTOPHER & ANDREA MCBRIDE	0.32	Apartments: 4 units

Source: Town of Westford Grand List, 2006.
Notes: Parcel acreage is from the Assessor's list. If data was unavailable, the value was left blank.
Path: O:\Proj-06\1854-W-Westford\Data\Westford_Project_Data.mdb [rptTable02_StudyAreaProperties]
Date/init: 10/18/07 anm

TABLE 2 (continued): Study Area Description

Parcel ID	Property Location	Owner or Contact Name	Acres	Property Description
05TW043.	1705 VT RT 128	ROLAND & NETTIE PIGEON	3.3	Single Family
05VL001._1	1713 VT RT 128	TOWN OF WESTFORD	3.6	Town-owned: Office and Library
05VL001._2	1713 VT RT 128	TOWN OF WESTFORD	3.6	Town-owned: Town Common
05VL001._3	1713 VT RT 128	TOWN OF WESTFORD	3.6	Town-owned: West of Town Common
05TW041.X	1715 VT RT 128	MARY CAVANAUGH	0.6	Single Family
05TW039.	1723 VT RT 128	ROBERT VAUGHAN & DENISE BRICKELL	1.69	Single Family
05TW039.AX_1	1729 VT RT 128	JOEL & MARY FAY	11.41	Vacant Land
05TW039.AX_2	1729 VT RT 128	JOEL & MARY FAY	11.41	Single Family
05TW037.	1737 VT RT 128	ARTHUR VIGIL	0.6	Single Family
05TW046.	1738 VT RT 128	SUSAN SCHMIDT & THOMAS ORFEO	1.15	Single Family
05PO006.	1750 VT RT 128	MICHELLE & BRIAN MARTIN & CHRISTOPHER & ROSEMARY PERRY	15.62	Vacant Land
05TW035.	1760 VT RT 128	PAUL BIRNHOLZ	51.7	Vacant Land
05TW035.A	1797 VT RT 128	ELIZABETH WINTERS	10.63	Single Family
05WC002.A	20 WHITE CHURCH LANE	THOMAS & CHERYL DUNKLEY	1.25	Vacant Land
05WC002.B	20 WHITE CHURCH LANE	THOMAS & CHERYL DUNKLEY	0.75	Vacant Land
05CU002.	24 WHITE CHURCH LANE	THOMAS & CHERYL DUNKLEY	2.7	Single Family

Source: Town of Westford Grand List, 2006.
Notes: Parcel acreage is from the Assessor's list. If data was unavailable, the value was left blank.
Path: O:\Proj-06\1854-W-Westford\Data\Westford_Project_Data.mdb [rptTable02_StudyAreaProperties]
Date/init: 10/18/07 anm

Study of Community Wastewater Disposal Alternatives for the Town Center

Town of Westford, Vermont

TABLE 3

Summary of Soil Characteristics Regarding Onsite Wastewater Disposal Within Study Area

Series Name	Mapping Unit	Slope (Percent)		Water Table (Feet)		Hydric Soil	Depth to Bedrock (Inches)		Potential On-Site System Suitability	% Study Area
		Low	High	Low	High		Low	High		
Adams and Windsor loamy sands	AdA	0	5	6	6	N	60	60	Conventional Subsurface	0.0
Agawam fine sandy loam	AgA	0	5	6	6	N	60	60	Conventional Subsurface	0.4
Alluvial land	An	999	999	99.9	99.9	U	999	999	Not Ranked	0.7
Cabot extremely stony silt loam	CbD	3	25	0	2	Y	60	60	Filtrate + Mound w/Curtain Drain	1.7
Cabot stony silt loam	CaA	0	3	0	2	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	0.5
Colton and Stetson soils	CsD	20	30	6	6	N	60	60	Conventional Subsurface	1.8
Colton and Stetson soils	CsE	30	60	6	6	N	60	60	Conventional w/Excessive Slope or Permeability	0.2
Duane and Deerfield soils	DdA	0	5	1.5	3	N	60	60	Mound or Filtrate + At-grade	0.2
Duane and Deerfield soils	DdB	5	12	1.5	3	N	60	60	Mound or Filtrate + At-grade	0.1
Enosburg and Whately soils	EwA	0	3	0	1.5	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	0.2
Hadley very fine sandy loam	Hf	0	3	4	6	N	60	60	At-grade or Filtrate + Conventional	0.4
Hartland very fine sandy loam	HlE	25	60	6	6	N	60	60	Conventional w/Excessive Slope or Permeability	0.5
Hinesburg fine sandy loam	HnA	0	3	2	4	N	60	60	Mound or Filtrate + At-grade	0.3
Lyman-Marlow rocky loams	LmB	5	12	2	6	N	10	60	Filtrate + Mound w/Curtain Drain	0.0
Lyman-Marlow rocky loams	LmC	12	20	2	6	N	10	60	Filtrate + Mound w/Curtain Drain	1.8

Source: National Resource Conservation Service (NRCS), SEI Field Notes

STONE ENVIRONMENTAL, INC.

Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each Series in the Service Area by the total area (acres) of the Service Area.

Path: O:\Proj-06\1854-W-Westford\Data\GISData\Spatial_Analysis\WW_Analysis.mdb[rptTableXX_SoilsSummary]

Date/Initials: 10/16/07 anm

Study of Community Wastewater Disposal Alternatives for the Town Center
Town of Westford, Vermont
TABLE 3 (continued)
Summary of Soil Characteristics Regarding Onsite Wastewater Disposal Within Study Area

Series Name	Mapping Unit	Slope (Percent)		Water Table (Feet)		Hydric Soil	Depth to Bedrock (Inches)		Potential On-Site System Suitability	% Study Area
		Low	High	Low	High		Low	High		
Lyman-Marlow very rocky loams	LyD	5	30	2	6	N	10	60	Filtrate + Mound w/Curtain Drain	28.9
Lyman-Marlow very rocky loams	LyE	30	60	2	6	N	10	60	Not Suited	4.2
Marlow extremely stony loam	MeC	5	20	2	3.5	N	60	60	Mound or Filtrate + At-grade	0.1
Munson and Belgrade silt loams	MuD	12	25	0.5	3.5	N	60	60	Filtrate + Mound w/Curtain Drain	14.0
Munson and Raynham silt loams	MyB	2	6	0	2	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	16.7
Munson and Raynham silt loams	MyC	6	12	0	2	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	11.1
Peru extremely stony loam	PsC	0	20	1	2	N	60	60	Filtrate + Mound w/Curtain Drain	0.7
Peru stony loam	PeD	20	30	1	2	N	60	60	Filtrate + Mound w/Curtain Drain	0.2
Scantic silt loam	ScA	0	2	0	1	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	2.3
Scantic silt loam	ScB	2	6	0	1	Y	60	60	Not Suited or 2 Year Time of Travel and/or Store + Dose	3.0
Stetson gravelly fine sandy loam	StB	5	12	6	6	N	60	60	Conventional Subsurface	1.1
Stetson gravelly fine sandy loam	StC	12	20	6	6	N	60	60	Conventional Subsurface	2.9
Terrace escarpments, silty and clayey	TeE	999	999	99.9	99.9	U	999	999	Not Ranked	0.6
Winooski very fine sandy loam	Wo	0	3	1.5	3	N	60	60	Mound w/Curtain Drain or Filtrate + Mound	1.8

Source: National Resource Conservation Service (NRCS), SEI Field Notes

Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each Series in the Service Area by the total area (acres) of the Service Area.

