

State of Vermont
Agency of Natural Resources
Department of Environmental Conservation

Wastewater Management Division
The Sewing Building
103 South Main Street
Waterbury, Vermont 05671-0405

(802) 241-3822

Environmental Protection Rules

Chapter 1

Wastewater System and Potable Water Supply Rules

Effective September 29, 2007

Department of Environmental Conservation (DEC) District Environmental Commissions (Act 250)

DISTRICTS 1, 8 & 9

450 Asa Bloomer State Office Bldg.
Merchants Row,
Rutland, VT 05701-5903

Permit Specialist..... 786-5907
Regional Engineer..... 786-5900
Act 250 (Dist #1 & 8)..... 786-5920
Act 250 (Dist #9)..... 879-5614
River Management..... 786-5906

DISTRICTS 2 & 3

100 Mineral St, Ste #303
Springfield, VT 05156

Permit Specialist..... 885-8850
Regional Engineer..... 885-8855
Act 250 (Dist #2, 3 & 3A)..... 885-8855
River Management..... 786-5906

DISTRICTS 4 & 6

111 West Street
Essex Junction, VT 05452

Permit Specialist..... 879-5676
Regional Eng (Dist #4 & 6)..... 879-5656
Regional Eng (Dist #9)..... 786-5900
Act 250 (Dist #4, 6 & 9)..... 879-5614
River Management..... 879-5631

DISTRICTS 3A & 5

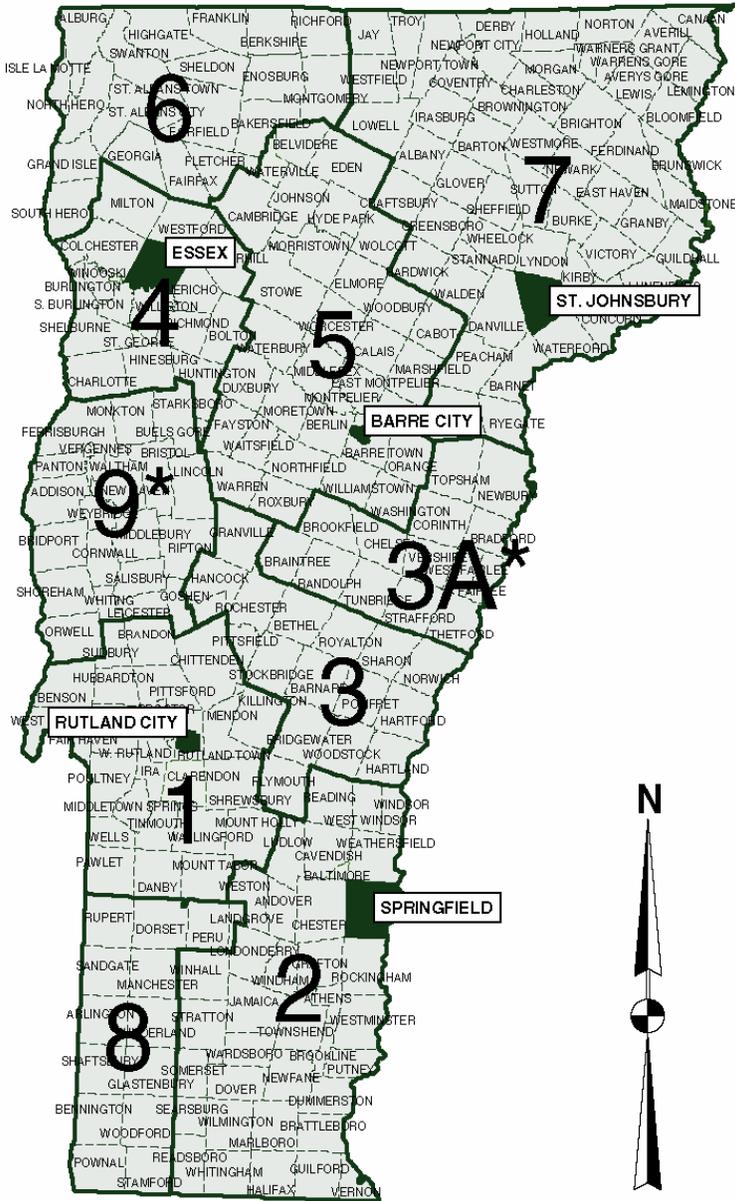
5 Perry Street, Suite 80
Barre, VT 05641

Permit Specialist..... 476-0195
Regional Engineer..... 476-0190
Act 250 (Dist #3A)..... 885-8855
Act 250 (Dist #5)..... 476-0185
River Management..... 879-5631

DISTRICT 7

1229 Portland St-Ste 201
St. Johnsbury, VT 05819

Permit Specialist (Tues)..... 751-0127
Regional Engineer..... 751-0130
Act 250..... 751-0120
River Management..... 751-0129



3A* NOTE:

Towns in District 3A must contact the Springfield Office for Act 250 Permits. For Water Supply, Wastewater Disposal and Subdivision Permits, District 3A must contact the Barre Office.

9* NOTE:

Towns in District 9 must contact the Essex Junction Office for Act 250 Permits. For Water Supply, Wastewater Disposal and Subdivision Permits, District 9 must contact the Rutland Office.

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Subchapter 1 – Scope, Purpose and Authority

§1-101 Scope

- (a) These Rules apply to the subdivision of land, the construction, modification or change in use of a building or structure, the creation or modification of a campground, and the construction, modification, replacement and operation of their associated potable water supplies and wastewater disposal systems.
- (b) These Rules regulate soil-based disposal systems with design flows of less than 6500 gallons per day and sewerage connections of any size.
- (c) These Rules regulate potable water supplies that are not subject to regulation under the Vermont Water Supply Rule as public water supplies.

§1-102 Purpose

- (a) The purpose of these Rules is to:
 - (1) establish a comprehensive program to regulate the design, construction, replacement, modification, operation, and maintenance of potable water supplies and wastewater systems in order to protect human health and the environment, including potable water supplies, surface water and groundwater;
 - (2) prevent the creation of health hazards or unsanitary conditions;
 - (3) insure the availability of an adequate supply of potable water;
 - (4) insure adequate effluent dispersal and drainage for the proper functioning of wastewater systems;
 - (5) insure that potable water supplies and wastewater systems are designed, constructed, operated and maintained in a manner that supports the intended use of the supplies and systems with respect to reliability, incremental costs, and sustainability;
 - (6) insure that owners of potable water supplies and wastewater systems permitted under these Rules have knowledge of their systems' design, the operation and maintenance requirements, and their responsibilities for the satisfactory functioning of the systems;
 - (7) allow the use of alternative, innovative, and experimental technologies for the treatment and disposal of wastewater in the appropriate circumstances;
 - (8) protect the investment of homeowners through a flexible remediation process for failed potable water supplies and wastewater systems; and
 - (9) increase reliance on and the accountability of the private sector for the design and installation of potable water supplies and wastewater systems through licensing and enforcement.