Path: O:\Proj-06\1854-W-Westford\Data\GISData\Spatial_Analysis\WW_Analysis.mdb[rptTableXX_SoilsSummary]

Date/Initials: 10/16/07 anm

Study of Community Wastewater Disposal Alternatives for Westford Town Center
Town of Westford, Vermont
Table 4: Permit Information Summary

Parcel ID	Permittee Name	Permit	Permit Date	Reason for Permit
05PO004.	Edward Von Turkovich	D-4-1341	2/21/1990	Retain Lot 6B, 2.05 acres, not improved. Part of EC-4-1411
05PO004.	Edward Von Turkovich	DE-4-1400	2/21/1990	Retain Lot 6C, 0.97 acres, not improved. Part of EC-4-1411
05PO002.	Edward Von Turkovich	EC-4-1411	2/21/1990	Four-lot subdivision, on-site water and septic. Retain 14.6 acres.
05PO002.	E.B. & F.J. Von Turkovich	PB-4-1303	2/21/1990	Construction of new post office
06CM007.	Clyde C. Drinkwine	EC-4-0035	1/17/1975	DENIAL-one lot subdivision denied for type and depth of soils not meeting the regulations
06CM006._1	Norman Spiller	EC-4-0250	9/10/1976	One-lot subdivision
06EL004.	Norman Spiller	EC-4-0301	8/10/1977	One-lot subdivision
06EL001.	Norman Spiller	DE-4-1666	10/22/1991	Convey 3 acre parcel with no acreage remaining
06EL001.	Clifford & June Ross	EC-4-2155	5/13/1998	Remove deferral DE-4-1666 for proposed 3 bdrm s.f.r.on 2.69 acres, on-site water and sewer
05BS003.	David M. Driscoll	HE-4-0076	7/6/1995	1 lot being 3+/- acres on-site water; privy to be replaced with septic system
06OS004.	Linda Rivers	HE-4-0083	9/13/1995	Single family dwelling on .65 acre parcel with onsite water & sewage disposal
06OS006.	Francis & Karen Benoit	HE-4-0084	9/13/1995	Single family dwelling on .56 acre parcel with onsite water & sewage disposal
06OS006.	Gretchen C. Perez	HE-4-0084-1	10/25/2001	Amend Homestead to 0.70 acre parcel with single family dwelling onsite water & sewage disposal
05BS001.	Steven Levinson	HE-4-0148	10/24/1996	Single family residence on 2 acres with on-site water and sewer.
05BS005.	Lisa Gail Friedman	HE-4-0164	5/1/1997	Single family dwelling on 9.7 acres with onsite water & septic
05CU002.	Tom & Cheryl Dunkley	HE-4-0364	8/7/2002	Single family dwelling with onsite water & sewage disposal on Lot 2 1.09 acre parcel.
06CM004.	Town of Westford	PB-4-0270		Construction of Town Highway Garage and office area
05BS009.	Westford Elementary School	PB-4-0324	5/23/1978	8 classroom addition, 2 bathrooms, 2 storage rooms, and subsurface disposal system
05BS009.	Westford School District	WW-4-0630	1/22/2001	Addition to school for gym and classroom space, on-site water & sewer; 5320 gpd
05BS009.	Westford School District	WW-4-0630-1	1/22/2001	Relocate water storage and water lines, add new floor drains, no increase in flows
05BS009.	Westford School District	WW-4-0630-2	12/18/2001	Relocate 5,000 gallon water storage tank outside of building, no changes to water or septic
05VL001._1	Town of Westford	WW-4-0877	7/20/1995	Drill new well for existing Town offices & Library, onsite sewage disposal
05TW049.	United Church of Westford	WW-4-1173	6/16/1998	Construct new onsite sewage disposal for Brick Meeting House
05TW049.	Brick Meeting House Soc. of VT	WW-4-1173-R	6/16/1998	Amended permit to correct wrong date noted on the plans
05TW039.	Joel, Mary, William & Jeanne Fay	WW-4-1965	10/1/2003	Boundary line adjustment for Lot #1, existing single family dwelling, onsite water and sewer
05TW039.	William & Vanessa Smith	WW-4-1965-1	7/8/2005	Construct replacement system using Septitech instead of Advantex for a failed system on Lot #1
05CU002.	Thomas & Cheryl Dunkley	WW-4-2409	8/22/2005	Two-lot subdivision (one existing 3-BR home, one proposed 4-BR home) onsite water and sewer
05TW035.	Paul Birnholz	WW-4-2419	7/21/2005	3 lot subdivision, all with onsite water and sewer

Source: Review of Vermont Dept. of Environmental Conservation permits, September 2007.

STONE ENVIRONMENTAL, INC

Notes: D or DE = Deferral of permit; EC = Subdivision permit; HE = Homestead Exemption; PB = Public Building Permit; WW = Wastewater System and Potable Water Supply Permit

Path: O:\Proj-06\1854-W Westford WW Feasibility Study\Data\Permits\Westford-WWPermitsSummary.xls

Date: 9/11/2007, anm

Study of Community Wastewater Disposal Alternatives for the Town Center

Town of Westford, Vermont

TABLE 5: Summary of Needs Assessment Results

Description:

47 Single Family Residences

1 Camp

5 Apartments

10 Public Properties

16 Vacant Properties

79 Properties Total

Water Supplies:

40 Individual Drilled Wells

7 Individual Dug (Shallow) Wells

1 Property Using a Shared Drilled Well

1 Property Using a Public Drilled Well

13 Unknown Water Supplies

Factors Affecting Recommended Solutions:

Factor	Number of Properties Affected	% of Tota
Limited Available Area Only	5	6%
Proximity to Water Supply Wells	5	6%
Proximity to Surface Water	4	5%
Proximity to Steep Slopes	0	0%
Shallow Seasonal Groundwater Only	19	24%
Shallow Seasonal Groundwater and		
Limited Available Area	12	15%
Proximity to Water Supply Wells	11	14%
Proximity to Surface Water	9	12%
Proximity to Steep Slopes	0	0%
Shallow Bedrock Only	0	0%
No Restrictions	42	54%

Recommended Solutions:

42 Properties Recommended for an Onsite Solution

36 Properties May Need Offsite Solutions

Source: Stone field notes; Survey results; Town Grand List data table; parcel GIS database

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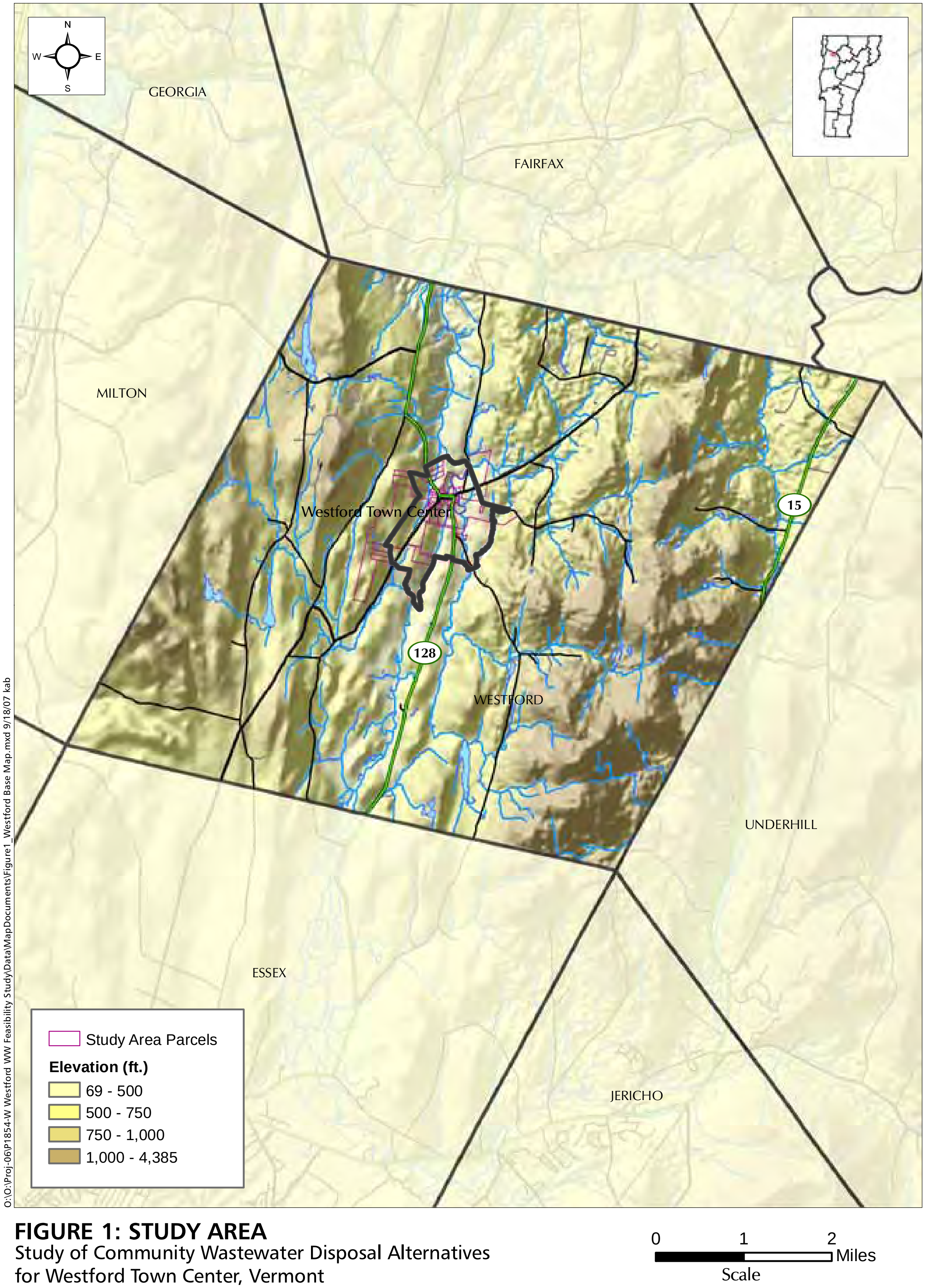

FIGURE 1: STUDY AREA

Study of Community Wastewater Disposal Alternatives
for Westford Town Center, Vermont

Sources: Hydrography, VCGI, 2003; Roads, VCGI, 2003; Digital Elevation Model, VCGI, 2001; Town Boundaries, VCGI, 2001; Parcel Boundaries, Informational & Visualization Services, 2002; Watershed Boundaries, VGIS, 2004.

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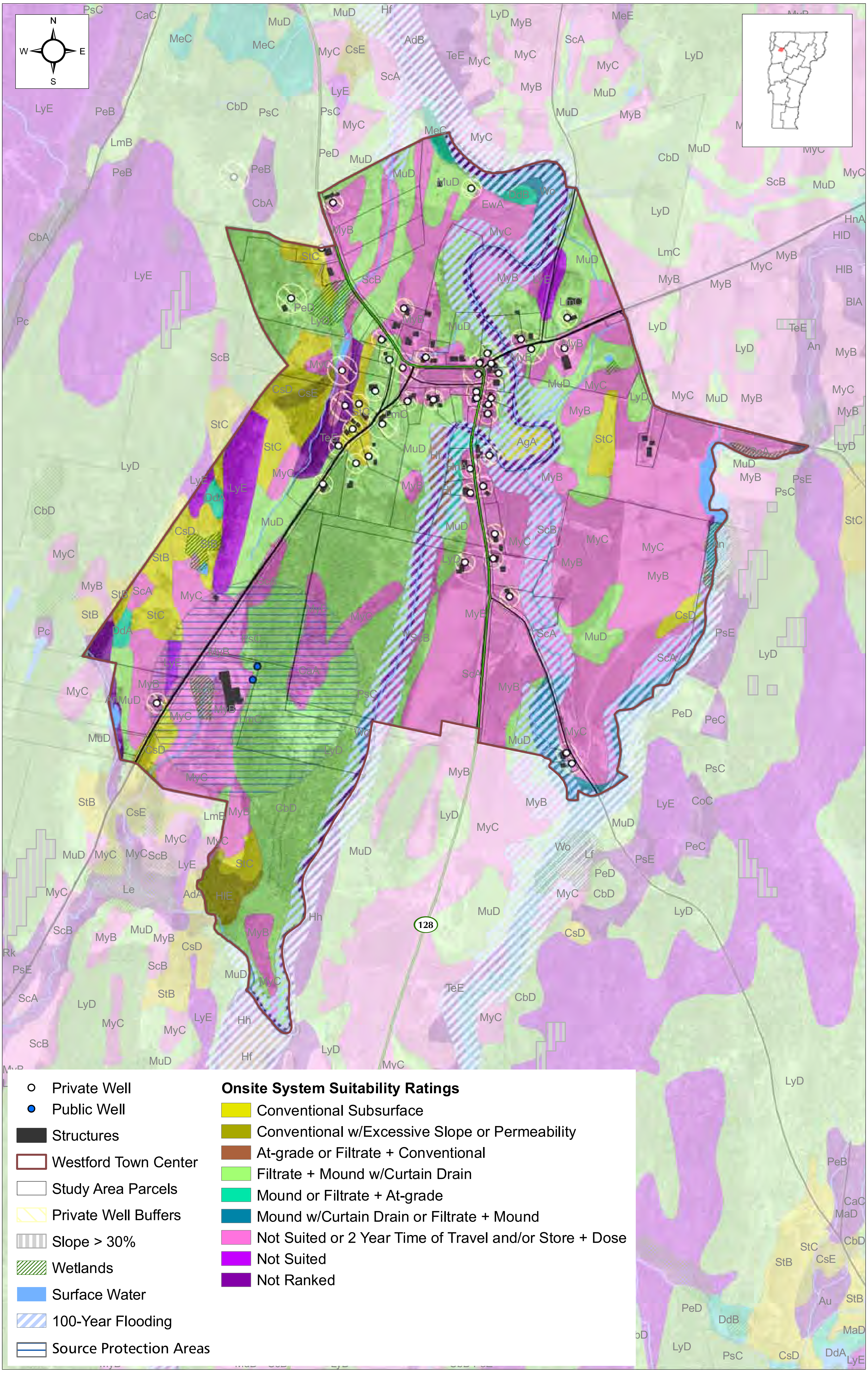

FIGURE 2: ENVIRONMENTAL SENSITIVITIES
Study of Community Wastewater Disposal Alternatives
for Westford Town Center, Vermont

0 0.25 0.5 Miles
Scale

Sources: Hydrography, VCGI, 2003; Roads, VCGI, 2003; Digital Elevation Model, VCGI, 2001; Parcel Boundaries, IVS, 2002; Onsite System Suitibility, SEI, 2007; Map Unit Symbols, NRCS, 2004.

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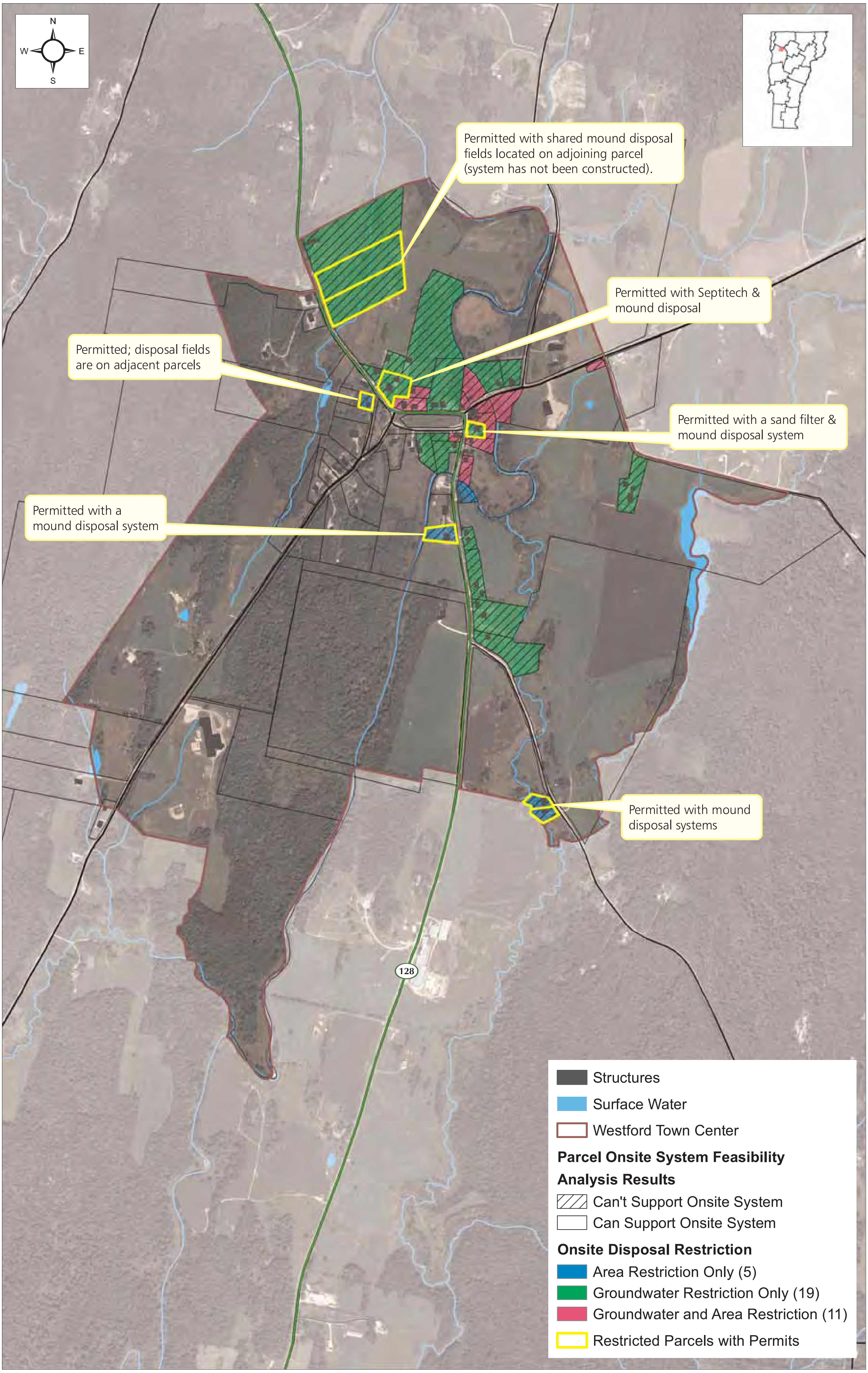

O:\O:\Proj-06\P1854-W Westford WW Feasibility Study\Data\MapDocuments\Figure3_OnsiteSystemFeasibility.mxd 10/11/07 kab

FIGURE 3: ONSITE DISPOSAL SYSTEM SUITABILITY RESTRICTIONS

Study of Community Wastewater Disposal Alternatives for Westford Town Center, Vermont

Sources: Hydrography, VCGI, 2003; Roads, VCGI, 2003;
Parcel Boundaries, IVS, 2002; Onsite System Suitibility, SEI, 2007; Map Unit Symbols, NRCS, 2004.