§1-02(b) Purpose

- (b) The basic performance criteria for the design, construction, operation and maintenance of wastewater systems are that:
 - (1) wastewater systems assure that wastewater not be exposed to the open air, not pool on the surface of the ground, or back up into a building or structure, unless the approved design specifically requires it to function in such a manner;
 - (2) wastewater systems do not allow direct discharges of wastewater to surface waters; and
 - (3) as affirmatively determined by the Secretary, wastewater systems have not contaminated a potable water supply so that it is rendered not potable.
- (c) While implementing the purposes of these Rules, it is the express intent of the Department to encourage innovation, allow maximum flexibility in design, and minimize the amount of time necessary to process applications.

§1-103 Authority

- (a) These Rules are adopted under the authority of the Secretary pursuant to: Title 3 V.S.A. §§808 and 2822 (i) and (j); 10 V.S.A §1259; 10 V.S.A. Chapter 64; 10 V.S.A. Chapter 159; 24 V.S.A. §§1154 and 1161; and 26 V.S.A. §1163(a).
- (b) These Rules supersede the existing Wastewater System and Potable Water Supply Rules, which were effective on January 1, 2005.
- (c) These Rules are not intended to affect other existing regulations, including but not limited to Vermont Health Regulations, Chapter 5, Subchapter 2 (Food Service Establishments), 3 (Schoolhouse Regulations), 4 (Food Establishments – not restaurants), Subchapter 14 (Day Care Facilities) and Subchapter 16 (Rental Housing Health Code).
- (d) These Rules do not limit the powers of state or local authorities to control existing or potential threats to human health or the environment, or limit the exercise of other authorities to regulate human health, safety and welfare except as provided in Subchapter 5 of these Rules.

Subchapter 2 - Definitions

§1-201 Definitions

- (a) As used in these Rules, the following terms shall have the specified meaning. If a term is not defined, it shall have its common meaning:
- (1) **Absorption Bed** - means a disposal field that is a shallow excavation in the ground more than 48” wide, lined with crushed stone, that releases wastewater into the soil through perforated distribution lines.
 - (2) **Absorption Trench** – means a disposal field that is a shallow ditch 48” or less in width with vertical sides, lined with crushed stone, that releases wastewater into the soil through perforated distribution lines.
 - (3) **Agency** – means the Agency of Natural Resources.
 - (4) **Applicant** – means the person(s) who owns the land on which a project is located.
 - (5) **Base Flood** – means the flood having a one percent chance of being equaled or exceeded in any given year.
 - (6) **Base Flood Elevation** – means the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the flood insurance study report prepared for a municipality by the Federal Emergency Management Agency, National Flood Insurance Program, or the average depth of the base flood, usually in feet, above the ground surface as designated on the Flood Insurance Rate Maps prepared for a municipality by the Federal Emergency Management Agency, National Flood Insurance Program.
 - (7) **Bedrock** – means both solid impervious ledge, and loose, slabby, or weathered rock and shale that are not soil and provide essentially no treatment of sewage effluent.
 - (8) **Bedroom** – means:
 - (A) any room in a residential structure that is at least 80 square feet in area, that is susceptible to present or future use as a private sleeping area, and that has at least:
 - (i) one window;
 - (ii) one closet; and
 - (iii) one interior method of entry and exit, excluding closets and bathrooms, allowing the room to be closed off from the remainder of the residence for privacy; or

§1-201(a)(8)(B) Definitions

- (B) any room within a building or structure that actually serves primarily as sleeping quarters.
- (C) On a case by case basis, the Secretary may determine that a room that meets the criteria of subsection (8)(A) of this section shall not be deemed to be a bedroom. When making this determination, the Secretary shall consider the following criteria:
 - (i) whether the room has a history of use as a bedroom;
 - (ii) whether the size of the room is similar to other bedrooms in the residential structure or is consistent with room sizes customarily used for bedrooms;
 - (iii) whether the room is located within the residential dwelling in an area customarily used for sleeping;
 - (iv) whether the room is in fairly close proximity to bathroom facilities;
 - (v) whether the room affords a level of privacy customarily expected for a bedroom;
 - (vi) whether the room has been, or could be, marketed as a bedroom; and
 - (vii) whether there are any other factors which could support a determination that the room is not a bedroom.

Note: In determining the number of bedrooms contained in any residence, it shall be presumed that all residences contain a living room, kitchen, bathroom, and at least one bedroom.

- (9) **Building or Structure** – means a building or structure whose use or useful occupancy requires the construction or modification of a potable water supply and/or wastewater system.
- (10) **Campground** – means any lot of land containing more than three (3) campsites occupied for vacation or recreational purposes by camping units, such as: tents, yurts, tepees, lean-tos, camping cabins, and recreational vehicles including motor homes, folding camping trailers, conventional travel trailers, fifth wheel travel trailers, truck campers, van campers, and conversion vehicles designed and used for travel, recreation and camping. There shall be no distinction made between non-commercial (no charge, no service) and commercial operations. Note: A mobile home or Park Model recreational vehicle that is used as a residence at a campground is regulated as a building or structure.

- (11) **Campsite** – means an area in a campground that is designed to accommodate a camping unit, for which design flows will be calculated. Design flows may be different for campsites in campgrounds that are open more than seven (7) months per year. A campsite may rely on water faucets, central toilet facilities, and/or a dumping station or may have individual potable water supply and sewerage connections.
- (12) **Change in Use** – means increasing the number of permitted users/employees, converting to a different type of use such as from a residence to a restaurant or office space, changing from seasonal to year-round use, adding bedrooms, and other changes that result in an increase in design flow or modification of other operational requirements of the potable water supply or wastewater system.
- (13) **Commissioner** - means the Commissioner of the Department or her or his designated representative.
- (14) **Critical Level** - means the elevation of the seasonal high water table that must not be exceeded. Each site has a critical level that must be met in order to allow installation of any soil-based disposal system. The critical level varies when using the prescriptive, enhanced prescriptive, or performance based design approaches. The critical level also varies depending on the type of soil-based disposal system that will be used on the site.
- (15) **Crushed Stone** - means clean, durable stone no smaller than ¾” or larger than 1-1/2” in diameter.
- (16) **Department** - means the Department of Environmental Conservation.
- (17) **Design Flow** - means the flows, set by section 1-808 of these Rules and Section 2.2 of Appendix A of the Vermont Water Supply Rules, that establish the size of the potable water supply and wastewater system serving a lot, building or structure, or campground.
- (18) **Designer** – means a person who is operating within the scope of his or her license, as specified in Subchapter 7 of these Rules.
- (19) **Desk Top Hydrogeologic Analysis** – means a hydrogeologic analysis that is based on assumptions about the hydraulic capacity of the soils on a specific site. The designer will consider the soil properties based on the test pit information and will assign a conservative estimate of the hydraulic conductivity for the soil. Based on this conservative assumption, the designer will calculate the site’s hydraulic capacity without the expense of doing a site specific test.
- (20) **Director** - means the Director of the Division or her or his designated representative.
- (21) **Division** - means the Wastewater Management Division of the Department.