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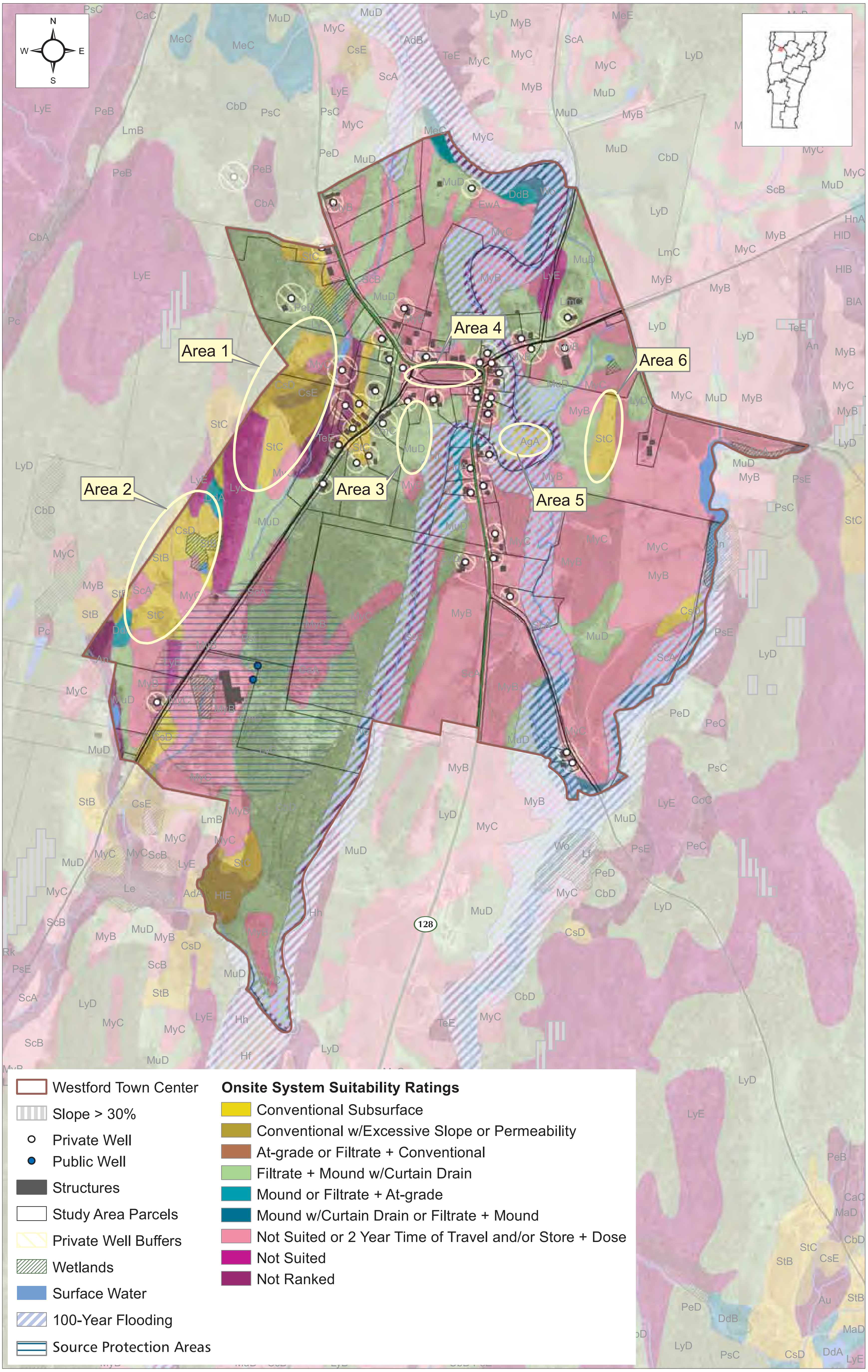

O:\O:\Proj-06\P1854-W Westford WW Feasibility Study\Data\MapDocuments\Figure4_Westford WW Sites.mxd 1/11/2008 kab; 1/18 anm

FIGURE 4: POTENTIAL COMMUNITY WASTEWATER DISPOSAL SITES

Study of Community Wastewater Disposal Alternatives
for Westford Town Center, Vermont

0 0.25 0.5 Miles
Scale

Sources: Hydrography, VCGI, 2003; Roads, VCGI, 2003; Digital Elevation Model, VCGI, 2001;
Parcel Boundaries, IVS, 2002; Onsite System Suitibility, SEI, 2007; Map Unit Symbols, NRCS, 2004.

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APPENDIX A WESTFORD WASTEWATER COMMITTEE MEMBERS

Seth Jensen
Tom Orfeo
Dave Tilton
Paul Birnholz
Ben Ware
Douglas Frink

APPENDIX B HANDOUTS FROM PUBLIC MEETINGS

Study of Community Wastewater Disposal Alternatives for the Westford Town Center

Presented by: Amy Macrellis, Stone Environmental Inc.

September 20, 2007

Objectives of presentation

- What are septic systems
- How do they affect public health and the environment
- What are the soils and site requirements
- What are the local and state regulations
- Current results and next steps in study

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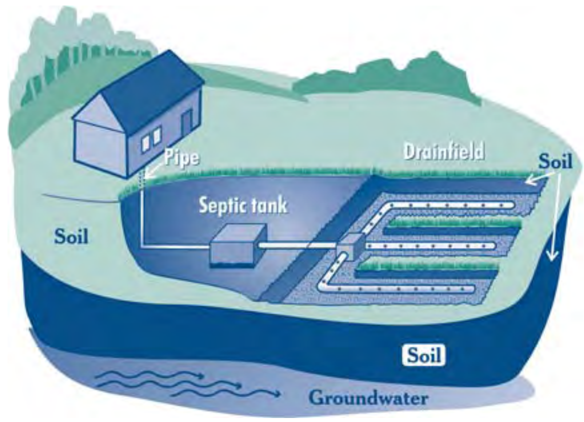
Traditional onsite system



Benefits of soil absorption systems

- Treatment and dispersal close to source
- Resilient to variable flows and wastewater content
- Minimize costs
  - Use existing investment in functioning systems
  - Avoid costs of new sewer lines
- Safe and effective when properly designed and managed
- Recharge local groundwater

Potential public health & environmental impacts

- Exposures to surfacing sewage, discharging of poorly treated sewage
- Pathogens, risk of disease
- Beach closures, swimming exposures
- Drinking water supplies (drilled and shallow wells)

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Health risks from exposure to untreated wastewater

- Infectious Organisms (Disease)
  - Bacteria
    - Fecal coliform, *E. coli* (gastroenteritis)
    - Others (e.g., cholera)
  - Viruses
    - Hepatitis A (infectious hepatitis)
    - Others
  - Protozoa
    - Cryptosporidium
    - Giardia (giardiasis)
    - Others

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System constraints based on current regulations

- Setbacks
  - Surface waters and wetlands
  - Drinking water wells
  - Water lines
- Soils
  - Depth to seasonal high groundwater table
  - Depth to impervious soils
  - Depth to bedrock

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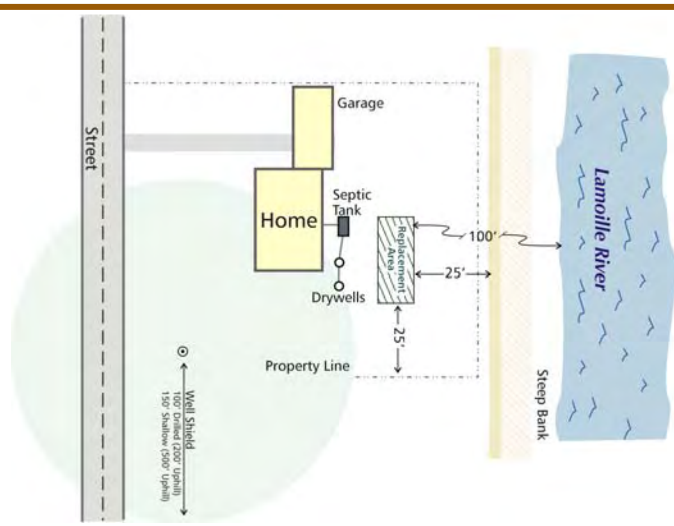
Typical lot layout with well



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Types of decentralized wastewater systems

- Seepage Beds and Leach Trenches
- Drywells
- At-grade and Mound Systems
- Sand Filters and Other Alternative Systems
- Shared or Cluster Systems

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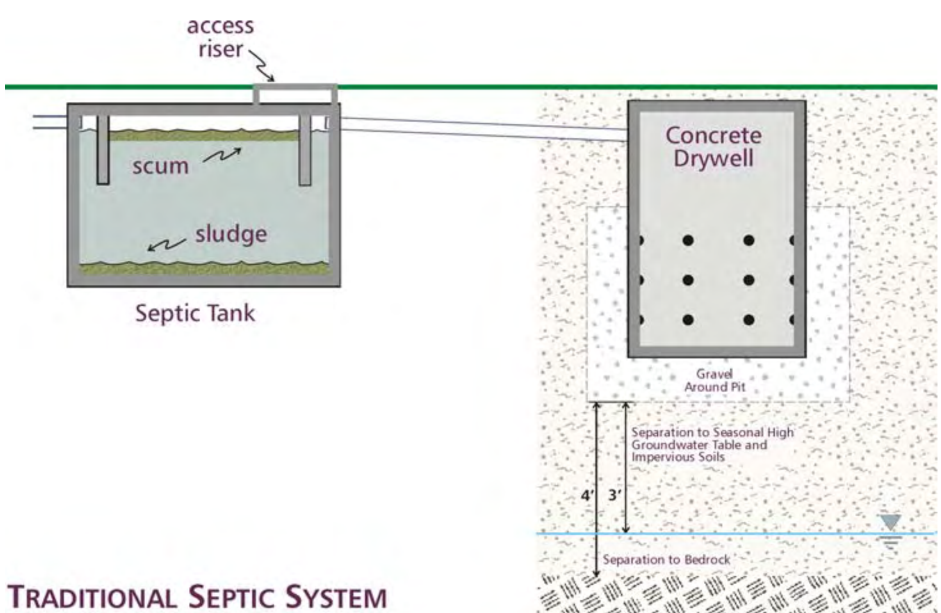

TRADITIONAL SEPTIC SYSTEM WITH DRYWELL

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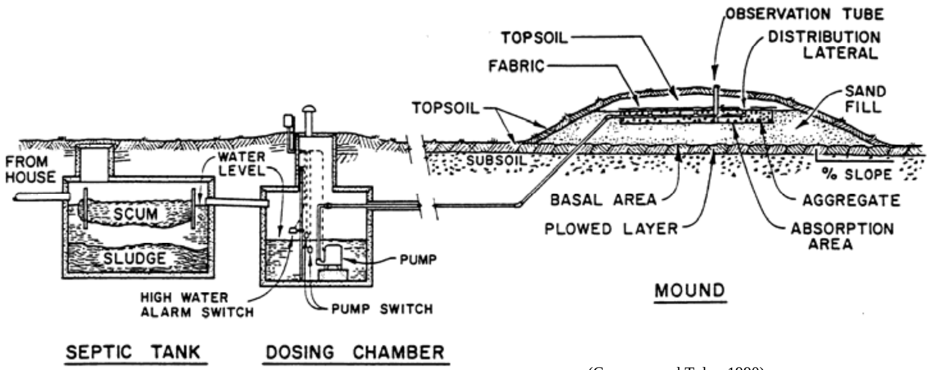
Mound system



(Converse and Tyler, 1990)

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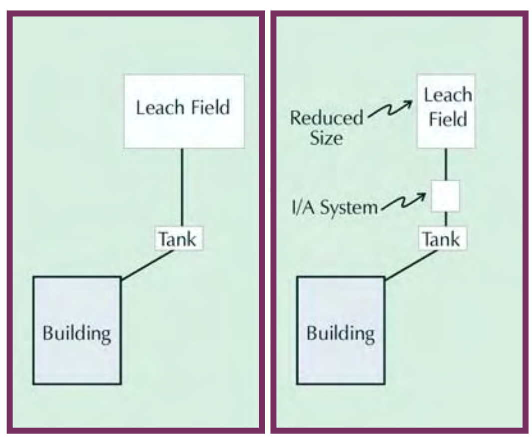
Beyond the Mound

- Traditional septic system
- Alternative system
  - when to use?
  - allowable alternative systems
  - part of management plan



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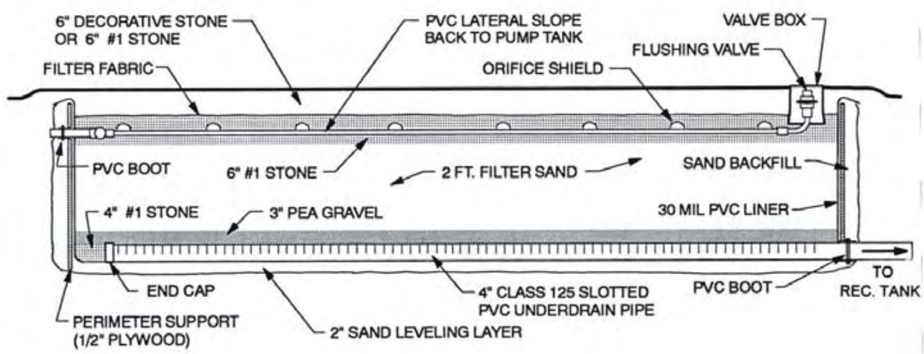
Sand filter



(Converse 1999, adapted from Orenco)

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Approved alternative systems

- Sand filters
- Constructed wetlands
- Avantex geotextile filter
- Ecoflo and Puraflo peat biofilters
- Several aerobic treatment units
- Enviro-Septic and Infiltrator leaching systems

- Disposal field can be ½ the size of conventional septic tank system
- Separation distance to groundwater can be reduced
- Systems don't work if they are not maintained

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Town regulations

- Westford Zoning Ordinance
- Construction or change of use requires a zoning permit
- State permits must be approved before zoning permit is issued
- Water Resources Overlay District establishes stricter protection than State wastewater disposal rules

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Vermont Department of Environmental Conservation

- Regional Office in Essex
  - Environmental Protection Rules (EPRs) are for systems smaller than 6,500 gallons per day
- Water Supply Division in Waterbury
- Indirect Discharge Section in Waterbury for larger systems

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EPR new rule changes

- New rules effective September 29, 2007
- "Universal permitting"—no more exemptions
- "Clean Slate"—grandfathers working wells and systems built before January 1, 2007
- Site and Design Changes
  - Constructed wetlands and drip irrigation allowed
  - Minimum design flow = 2 bedrooms (was 3)
  - No replacement area required for mounds

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Want to replace your system?

- Determine what permits are needed at town & state levels
- Hire a licensed site designer or professional engineer
- Coordinate field work with town/state
- Submit plans & application
- Construct/inspect system

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Elements of this study

- Collect and review available information
- Property owner survey questionnaire
- GIS analysis and lot-by-lot review
- Identify properties that may benefit from an offsite system connection
- Identify potential cluster system sites
- Preliminary engineering layouts and cost estimates

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Some possible outcomes of study

- Do nothing
- Encourage owners to maintain systems
- Find off-site solutions for properties with limited or no onsite capacity

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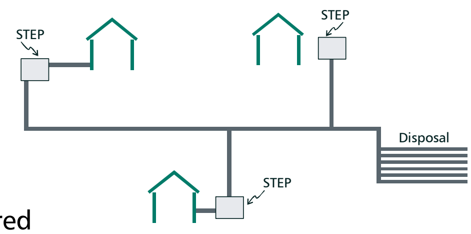
A few off-site replacement options

- Collection Systems
  - STEP systems
  - Grinder pumps
- Treatment Systems
  - Depending on size if required
  - Sand filter, other alternative systems
- Disposal Systems
  - <6,500 gpd (Environmental Protection Rules)
  - >6,500 gpd (Indirect Discharge Rules)



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Questions and Answers

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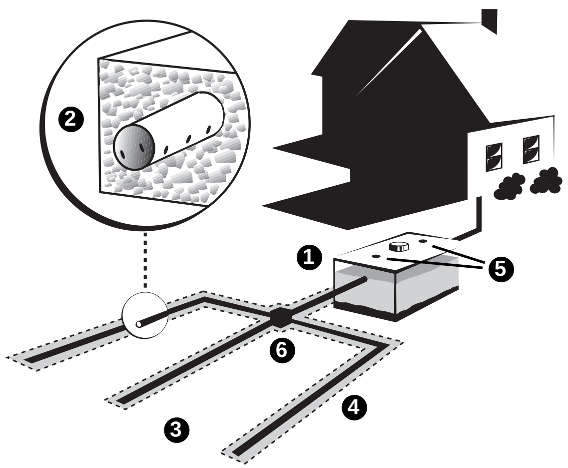
APPENDIX C BROCHURES FOR PROPERTY OWNERS ABOUT MAINTAINING WASTEWATER SYSTEMS

So . . . now you own a septic system

More than 25 million homes, encompassing almost 25 percent of the U.S. population, dispose of domestic wastewater through onsite (unsewered) systems. According to the American Housing Survey for the United States, in 1993 1.5 (million) out of every 4 (million) new owner-occupied home starts relied upon a form of onsite sewage disposal.