§1-201(a)(22) Definitions

- (22) **Elevation** - means the height of a specified object or geologic feature relative to an established benchmark. The benchmark may be established by the licensed designer, or may be established by others, such as the U.S. Geological Survey datums. When working with plans or maps prepared by others, the related benchmark must be used to interpret those plans or maps.
- (23) **Enhanced Prescriptive Designs** – means those designs for sites with less than 24” of naturally occurring permeable soil above bedrock and the seasonal high water table that meet specific soil and site criteria.
- (24) **Failed Supply** - means
- (A) a potable water supply:
- (i) that has been tested for the following contaminants, in accordance with the protocols approved by the Secretary, and is found not to comply with the specified standard for one or more of the contaminants:

(I)	Total Coliform	None;
(II)	Nitrate	10 mg/L;
(III)	Nitrite	1 mg/L;
(IV)	Arsenic	0.010 mg/L;
(V)	Uranium	20 ug/L
 - (ii) that the Secretary affirmatively determines to be not potable, due to the presence of a contaminated site, a leaking underground storage tank, or other known sources of groundwater contamination or naturally occurring contaminants, and that information has been posted on the Agency website; or
 - (iii) that the Secretary affirmatively determines to be failed due to the supply providing an insufficient quantity of water to maintain the usual and customary uses of a building or structure or campground, and that information has been posted on the Agency of Natural Resources website:
- (B) Notwithstanding the provisions above, a potable water supply shall not be a failed supply if:
- (i) these effects can be and are remedied solely by a minor repair or replacement; or
 - (ii) these effects have lasted for only a brief period of time, the cause of the failure has been determined to be an unusual and non-recurring event, and the supply has recovered from the state of failure. Supplies which have recurring, continuing, or seasonal failures shall be considered to be failed supplies.

§1-201(a)(24)(C) Definitions

(C) If a project is served by multiple potable water supplies, the failure of one supply will not require the issuance of a permit or permit amendment for any other supply that is not in a state of failure.

(25) **Failed System** - means

(A) a wastewater system that is functioning in a manner:

(i) that allows wastewater to be exposed to the open air, to pool on the surface of the ground, to discharge directly to surface water, or to back up into a building or structure, unless in any of these instances the approved design of the system specifically requires the system to function in such a manner; or

(ii) that results in a potable water supply being affirmatively determined by the Secretary to be a failed supply, and that information has been posted on the Agency website.

(B) Notwithstanding the provisions above, a system shall not be a failed system if:

(i) these effects can be and are remedied solely by a minor repair or replacement; or

(ii) these effects have lasted for only a brief period of time, the cause of the failure has been determined to be an unusual and non-recurring event, and the system has recovered from the state of failure. Systems that have recurring, continuing, or seasonal failures shall be considered to be failed systems.

(C) If a project is served by multiple wastewater systems, the failure of one system will not require the issuance of a permit or permit amendment for any other system that is not in a state of failure.

(D) A wastewater system may be determined to be a failed system by the completion of a site visit that identifies one or more of the conditions set forth in subdivision (A)(i) of this definition.

(26) **Filtrate Effluent** – means effluent that has been treated to reduce BOD₅ and total suspended solids to 30 mg/l or less each.

(27) **Special Flood Hazard Area** - means the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year as designated on the flood insurance maps prepared for a municipality by the Federal Emergency Management Agency, National Flood Insurance program. For the purpose of these Rules, the term special flood hazard area is synonymous in meaning with the terms “area of special flood hazard” and “100-year floodplain”.

- (28) **Floodway** - means the channel of a river or other water course and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. Where available, the floodway is designated on either the Flood Insurance Rate maps or Flood Boundry and Floodway maps prepared for a municipality by the Federal Emergency Management Agency, National Flood Insurance Program.
- (29) **Graywater** – means the wastewater from normal domestic activities such as bathing, clothes washing, food preparation, and cleaning but excluding wastewater from toilets.
- (30) **Impervious Soil or Subsoil** – means a soil layer with a percolation rate that is slower than 120 minutes per inch.
- (31) **Improved Lot** – means a lot that has a substantially completed building or structure on it, and an associated substantially completed potable water supply and wastewater system that may or not be located on the lot.
- (32) **Induced Groundwater Mounding** – means the rise in the seasonal high water table caused by the discharge of wastewater into a soil-based disposal system.
- (33) **Installer** - means a person who constructs a potable water supply and/or wastewater system serving or intended to serve a lot, building or structure, or campground. Installer does not mean the owner of an owner occupied single family residence who constructs a potable water supply and/or wastewater system to serve such residence.
- (34) **Kitchen Facilities** – means the common plumbing fixtures and appliances normally expected in the food preparation area of a living unit. The presence of a sink, a refrigerator, and cooking facilities would meet this definition. Cooking facilities include, but are not limited to stoves, built-in ovens, counter top ovens, and microwave ovens.
- (35) **Leachfield** – means that portion of a soil-based disposal system used to discharge wastewater into the soil. Examples of leachfields include, but are not limited to: absorption trenches and beds; at-grade systems; and mound systems.
- (36) **Living Unit** – means a building or structure or a portion of a building or structure that has a toilet, lavatory, kitchen facilities, and one or more bedrooms that is reasonably private and separated from other living units. A single living unit may include one or more bedrooms, toilets and lavatories in an attached building or structure, such as a garage, or in a detached building or structure provided that the attached or detached building or structure does not have kitchen facilities. Notwithstanding the above definition, if a portion of a building or structure is rented or leased for residential occupancy, that portion shall be regulated as a separate living unit. Examples of buildings or

structures that contain more than one living unit include, but are not limited to: duplexes; single family residences with an accessory apartment; and rooming houses.

Note: There are situations where the presence of more than one kitchen might not automatically create a second living unit. Examples include, but are not limited to, outdoor kitchen facilities such as might be located on a deck or porch, or kitchen facilities in a wet bar or family room location. If the Secretary determines that additional living units are not created by the presence of additional kitchen facilities, that determination which may be in the form of a permit or letter, shall be filed and indexed in the land records of the municipality where the property is located.

- (37) **Lot** – means a tract or portion of land with defined boundaries created by the act of subdivision. A deed may describe one or more lots. Multiple lots described in a single deed remain separate lots provided that they are described as having separate and distinct boundaries and that any subsequent deed describing the lots does not specifically eliminate the separate and distinct boundaries.
- (38) **Minimum Site Conditions** – means those naturally occurring conditions related to soil permeability, soil depth, depth to seasonal high water table, depth to bedrock and slope that must exist in order to construct any soil-based wastewater system.
- (39) **Minor Repair or Replacement** – means:
- (A) For wastewater systems, the repair or replacement of a pipe leading from a building or structure to the septic tank; replacement of a septic tank; repair or replacement of a pump and/or associated valves, switches and controls; the repair or replacement of a toilet; or any other repair or replacement that the Secretary, on a case by case basis, determines to be a minor repair or replacement.
- (B) For potable water supplies, the repair or replacement of an individual pipe leading from a building or structure to a well; repair or replacement of a pump; repair or replacement of filters or screens; repair or replacement of a mechanical component; repair or reconstruction of a driven well point in approximately the same location; deepening or hydrofracturing a well; repair or replacement of a lavatory; or any other repair that the Secretary, on a case by case basis, determines to be a minor repair or replacement.

Note: replacement of a distribution system, or replacement of piping related to a change in use, increase in design flow, or change in operational requirements of the water system are not normally considered minor repairs or replacements.