One of the major differences between owning an unsewered versus a sewered home is that unsewered wastewater treatment and disposal systems must be maintained by the homeowner. Treatment and disposal of wastewater should be one of the primary concerns of any homeowner in an unsewered area.

The most common way to treat and dispose of wastewater in rural homes is through the use of an onsite disposal system. The majority of onsite disposal systems in the United States are septic systems.



1 septic tank
2 4” perforated pipe
3 absorption field
4 crushed rock or gravel lined trench
5 inspection ports
6 distribution box

Typical Septic System **Fig. 1**

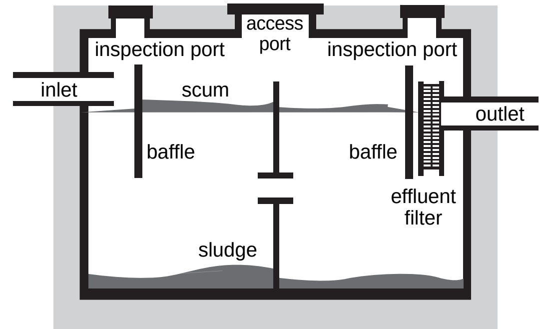
HOW IT WORKS

A typical septic system contains two major components: a septic tank and the absorption field (see Figure 1). Often, a distribution box is included as part of the system to separate the septic tank effluent evenly into a network of distribution lines that make up the absorption field. The septic tank is usually made of concrete, fiberglass, or plastic, is typically buried and should be watertight. All septic tanks have baffles (or tees) at the inlet and outlet to insure proper flow patterns (see Figure 2). Most septic tanks are single compartment; however, a number of states require two-compartment tanks or two single compartment tanks in series.

While typically designed to hold a minimum of 750–1000 gallons of sewage, the size of the tank may vary depending upon the number of bedrooms in the home and state and local regulatory requirements. The primary purpose of the septic tank is to separate the solids from the liquids and to promote partial breakdown of contaminants by microorganisms naturally present in the wastewater. The solids, known as sludge, collect on the bottom of the tank, while the scum floats on the top of the liquid. The sludge and scum remain in the tank and should be pumped out periodically (see Figure 2).

Solids that are allowed to pass from the septic tank may clog the absorption field. Keeping solids out of the absorption field not only prevents clogging, but also reduces potentially expensive repair or replacement costs and helps ensure the ability of the soil to effectively treat the septic tank effluent. Therefore, an additional safeguard in keeping solids out of the absorption field is the use of effluent filters on the outlet of the septic tank (see Figure 2).

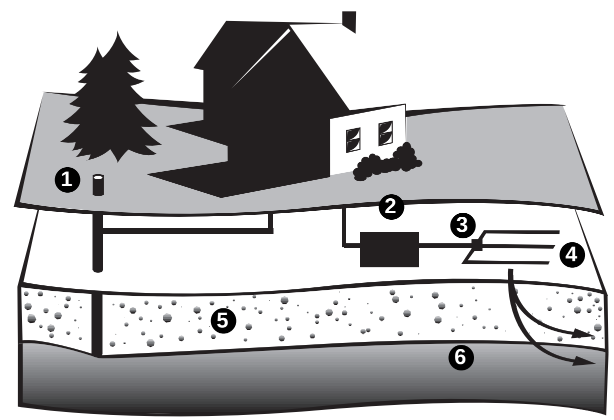
The wastewater (effluent) coming out of the septic tank may contain many potentially disease-causing microorganisms and pollutants (i.e., nitrates, phosphates, chlorides). The effluent is passed on to the absorption field through a connecting pipe or distribution box. The absorption field is also known as the soil drainfield, the disposal field, or the leachfield. The absorption field contains a series of underground perforated pipes, as indicated in Figure 1, that are



Cross-section of a two-compartment septic tank **Fig. 2**

sometimes connected in a closed loop system, as illustrated on the front cover, or some other proprietary distribution system

The effluent is distributed through the perforated pipes, exits through the holes in the pipes, and trickles through the rock or gravel where it is stored until absorbed by the soil. The absorption field, which is located in the unsaturated zone of the soil, treats the wastewater through physical, chemical, and biological processes. The soil also acts as a natural buffer to filter out many of the harmful bacteria, viruses, and excessive nutrients, effectively treating the wastewater as it passes through the unsaturated zone before it reaches the groundwater (see Figure 3).



1 drinking water well
2 septic tank
3 distribution box
4 absorption field
5 soil absorption (unsaturated zone)
6 groundwater (saturated zone)

Wastewater treatment and disposal in soil **Fig. 3**

Wastewater contains nutrients, such as nitrates and phosphates, that in excessive amounts may pollute nearby waterways and groundwater supplies. Excessive nutrients in drinking water supplies can be harmful to human health and can degrade lakes and streams by enhancing weed growth and algal blooms. However, the soil can retain many of these nutrients, which are eventually taken up by nearby vegetation.

What to Put In, What to Keep Out

- Direct all wastewater from your home into the septic tank. This includes all sink, bath, shower, toilet, washing machine and dishwasher wastewaters. Any of these waters can contain disease-causing microorganisms or environmental pollutants.
- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater, which can lead to groundwater and/or nearby surface water pollution.
- Conserve water to avoid overloading the septic system. Be sure to repair any leaky faucets or toilets. Use low-flow fixtures.
- Do not use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system.
- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.

continued . . .

- Check with your local regulatory agency if you have a garbage disposal unit to make sure that your septic system can accommodate this additional waste.

- Check with your local regulatory agency before allowing water softener backwash to enter your septic tank.

- Your septic system is not a trash can. Do not put grease, disposable diapers, sanitary napkins, tampons, condoms, paper towels, plastics, cat litter, latex paint, pesticides, or other hazardous chemicals into your system.

- Keep records of repairs, pumpings, inspections, permits issued, and other system maintenance activities.

- Learn the location of your septic system. Keep a sketch of it handy with your maintenance record for service visits.

- Have your septic system inspected every 1–2 years and pumped periodically (usually every 3–5 years) by a licensed inspector/contractor.

- Plant only grass over and near your septic system. Roots from nearby trees or shrubs may clog and damage the absorption field.

- Do not drive or park over any part of your septic system. This can compact the soil and crush your system.

In summary, understanding how your septic system works and adhering to these few simple rules will ensure that your septic system is a safe and economical method for treating and disposing of your wastewater onsite.

For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

Groundwater protection and your septic system,
Item #**WWBRPE21**

The care and feeding of your septic system,
Item #**WWBRPE18**

For more information about this or other NSFC products, please contact us by writing to:
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
or phone:
(800) 624-8301, (304) 293-4191
or fax: (304) 293-3161

www.nsfc.wvu.edu

Helping America's small communities meet their wastewater needs

So . . . now you own a septic system

One in a series of three brochures designed to aid you in caring for your septic system.

Helping America's small communities meet their wastewater needs

The care and feeding of your septic system

Septic systems are very much like automobiles. They need periodic inspections and proper maintenance to continue working properly. Also, like automobiles, they must be operated properly and cannot be overtaxed without the owner suffering consequences such as repair or replacement bills.

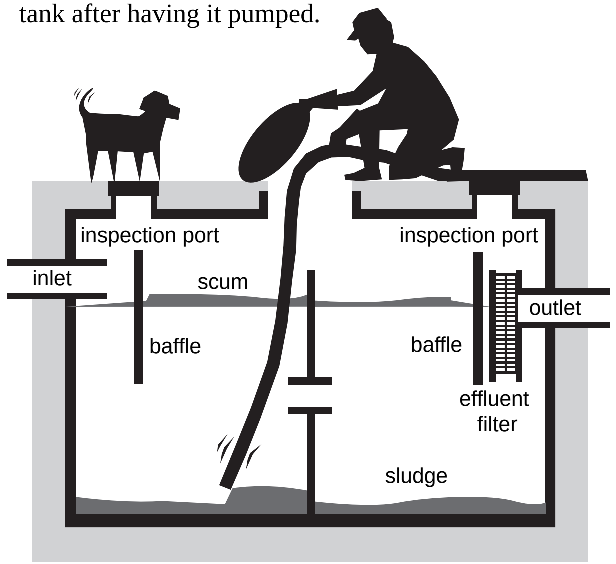
Often overlooked or neglected is the fact that a septic system should have a regular check-up to prevent problems. You should have your septic system inspected every 1-2 years by a professional and your tank pumped when necessary. The septic tank traps the solids in the wastewater and should be checked to determine whether or not it is time for it to be pumped out. The inspection port should be opened and the baffles (internal slabs or tees) should be checked to ensure that they are in good condition since the last check-up (see Figure 1). If you have a septic tank effluent filter, it should also be inspected. Effluent filters require periodic cleaning. Some filters are now equipped with alarm systems to alert the homeowner when the filter has become dirty and needs to be cleaned. Failure to keep the filter clean may result in a backup of wastewater in the home from a clogged filter. Septic systems that have mechanical parts such as a pump should be inspected at least once a year or more frequently as recommended by the manufacturer. The absorption field should be checked for sogginess or ponding, which indicates improper drainage, a clogged system, or excessive water use. The presence of damp or soggy areas or odors may indicate a leak in the system.

SEPTIC TANK

A properly designed septic system will have a septic tank with sufficient volume to accumulate solids for several years. As the level of solids rises in the tank, the wastewater has less time to settle properly and suspended solid particles flow into the absorption field. If the tank is not periodically pumped out, these solids will eventually clog the absorption field to the point where a new field will be needed.

When the tank is pumped, the contractor should pump the contents through the manhole, which is usually located in the center of the tank, rather than through the inspection ports. Pumping through one of the inspection ports could damage the baffles inside the tank (see Figure 1). Damage to the baffles could result in the wastewater flowing directly into the absorption field without the opportunity for the solids to settle.

Remember, commercial septic tank additives do not eliminate the need for periodic pumping and may be harmful to the absorption field. You should check your local health department regulations before using additives. Be sure when the septic tank is pumped that it is completely emptied. It is not necessary to retain any of the solids to restart the digestive process. You do not need biological or chemical additives for successful restart or continuous operation of your septic system, nor should you wash or disinfect the tank after having it pumped.



Cross-section of a two-compartment septic tank being pumped **Fig. 1**

When to Have Your Septic Tank Pumped

A specific determination of when it's time to pump out the solids can be made by having the depth of solids and level of scum buildup on top of the wastewater in the septic tank checked periodically. Two factors affect how often you should have your septic tank pumped. Whether you need to have your tank pumped every year, once every five years, or some other time interval is affected by these factors. The first factor is the size or capacity of the tank itself. If more people are living in the home than when the system was installed, or if new high water use appliances or technologies such as a hot tub or whirlpool bath are now in use, then the capacity may be too small. The more people using a system, the faster the solids will accumulate in the tank, and the more frequently the tank will need to be pumped. Also, the additional surge of water from hot tubs and whirlpool baths may wash solids out of the tank and into the absorption field. An inspection can determine whether the system is of adequate capacity to handle the volume of solids and flow from the number of people in the household and types of appliances used. A larger capacity system provides better treatment and requires less pumping.

The second factor is the volume of solids in the wastewater. If you have a garbage disposal, for example, you will have to pump out your system more frequently than persons disposing of their food wastes through other means. The use of a garbage disposal may increase the amount of solids in the septic tank by as much as 50 percent. Excessively soiled clothes may add solids to your septic tank. Sometimes, geographical location may also contribute to extra solids ending up in the septic tank. For example, systems in coastal areas may have an accumulation of sand in the septic tank from washing beach clothes.

Reducing the Flow of Wastewater

Generally, the more people, the more water will flow through the system. However, the use of water conservation devices such as low-flow toilets or shower fixtures greatly reduces the amount of wastewater thus prolonging the life of your septic system. For example, up to 53 gallons of water are discharged into your system with each load of laundry. If several loads are done in one day, it can put considerable stress on your system. A better practice would be to space your laundry washing throughout the week.

The new ultra low-flush toilets use between 1 and 1.6 gallons of water per flush and will provide as much as a 30 percent water savings. Low-flow faucet aerators on sink faucets and low-flow showerheads will save additional water. There are also low-flow washing machines which use much less water than standard washing machines.

ABSORPTION FIELD

An absorption field generally does not require any maintenance. However, to protect and prolong the life of the absorption field, follow these simple rules:

- Plant only grass over and near your septic system. Roots from nearby trees or shrubs may clog and damage the absorption field.
- Do not drive or park over any part of your septic system. This can compact the soil and crush your system.
- Direct all wastewater from your home into the septic tank. This includes all sink, bath, shower, toilet, washing machine and dishwasher wastewaters. Any of these wastewaters can contain disease-causing microorganisms or environmental pollutants.
- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater, which can lead to groundwater and/or nearby surface water pollution.

continued . . .

Septic System Health Tips

What you put into your septic system will have a direct effect on whether or not you have a healthy, long-lasting and trouble-free system. Your septic system is not a dispose-all.

- Conserve water to avoid overloading the septic system. Be sure to repair any leaky faucets or toilets. Use low-flow fixtures.
- Do not use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system.
- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.
- Check with your local regulatory agency if you have a garbage disposal to make sure that your septic system can accommodate this additional waste.
- Check with your local regulatory agency before allowing water softener backwash to enter your septic tank.
- Your septic system is not a trash can. Do not put disposable diapers, sanitary napkins, tampons, condoms, paper towels, facial tissues, plastics, cat litter, or cigarettes into your septic system. These items quickly fill your septic tank with solids, decrease the efficiency, and will require that you pump out the septic tank more frequently. They may also clog the sewer line to the septic system causing wastewater to back up into your home.
- Avoid dumping grease or fats down your kitchen drain. They solidify and the accumulation may contribute to blockages in your system.
- Keep latex paint, varnishes, thinners, waste oil, photographic solutions, pesticides, or other hazardous chemicals out of your system. Even in small amounts, these items can destroy the biological digestion taking place within your septic system.

Septic systems are a very simple way to treat household wastewater and are easy to operate and maintain. Although homeowners must take a more active role in maintaining septic systems, once they learn how their systems work, it is easy for them to appreciate the importance of a few sound operation and maintenance practices.

For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

Groundwater protection and your septic system,
Item #**WWBRPE21**

So . . . now you own a septic system,
Item #**WWBRPE20**

For more information about this or other NSFC products, please contact us by writing to:
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
or phone:
(800) 624-8301, (304) 293-4191
or fax (304) 293-3161

www.nsfc.wvu.edu

Helping America's small communities meet their wastewater needs

The care and feeding of your septic system

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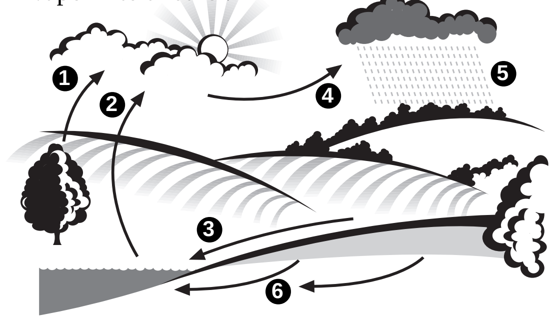
Groundwater protection and your septic system

WHAT IS GROUNDWATER?

Water in the saturated zone beneath the soil surface is commonly referred to as *groundwater*. Groundwater is but one stage, or form, through which water passes in the earth's *hydrologic cycle* (see Figure 1). The hydrologic cycle is the continual movement of water over, in, and through the earth and its atmosphere as it changes from one form—solid, liquid, or vapor—to another.



1. evapotranspiration
2. evaporation
3. runoff
4. water-vapor transport
5. precipitation
6. groundwater flow

Hydrologic cycle **Fig. 1**

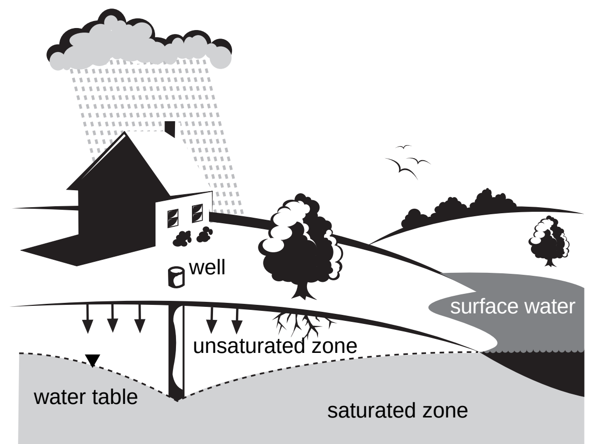
The water you use today may have evaporated from an ocean, traveled through the atmosphere, fallen back to the earth's surface, gone underground, and flowed through streams leading back to the oceans. Water is readily visible in many forms, including clouds, rain, snow, fog, lakes, streams, oceans, and polar ice caps. However, groundwater located beneath the soil surface is a vital resource for the success and survival of the entire ecosystem.