§1-201(a)(40) Definitions

- (40) **Mobile Home** - means a prefabricated dwelling unit that:
- (A) is designed for long term and continuous residential occupancy;
 - (B) is designed to be moved on wheels, as a whole or in sections;
 - (C) on arrival at the site, is complete and ready for occupancy, except for incidental unpacking, assembly, connections with utilities, and placing on supports or a permanent foundation, or installation as a unit in a previously prepared structure; and
 - (D) contains the same type of interior plumbing fixtures as immovable housing (not RV (recreational vehicle) type fixtures);
- (41) **Modification of Operational Requirements** – means physically changing a building or structure or campground or changing its use so that new operational standards must be applied. Examples of modifications of operational requirements include, but are not limited to: conversion to a restaurant or food preparation business requiring the installation of a grease trap, adding fire sprinklers that require upgrading of the water supply line, or increasing the number of plumbing fixtures that requires upgrading of the water distribution system. The addition of plumbing fixtures in a single-family residence is not a modification of operational requirements.
- (42) **Municipality** - means a town, city, incorporated village or unincorporated village, or gore.
- (43) **Permanent Legal Access** – means an easement, right of way, deed or other legal document that creates an enforceable permanent property interest that provides access to a potable water supply or wastewater system located off the lot for the purposes of construction, operation and maintenance of the supply or system.
- (44) **Perched Water Table** – means a water table that forms in the upper horizons of some soils because layers with low permeability overlie layers with higher permeability. Under these Rules, a perched water table is the seasonal high water table and shall be treated as such.
- (45) **Performance Based Design** – means a design based on site specific hydrogeologic testing that demonstrates the site’s ability to function in accord with these Rules.
- (46) **Person** - means any individual, partnership, company, corporation, association, unincorporated association, joint venture, trust, municipality, the state of Vermont or any agency, department or subdivision of the state, federal agency, or any other legal or commercial entity.

- (47) **Potable Water Supply** - means the source, treatment and conveyance equipment used to provide water used or intended to be used for human consumption, including drinking, washing, bathing, the preparation of food, or laundering. This includes mechanical systems, such as pump stations and storage tanks or lavatories, that are located inside a building or structure and that are integral to the operation of a potable water system but does not include the building's internal piping or plumbing. This definition also does not include a potable water supply that is subject to regulation under 10 V.S.A. Chapter 56 (Public Water Supplies).
- (48) **Prescriptive Design** – means a wastewater system design based on at least 24” of naturally occurring, permeable soil above bedrock and the seasonal high water table, such as a traditional septic tank and leachfield design. (See enhanced prescriptive and performance based designs for alternatives to prescriptive design.)
- (49) **Primary Area** - means the area reserved for or containing the original wastewater system.
- (50) **Project** – means all lots, buildings, structures, campgrounds, potable water supplies and wastewater systems for which a particular permit application is submitted.
- (51) **Professional Engineer** - means an engineer licensed and in good standing by the Board of Professional Engineering under 26 V.S.A. Chapter 20.
- (52) **Qualified Hydrogeologist** - means a person with training or experience in bedrock geology, glacial geology and groundwater hydrology sufficient to adequately prepare the hydrogeologic studies and analyses required by these Rules.
- (53) **Seasonal High Water Table** – means the highest elevation that the water table reaches during the seasonally wet times of the year. This is determined by soil examination or groundwater level monitoring as described in the Rules.
- (54) **Secretary** - means the Secretary of the Agency or a duly authorized representative of Secretary. A duly authorized representative of the Secretary includes a municipality that has requested delegation, in writing, and has been delegated the authority to implement provisions of these Rules in lieu of the Secretary.
- (55) **Sewage** - means sanitary waste or used water from any building or structure or campground including, but not limited to, carriage water, and shower and wash water. For the purposes of these Rules, sewage does not include process wastewater. For purposes of these Rules, stormwater shall not be considered sewage.

§1-201(a)(56) Definitions

- (56) **Sewage Officer** – means a person appointed or employed by a municipality to administer these Rules when the municipality has received delegation of this program in accord with Subchapter 6 of these Rules,
- (57) **Single Family Residence** – means a building (s) or a structure (s) that contains only one living unit.
- (58) **Soil-Based Disposal System** – means a wastewater system that depends on naturally occurring soil to absorb the effluent from the system and to transmit the wastewater away from the site without any overland flow. Soil-based disposal systems include those that have a septic tank with leachfield, an advanced treatment system with leachfield, or a spray disposal system.
- (59) **Subdivide** - means to divide land by sale, gift, lease, mortgage foreclosure, court-ordered partition or decree, or filing of a plat, plan, or deed in the town records where the act of division creates one or more lots. Subdivision shall be deemed to have occurred on the conveyance of the first lot or the filing of a plat, plan, or deed in the town records, whichever first occurs. A subdivision of land shall also be deemed to have taken place when a lot is divided by a state or municipal highway, road or right-of-way or when a lot is divided by surface waters with a drainage area of greater than ten square miles. A town boundary does not create a subdivision. A mortgage deed does not create a subdivision unless a foreclosure occurs that results in the division of land.
- (60) **Substantially completed** - means a building or structure, potable water supply, or and wastewater system that is sufficiently constructed so that it can be used for its intended purpose.
- (61) **Unimproved Lot** – means a lot that has no building or structure on the lot.
- (62) **Wastewater** – means sanitary waste or used water from any building or structure or campground, including, but not limited to, carriage water, shower and wash water, and process wastewater. For the purposes of these Rules, stormwater shall not be considered wastewater.
- (63) **Wastewater system** - means any piping, pumping, treatment or disposal system used for the conveyance and treatment of sanitary waste or used water, including, but not limited to, carriage water, shower and wash water, and process wastewater. This definition does not include any internal piping or plumbing, except for mechanical systems, such as pump stations and storage tanks or toilets, that are located inside a building or structure and that are integral to the operation of a wastewater system. This definition also does not include wastewater systems that are used exclusively for the treatment and disposal of animal manure. For the purposes of these Rules, “wastewater system” refers to a soil-based disposal system of less than 6,500 gallons per day, or a sewerage connection of any size.

Subchapter 3 – Water Supply and Wastewater Permits

§1-301 Applicability

- (a) This Subchapter sets forth the permitting requirements for buildings or structures and campgrounds, together with their associated potable water supplies and wastewater systems, and for all other potable water supplies and wastewater systems.
- (b) Buildings or structures, campgrounds, potable water supplies, and wastewater systems may also be subject to other state permits.
- (c) No provision of this Subchapter shall limit the authority of the Department of Health with respect to facilities licensed by that Department. No provision of this Subchapter shall limit the authority of the Agency of Commerce and Community Development with respect to its authority to regulate mobile home parks including, but not limited to, sales, evictions, rents, habitability, and registrations.
- (d) Buildings or structures, potable water supplies, and wastewater systems may also have to comply with municipal ordinances and bylaws that require municipal permits.
- (e) Examples of buildings or structures that require a permit under this Subchapter include, but are not limited to, the following: single family residences on their own individual lots, accessory apartments, duplexes, buildings with three or more living units, condominiums, apartments, mobile homes, Park Model recreational vehicles and/or mobile homes used as a residence at a campground, places of employment, hospitals, nursing homes, motels, hotels, restaurants, filling stations, boarding homes, rooming houses, stores, shops, buildings or structures used as places of public assembly, buildings or structures used for home occupations, offices, manufacturing facilities, industrial facilities, and farm buildings or structures.