Groundwater has been tapped for thousands of years, but only recently have we started to understand its importance and how to manage this precious resource. Much remains to be discovered about groundwater, and wider public awareness of its nature and properties is an important first step.

Recharge

The process by which water—from rainfall, snowmelt, and other sources—flows into a water-bearing geologic formation (aquifer) is known as *recharge*. Water first passes through the *unsaturated zone*, where soil pores are filled partly with air and partly with water. The water then flows downward through the unsaturated zone into the *saturated zone*, where the soil pores are completely filled with water.

The boundary between these two zones is called the *water table* (see Figure 2). The water table rises when water enters the saturated zone and falls when water is discharged from the saturated zone either naturally (e.g., springs, lakes, or rivers) or by pumping (e.g., wells).



Water table **Fig. 2**

The unsaturated zone is important to the groundwater underlying it. As incoming water seeps down through the unsaturated zone, impurities are removed, helping to cleanse the water. Both the quantity and quality of groundwater is affected by the condition of the unsaturated zone in a recharge area.

SEPTIC SYSTEMS

A properly designed, installed, and maintained septic system poses no threat to groundwater. However, inadequately functioning and/or failing septic systems can contribute to the contamination of groundwater. Wastewater from septic systems may include many types of contaminants, such as nitrates, harmful bacteria, and viruses. Trace amounts of metals may be contributed to the system from persons using some medications. Also, commonly used chemical substances, such as pesticides, paints, varnishes, and thinners, can contaminate the groundwater if they are not disposed of properly. Some chemicals, even in small amounts, can be dangerous to both the environment and public health.

Through physical, chemical, and biological processes, the soil acts as a natural buffer to remove bacteria and viruses in the unsaturated zone. However, various geologic conditions, such as fractured bedrock and shallow groundwater tables, may allow these bacteria and viruses to be transported very rapidly and could contaminate nearby drinking water supplies.

Therefore, it is critical that your drinking water well is properly sited, has a sealed casing, and the required distances from nearby septic systems are maintained. This will help prevent contaminants from seeping into and mixing with your drinking water (see Figure 3).

Separation Distances

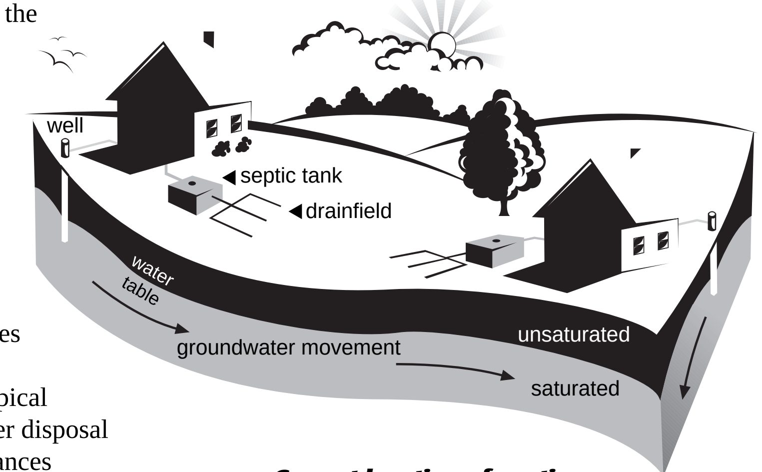
A septic system must be located a certain distance away from drinking water wells, streams, lakes, and houses. These distances are referred to as *horizontal separation distances*. Figure 4 (see back) shows a typical layout of a conventional onsite wastewater disposal system. Actual horizontal separation distances have been established and are specified in local regulations.

In order to maintain aerobic digestion processes and remove contaminants effectively, the absorption field must be adequately separated from the groundwater or other limiting layer. This is known as the *vertical separation distance* and is also specified by local regulations.

Determining System Size and Water Usage

Water use in rural households can be predicted from the house plan, depending on the number of bedrooms, water-using appliances, and potential additions. Although the actual number of residents determines water use in a house, the house plan determines the potential number of residents (e.g., number of bedrooms), water usage, and subsequent wastewater flow.

Typical wastewater flow rates range from 60–120 gallons per person per day. Typical minimum septic tank sizes range from 750–1000 gallons. The flow estimate, plus the soil permeability estimate (i.e., how easily water moves through the soil), is used to determine the area of the absorption field needed for the system. Installing a drainfield of sufficient size is critical to the proper functioning of your septic system. Local regulations should always be reviewed before installing a septic system.



Correct location of septic systems and drinking water wells **Fig. 3**

Are Contaminants Reaching the Water?

Signs that wastewater from your septic system could be reaching water sources include:

- **Unpleasant odors (e.g., persistent rotten egg smell), soggy soil, liquid waste flow, or excessive grass growth over the soil absorption area.** These symptoms often indicate failure of the system and the need for repairing, expanding, or replacing the absorption area.

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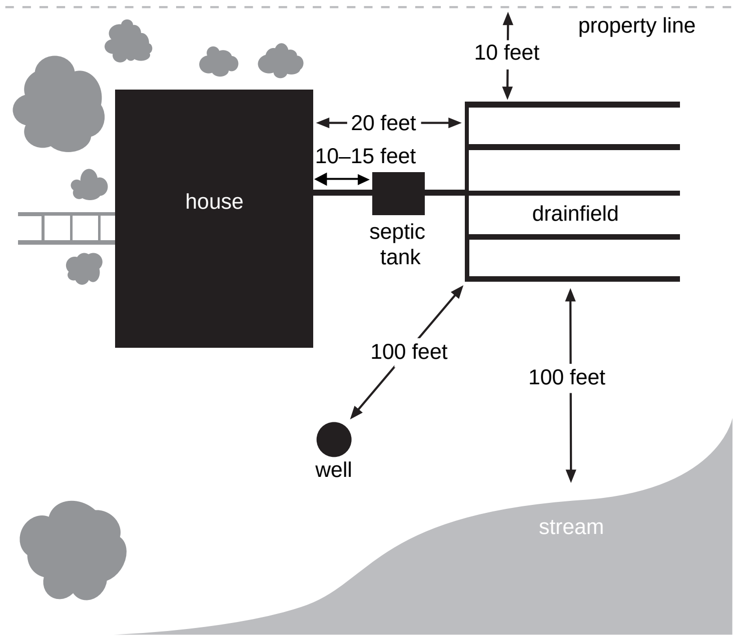

Typical layout of a septic system **Fig. 4**

- **Excessive weed or algae growth in the water near shorelines.** Nutrients leaking from septic systems could be a cause of this type of growth.

- **Health department test results of well water indicate the presence of contamination.** These tests may show the presence of indicator bacteria (e.g., total coliform, fecal coliform) in the water. Nitrate testing is not commonly performed and may need to be requested. Although wastes from septic systems are not the only source of these contaminants, they can be likely suspects.

- **Indicator dye put into your septic system reaches nearby ditches, streams, lakes, or drinking water supplies.** Special dyes are available from your local health department that may help find problems that otherwise are difficult to detect. This method can also help verify the other symptoms listed above.

How to Prevent Problems

- Before installation is complete, have the septic tank tested for watertightness.

- Maintain your septic system by having it inspected and pumped regularly.

- Conserve water in your home by using low-flow fixtures and by implementing water conservation practices to avoid hydraulic overload of your septic system.

- Redirect surface water flow away from your soil absorption field.

- Do not drive vehicles or heavy equipment over the absorption field. This will compact the soil and reduce its ability to absorb water.

- Plant a greenbelt (grassy strip or small, short-rooted vegetation) between your soil absorption field and the shoreline of any nearby surface water body.

- Keep chemicals and other hazardous wastes out of the septic system.

- If you have a drinking water well, have it tested yearly for contaminants. If you suspect a contamination problem, have it tested more often.

For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

So . . . now you own a septic system,
Item #**WWBRPE20**

The care and feeding of your septic system,
Item #**WWBRPE18**

For more information about this or other NSFC products, please contact us by writing to:
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Morgantown, WV 26506-6064
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