§ 1-302 Technical Assistance and Project Review

- (a) The Department has permit specialists available to assist applicants in identifying the applicability of specific permit programs to their projects. These permit specialists complete a Project Review Sheet, that, based on the information and description provided by the applicant, initially identifies what permits may be required for a project.
- (b) A prospective applicant should request a Project Review Sheet from the permit specialist or district coordinator in the early planning stages of a project so that potential regulatory requirements are identified.
- (c) The Secretary shall give deference to a certification by a designer with respect to engineering design or judgment exercised by the designer in order to minimize the Secretary's review of certified designs. Nothing in this subsection shall limit the responsibility of the designer to comply with the standards and the Rules, or the authority of the Secretary to review and comment on design aspects of an application or to enforce these Rules with respect to the design or the design certification.

§ 1-302(d) Technical Assistance and Project Review

- (d) The Secretary reserves the option to issue a permit without prior review of the potable water supply or wastewater system design by relying on the design certification required by these Rules.

§1-303 Permit Required

- (a) Except as provided in this section and in section 1-304 of this Subchapter, no person shall take or cause to be taken any of the following actions without first obtaining a permit or permit amendment from the Secretary:
- (1) the subdivision of a lot or lots;
 - (2) the construction of a new potable water supply or wastewater system;
 - (3) the modification or replacement of an existing potable water supply or wastewater system;
 - (4) the construction of a new building or structure;
 - (5) the modification of an existing building or structure in a manner that increases the design flow or modifies other operational requirements of a potable water supply or wastewater system;
 - (6) the connection of an existing potable water supply or wastewater system to a new or modified structure;
 - (7) the change of use of a building or structure in a manner that increases the design flow or modifies other operational requirements of a potable water supply or wastewater system including the conversion of a single family residence from seasonal to year-round use;
 - (8) the creation of a campground;
 - (9) the modification of a campground, including the creation, modification or relocation of one or more individual campsites, in a manner that affects a potable water supply or wastewater system or the requirements for providing potable water and wastewater disposal;
 - (10) the use or operation of a failed potable water supply or failed wastewater system; or
 - (11) the commencement of construction of any of the above. For the purposes of this section, commencing construction means any work involving the physical construction or modification of a building or structure and its associated potable water supply or wastewater system including, but not limited to: foundation excavation; foundation or building construction; and site work that involves or may affect any portion of the existing or proposed potable water supply or wastewater system serving the project.

§1-303(b) Permit Required

- (b) A person may request, in writing, a jurisdictional determination by the Secretary that a particular building's or structure's use or useful occupancy does not require either a potable water supply or a wastewater system and therefore does not require a permit under this Subchapter. Such request should be submitted prior to the submission of a permit application. All jurisdictional determinations by the Secretary shall be in writing and, if the Secretary determines that no permit is required, such determinations shall be recorded and indexed by the person who requested the determination in the land records for the municipality where the building or structure is located. The Secretary's written determination will indicate that any change in the facts on which the determination is based may require a permit under this subchapter.

§1-304 Exemptions

- (a) The following are exempt from the permitting requirements of this Subchapter provided the specified conditions are met (Note: more than one exemption may apply in a particular situation).
- (1) (A) All buildings or structures, campgrounds, and their associated potable water supplies and waste water systems that were substantially completed before January 1, 2007 and all improved and unimproved lots that were in existence before January 1, 2007. This exemption shall remain in effect provided:
- (i) No action for which a permit is required under these Rules is taken or caused to be taken on or after January 1, 2007 unless such action is exempt under one of the other permitting exemptions listed in this section; and
- (ii) If a permit has been issued under these Rules before January 1, 2007 that contained conditions that required actions to be taken on or after January 1, 2007, including, but not limited to, conditions concerning operation and maintenance and transfer of ownership, the permittee shall continue to comply with those permit conditions.
- (B) If a permit or permit amendment is required under this subdivision because the potable water supply and/or wastewater system has failed, the variance provisions of section 1-806 of these Rules and the Vermont Water Supply Rules shall be available.
- (C) An owner of a single family residence that qualified on January 1, 2007 for this exemption shall not be subject to administrative or civil penalties under 10 V.S.A. chapters 201 and 211 title for a violation of these Rules when the owner believes the supply or system meets the definition of a failed water supply or failed system provided the owner:
- (i) conducts or contracts for an inspection of the supply or system;

§1-304(a)(1)(C)(ii) Exemptions

- (ii) notifies the Secretary of the results of the inspection; and
- (iii) has not taken or caused to be taken any other action on or after January 1, 2007 for which a permit would be required under these Rules.

Note 1: Some single family residences on their own lots were authorized under the prior version of these Rules to make changes to the residence, and its associated potable water supply and wastewater system, until July 1, 2007 without obtaining a permit. If those actions occurred prior to July 1, 2007, they do not terminate this exemption.

Note 2: In order to determine whether something is substantially complete or in existence for the purposes of this exemption, the design flow and/or use of a building or structure, campground, wastewater system, or potable water supply as it existed no earlier than January 1, 2006 shall be used. This year period allows consideration of the most recent seasonal use, fluctuations in business size, etc.

Note 3: For the purposes of this exemption, lots that before January 1, 2007 had a wastewater system and potable water supply used as a hook-up for a recreational vehicle that was used on a seasonal basis but not a continuous basis, ie: the vehicle comes and goes during the seasonal period, shall considered to be improved lots and therefore qualify for this exemption.

- (2) (A) unimproved lots created by an act of subdivision that occurs on or after January 1, 2007, provided that:
 - (i) the deed, that is recorded and indexed, that describes the affected property contains the following language:

“Notice of permit requirements. In order to comply with applicable state Rules concerning potable water supplies and wastewater systems, a person shall not construct or erect any structure or building on the lot of land described in this deed if the use or useful occupancy of that structure or building will require the installation of or connection to a potable water supply or wastewater system, without first complying with the applicable Rules and obtaining any required permit. Any person who owns this property acknowledges that this lot may not be able to meet state standards for a potable water supply or wastewater system and therefore this lot may not be able to be improved.”; or

- (ii) if there is no deed for the lot that was created by the act of subdivision, i.e. the retained lot, the owner of the unimproved lot shall record and index a copy of the notice language described in subdivision (2)(A)(i) above in the land records for the municipality in which the unimproved lot is located.

§1-304(a)(2)(B) Exemptions

- (B) This exemption shall terminate when the person who owns the unimproved lot takes or causes to be taken any action for which a permit is required under this Subchapter, except for the construction, modification, or replacement of a wastewater system or potable water supply that serves a building or structure located on a different lot.

Note 1: When a lot that is subject to the notice of permit requirements (lot 1) is merged with another lot (lot 2), the notice language may be removed if the two lots are merged in a recorded deed as one lot. The resulting lot shall have the status that lot 2 had prior to the merger. So, for example, if lot 2 was subject to the notice of permit requirements, the entire resulting lot has deferral restrictions. If lot 2 has an existing wastewater and potable water supply permit, the permit may be amended to reflect the additional land. If lot 2 was exempt under this section, the resulting lot shall retain the same exemption.

Note 2: Some old deferred permits contained a condition that required re-issuance of the permit upon the transfer of land. Notwithstanding the language of that permit condition, these permits do not need to be re-issued provided that the provisions of this exemption are met.

- (3) a single family residence on its own lot, and its associated potable water supply and wastewater system, provided that the residence, supply, and system are constructed in accordance with a municipal permit, issued prior to November 1, 2004 pursuant to a municipal ordinance or zoning bylaw that requires the application of specific technical standards for the design and construction of wastewater systems and provided that no permit under these Rules has been issued. This exemption shall terminate:

- (A) when the lot is subdivided and the resulting lots are not otherwise exempt under these Rules; or

- (B) when any other action for which a permit is required under this Subchapter is taken or is caused to be taken on or after July 1, 2007 other than the construction authorized in this exemption.

Note 1: Some municipal permits approving wastewater systems include expiration dates to assure that construction occurs within a set period of time. If the municipal permit has expired, it is no longer in effect and therefore this exemption would not apply. People should review their municipal permits before relying on them under this exemption.

Note 2: Some municipal ordinances and bylaws simply require a design prepared by a professional engineer or site technician and do not have specific technical standards. Municipal permits issued under these types of ordinances and bylaws do not qualify for this exemption.

§1-304(a)(3) Exemptions

Note 3: In accordance with statute, permits issued by municipalities remain in effect even though the local ordinance or by-law has been superseded unless the permit has expired or has been amended under these Rules.

Note 4: If a municipality required the construction of a temporary structure when issuing a municipal permit under a valid ordinance or by-law, a person may replace the temporary structure and construct the permanent building or structure that was actually permitted. So, for example, if a municipality issued a permit for a three bedroom house but required the construction of a storage shed instead of the house, the house may be finally constructed without requiring a permit under these Rules, so long as the municipal permit remains valid.

- (4) primitive camps on their own individual lots with no interior plumbing consisting of no more than a sink with water that are used for no more than three (3) consecutive weeks per year and no more than a total of sixty (60) days per year.
- (5) a primitive camp, that meets the criteria of subdivision (a)(4) of this section, except that it may be located on the same lot as only one single family residence.

Note 1: the residence, and its associated potable water supply and wastewater system are only exempt if some other exemption in this section applies.

- (6) the use of a single family residence on its own individual lot, and its associated potable water supply and wastewater system, as a family day care home, as defined in 33 V.S.A. section 4902(3), provided that:
 - (A) the residence, and its associated potable water supply and wastewater system, has been permitted under this Subchapter or is exempt from the permitting requirements of this Subchapter; and
 - (B) there has been no other change to the residence, lot, potable water supply or wastewater system that would otherwise require a permit under this Subchapter.
- (7) the use of a single family residence on its own individual lot, and its associated potable water supply and wastewater system, for both residential and commercial purposes provided that:
 - (A) the commercial purposes do not entail the substantial presence of non-residential employees or regular visits by the public;
 - (B) the residence, and its associated potable water supply and wastewater system, has been permitted under this Subchapter or is exempt from the permitting requirements of this Subchapter; and

§1-304(a)(7)(C) Exemptions

- (C) there has been no other change to the residence, lot, potable water supply or wastewater system that would otherwise require a permit under this Subchapter.
- (8) the use of an existing single family residence on its own lot, and its associated potable water supply and wastewater system for both residential and commercial purposes where the commercial purposes entail the substantial presence of non-residential employees or regular visits from the public provided that:
 - (A) the commercial use of the residence does not result in an increase in design flow or a change in the operational requirements of the potable water supply or wastewater system;
 - (B) the commercial use of the residence started after the building was used solely as a residence;
 - (C) the owner of the residence tests the potable water supply for total coliform, nitrate, nitrite, arsenic, and uranium;
 - (D) the results of the water tests demonstrate compliance with the standards contained in section 1-201(a)(24)(A)(i) of these Rules (the definition of a failed potable water supply) and the owner of the residence submits a copy of such water test results to the Secretary;
 - (E) the residence, and its associated potable water supply and wastewater system has been permitted under this Subchapter or is exempt from the permitting requirements of this Subchapter; and
 - (F) there has been no other change to the residence, lot, potable water supply or wastewater system that would otherwise require a permit under this Subchapter.
- (9) a building or structure that is used for commercial purposes by an occupant of a single family residence that is located on the same lot and that uses the potable water supply and wastewater system serving the single family residence, provided that:
 - (A) the commercial purposes do not entail the substantial presence of non-residential employees or regular visits by the public;
 - (B) the residence, and its associated potable water supply and wastewater system, has been permitted under this Subchapter or is exempt from the permitting requirements of this Subchapter; and
 - (C) there has been no other change to the building or structure, lot, potable water supply or wastewater system that would otherwise require a permit under this Subchapter.

§1-304(a)(10)

Exemptions

- (10) the use of an existing building or structure, and its associated potable water supply and wastewater system for commercial purposes by an occupant of a single family residence that is located on the same lot, when the commercial purposes entail the substantial presence of nonresidential employees or regular visits by the public, provided that:
 - (A) the commercial use of the building or structure does not result in an increase in design flow or a change in the operational requirements of the potable water supply or wastewater system;
 - (B) the owner of the residence tests the potable water supply for total coliform, nitrate, nitrite, arsenic and uranium;
 - (C) the results of the water tests demonstrate compliance with the standards contained in section 1-201(a)(24)(A)(i) of these Rules (the definition of a failed potable water supply) and the owner submits a copy of such water test results to the Secretary; and
 - (D) there has been no other change to the building or structure, lot, potable water supply or wastewater system that would otherwise require a permit under this Subchapter.

- (11) boundary line adjustments that affect either improved or unimproved lots provided that:
 - (A) each lot being adjusted meets one or more of the following standards:
 - (i) a lot being reduced in size is being reduced by no more than two percent;
 - (ii) a lot is increased in size;
 - (iii) the boundary line being adjusted is located, after adjustment, at least 500 feet from the footprint of the building or structure on an improved lot; or
 - (iv) the Secretary, on a case by case basis, makes a written determination that the proposed adjustment will not have an adverse effect on any existing potable water supply or wastewater system on the affected lots.
 - (B) a diagram is submitted to the Secretary that shows the existing and revised lot boundaries; and
 - (C) a copy of the diagram and, if applicable the Secretary's written determination, is recorded and indexed in the land records for the municipality where the lots are located by the landowner.

§1-304(a)(11)(C) Exemptions

Note 1: Boundary line adjustments that were done pursuant to the prior version of this exemption (sections 1-403(a)(12) or 1-404(a)(4) of the January 1, 2005 version of these Rules) remain exempt so long as the diagram and Secretary's determination are recorded and indexed in the land records for the municipality where the lots are located.

Note 2: Case by case determinations under subdivision(A)(iv) of this exemption will require the submission of a diagram of the lots that shows the locations of all existing, and permitted but not yet built, potable water supplies and wastewater systems.

- (12) minor repair or replacement of a potable water supply or wastewater system that serve a building or structure or campground. (See definition of minor repair or replacement in section 1-201(a)(39)).
- (13) the subdivision of an unimproved or improved lot or campground where the subdivision occurs due to state or municipal condemnation for highway or utility construction, including lots created as a result of a settlement of an action for condemnation and lots created by a transfer in lieu of condemnation, provided that the state has held a hearing pursuant to 19 V.S.A. §502 or a municipality has held a necessity hearing pursuant to 19 V.S.A. §709.
- (14) the connection of a building or structure or campground to a municipal sewer by a municipality at the time of initial construction and operation of the municipal sewer, provided that:
 - (A) the municipal sewer and the associated connection are part of a project approved by the Facilities Engineering Division of the Department; and
 - (B) either the Facilities Engineering Division of the Department has approved the building connection, or a designer retained by the municipality has signed the design and installation statements required under sections 1-306 and 1-308 of these Rules, submitted them to the Secretary, and recorded and indexed the statements in the land records for the municipality where the residence is located.

Note: If the building or structure or campground has been permitted under these Rules prior to the new connection, the existing permit shall be amended to reflect the change in the wastewater disposal method the amended permit shall be recorded and indexed in the land records for the municipality where the building or structure or campground is located.

§1-304(a)(15) Exemptions

- (15) a single family residence on its own lot that does not have both a piped potable water supply and a piped wastewater system before January 1, 2007 provided:
- (A) there is no increase in design flows;
 - (B) there is no change in use of the building or structure, including but not limited to, the addition of a home business or occupation or the initiation of a family day care operation;
 - (C) the building or structure is not a primitive camp, as that term is defined in subdivisions (a)(4) and (5) of this section;
 - (D) construction of a piped wastewater system or potable water supply that the building or structure did not have does not occur without first obtaining a permit under this Subchapter; and
 - (E) no other actions for which a permit is required under this Subchapter are taken or are caused to be taken.

Note 1: The replacement of wastewater systems and potable water supplies serving the residence requires a permit but may be done in accordance with the variance procedures of section 1-806 of these Rules.

Note 2: If the existing wastewater system uses a sewage holding tank, that tank may be replaced with another holding tank that meets the technical requirements of these Rules.

Note 3: Examples of situations where this exemption applies include, but are not limited to:

- (i) the residence does not have interior plumbing that is piped to a soil-based wastewater system
 - (ii) the residence does have interior plumbing that is piped to a soil-based wastewater system but does not have potable water piped into the building
 - (iii) the residence does have potable water piped into the building but wastewater is not piped out of the residence to a soil-based wastewater system; or
 - (iv) the residence does not have potable water piped into the building
- (16) disposal of wastewater associated with the operation and cleaning of milking equipment, milk storage tanks, and milking parlors. Note: consult the Vermont Agency of Agriculture, Food and Markets regarding regulation of this type of disposal.

§1-304(a)(17) Exemptions

- (17) land application of process wastewater generated by farming activities, provided that the land application is conducted in accordance with the Accepted Agricultural Practices adopted by the Vermont Agency of Agriculture, Food and Markets and, if applicable, the Guidelines for Land Application of Dairy Processing Wastes adopted by the Agency. Note: This type of land application may require an indirect discharge permit from the Secretary.
- (18) bonafide primitive or wilderness campgrounds, unless the Secretary determines, on a case-by-case basis, that a particular campground is likely to create a health hazard or threat to the environment.
- (19) the elimination of a campsite in a campground, provided that a permit is obtained before the campsite is reopened or relocated.
- (20) premises used solely for the storage or display of unoccupied or uninhabited mobile homes.
- (21) a building or structure that is exempt or has a permit under these Rules that has been destroyed by fire, flooding, or other act of God or voluntarily removed, may be reconstructed without obtaining a permit or permit amendment provided that:
 - (A) if permitted on or after January 1, 2007, the reconstructed building or structure is in compliance with all permit conditions;
 - (B) the building or structure is reconstructed in approximately the same location;
 - (C) there is no increase in design flow;
 - (D) there is no change in the operational requirements of the potable water supply or the wastewater disposal system;
 - (E) if the building or structure is exempt it must be reconstructed within two years of its destruction or voluntary removal unless, on a case by case basis, the Secretary extends the time period based on a determination that there are unavoidable delays in reconstruction. If the building or structure is permitted, there is no time limit for the reconstruction; and
 - (F) there has been no other change to the building or structure, lot, potable water supply, or wastewater system that would require a permit under these Rules.

§1-304(a)(22) Exemptions

- (22) the design and installation of a replacement potable water supply serving only one single family residence on its own individual lot provided:
 - (1) the design and installation is performed in accordance with the Vermont Water Supply Rules;
 - (2) a form provided by the Secretary regarding the replacement well is recorded and indexed in the land records for the municipality where the project is located and;
 - (3) no other action has been taken or has been caused to be taken that would require a permit under these Rules.

Note: This exemption does not apply if any activity other than single family residency is occurring, including, but not limited to, home occupations, family day care operations, and accessory living units.

- (b) For exemptions (a) (6), (7), (8), (9) and (10) of this section, non-compliance with the permit issued for the single family residence, or the conditions of the permit exemption for the residence, does not terminate the specific exemption but does constitute a violation that may be enforced by the Secretary.
- (c) Persons who wish to take advantage of any of the permit exemptions listed above are strongly encouraged to document compliance with the conditions of the exemption and record and index such documentation in the land records for the municipality where the lot, building or structure, campground, potable water supply, or wastewater system is located in order to avoid delays in closings for real estate transactions or financing.

§ 1-305 Applications for Permits

- (a) Any person who is required to obtain a permit or permit amendment under these Rules, shall submit an application to the appropriate Agency Regional Office. All applications shall be made in accordance with the requirements of Appendix 6-A and on the form provided by the Secretary in accordance with the directions provided by the Secretary.
- (b) Where hydrogeologic studies are required, they shall be performed by a qualified hydrogeologist who is a designer or who is working under the supervision of a designer.
- (c) Proposed wastewater disposal areas and potable water supply source locations shall be accurately flagged in the field prior to filing an application. Final approved locations shall be flagged and shall be retained until construction is complete.

Note: In certain specified circumstances, the Secretary may waive the submission of some or all of the information required for a complete application under this section and Appendix 6-A. Please refer to Appendix 6-A(h) for more details.

§ 1-305(d) Applications for Permits

- (d) The Secretary may deny an application in writing for one or more of the following reasons:
 - (1) the site conditions are not suitable for a soil-based wastewater system or potable water supply, or where an unreasonable burden will be placed on a municipal or private sewerage collection system or potable water supply;
 - (2) the proposed project does not meet the technical standards set forth in these Rules;
 - (3) the information submitted is not sufficient to make a determination that the proposed project can be developed in accord with these Rules;
 - (4) an applicant has failed to respond to a request for additional information within the time frame specified in the request;
 - (5) the information submitted is determined to be in error; or
 - (6) conditions exist or may be created by the proposed project that may endanger public health.
- (e) An applicant may withdraw an application without prejudice at any time until the Secretary renders a decision on the project. If the application is withdrawn prior to initiation of any technical review, the application fee will be refunded. No fee shall be refunded once technical review has begun.

§ 1-306 Design Certification

- (a) All designs and design-related information contained in an application for a permit shall be prepared by a designer and be accompanied by a certification, signed and dated by a designer, that states:

“I hereby certify that in the exercise of my reasonable professional judgment the design-related information submitted with this application is true and correct, and that the design included in this application for a permit complies with the Vermont Wastewater System and Potable Water Supply Rules and the Vermont Water Supply Rules.”
- (b) No permit shall be issued under these Rules unless the design certification required by this section has been submitted to the Secretary.
- (c) Notwithstanding the other provisions of this section, the required design certification:
 - (1) is not required when no installation certification is required under section 1-308 of these Rules;
 - (2) is not required when a permit amendment is done solely to authorize the addition of land to a permitted lot;

§ 1-306(c)(3) Design Certification

- (3) is not required for both the wastewater system and water supply when the project involves only the potable water supply or the wastewater system. In this situation, the certification will only be required for the supply or system that is being permitted; or
- (4) is limited to merely that information that the Secretary requires if a waiver of the submission of information is granted under Appendix 6-A, subsection (h).

§ 1-307 Filing of Permits, Certifications, and Other Documents

- (a) The Secretary shall forward a copy of all permits and/or denials to the municipal planning commission, or development review board, for the municipality in which the project is located, or to the municipal clerk in municipalities without a planning commission or development review board.
- (b) Each permit shall be recorded and indexed by the permittee in the land records for the municipality in which the project is located prior to commencement of any activity authorized under that permit. The permittee shall also be responsible for ensuring that all required design and installation certifications and other documents that are required to be filed under these Rules, or under a specific permit condition, are also recorded and indexed in the land records for the municipality in which the project is located, and that copies of all certifications are sent to the Secretary.
- (c) When a permit or document is required by these Rules to be recorded and indexed it shall be recorded and indexed in accordance with the provisions of 24 V.S.A. sections 1154 and 1161.

§ 1-308 Installation Certifications

- (a) No permit issued by the Secretary shall remain valid after substantial completion of a potable water supply or wastewater system until the Secretary receives a signed and dated certification from a designer or an installer, as specified in the permit, that states:

“I hereby certify that in the exercise of my reasonable professional judgment the installation-related information submitted is true and correct and that the potable water supply and wastewater system:

- (1) were installed in accordance with:
 - (A) the permitted design and all permit conditions; or
 - (B) record drawings and such record drawings are in compliance with the applicable rules, were filed with the Secretary, and are in accordance with all other permit conditions;
- (2) were inspected;

§ 1-308(a)(3) Installation Certifications

- (3) were properly tested; and
 - (4) have successfully met those performance tests.”
- (b) Notwithstanding the provisions of subsection (a) of this section, a permit issued by the Secretary shall remain valid for a substantially complete potable water supply or wastewater system without an installation certification if:
- (1) the potable water supply that is permitted is an existing supply where no construction is required and where the supply was either previously permitted or exempt under these Rules; or
 - (2) the wastewater system that is permitted is an existing system where no construction is required and where the system was either previously permitted or exempt under these Rules.
- Note: If a permitted project involves the construction of only a potable water supply or only a wastewater system, an installation certification is required only for the supply or system that will be constructed.
- (c) Notwithstanding the provisions of subsection (a) of this section, a permit amendment done solely to authorize the addition of land to a permitted lot does not need an installation certification.

§ 1-309 General Permit Requirements and Provisions

- (a) The Secretary may include any condition in a permit that he or she deems necessary to protect human health and the environment or to satisfy the purposes and requirements of these Rules including, but not limited to, requirements for operation and maintenance.
- (b) No permit issued by the Secretary for a potable water supply or wastewater system located off the lot shall remain valid as of the date of initiation of construction until a document establishing permanent legal access has been recorded and indexed in the land records of the municipality where the project is located.
- (c) Construction of a potable water supply or wastewater system, as permitted, does not relieve the permittee from the responsibility to properly operate and maintain the supply or system.
- (d) Permits issued under these Rules shall run with the land.
- (e) The Secretary, by issuing permits under these Rules, accepts no legal responsibility for any damage, direct or indirect, of whatever nature and by whomever suffered, arising out of the permitted project.

§ 1-309(f) General Permit Requirements and Provisions

- (f) Permits do not convey any property rights in either real or personal property, or any exclusive privileges, nor do they authorize any infringement of federal, state or local laws or regulations.
- (g) Notwithstanding the repeal of 3 V.S.A. §2873(c), 10 V.S.A. Chapter 61, the mobile home park permitting requirements of 10 V.S.A. Chapter 153, and 18 V.S.A. § 1218, permits regarding trailer camps, tent sites, campgrounds, potable water supplies, and wastewater systems, mobile home parks, and subdivisions issued before the August 16, 2002 shall be deemed to be permits issued under these Rules.

§1-310 Site or Foundation Approval

- (a) Site work or foundation construction may commence prior to the issuance of a permit under this Subchapter only if the Secretary issues a written authorization for the commencement of such activities. This authorization may be granted if the Secretary finds that the commencement of site work or foundation construction will not inhibit the proper planning, design, or construction of the required potable water supply or wastewater system. Such authorization shall either be granted or denied within 21 days of the submission of a written request for the authorization provided that the written request includes all plans and information that the Secretary deems necessary to make the required finding. The request shall include a completed permit application form and the applicable fee. The approval may include conditions limiting the amount of work that may be done prior to the permit being issued.

§1-311 Special Permit Standards for the Subdivision of Improved Lots

- (a) This section shall apply to any improved lots that are proposed to be subdivided.
- (b) Notwithstanding any other provisions of these Rules, the lot or lots subject to the permit or permit amendment required under this section shall comply with the following requirements:
 - (1) if permitted, and not otherwise exempt from the permit requirements, the potable water supply and wastewater system serving the building or structure or campground on the lot may continue to be used as is, unless the supply or system is failed at the time of subdivision, or is not in compliance with the continuing requirements of a permit issued before January 1, 2007 or is not in compliance with the conditions of a permit issued on or after January 1, 2007;
 - (2) if exempt, the potable water supply and wastewater system serving the building or structure or campground on the lot may continue to be used as is unless the system or supply is failed at the time of subdivision, or is not in compliance with the conditions of the applicable exemption;
 - (3) (A) a fully complying area for a replacement wastewater system and potable water supply, serving a single family residence, duplex, and buildings or structures or campgrounds with a design flow of 500 gallons per day or less, is identified unless:

§1-311(b)(3)(A)(i) Special Permit Standards for the Subdivision of Improved Lots

- (i) the existing system and supply meets all of the requirements of these Rules;
 - (ii) the new property boundary is 500 feet or more from the existing footprint of the building or structure or campground;
 - (iii) any fully complying replacement area is so inaccessible that it would be clearly unreasonable to require its use; or
 - (iv) no replacement wastewater area is required because either the existing primary wastewater system is designed and constructed to handle 150% of the design flows and uses pressure distribution designed in accordance with section 1-906 of these Rules or the existing primary wastewater system is a mound wastewater disposal system.
- (B) if no fully complying replacement area can be located within 500 feet of the existing footprint of the building or structure or campground, the variance provisions of section 1-806 of these Rules shall apply. In the event that no replacement is found because any replacement wastewater system built in the area is likely to fail, a holding tank may be used in accordance with the requirements of section 1-919 of these Rules and when the long term operation and maintenance costs of using the holding tank are considered.
- (4) (A) A fully complying area for a replacement wastewater system and potable water supply, serving anything other than a single family residence, duplex, and buildings or structures or campgrounds with a design flow of more than 500 gallons per day, is identified unless:
- (i) the existing supply meets all of the requirements of these Rules; or
 - (ii) any fully complying replacement area for the supply is so inaccessible that it would be clearly unreasonable to require its use; or
 - (iii) no replacement wastewater area is required because either the existing primary wastewater system is designed and constructed to handle 150% of the design flows and uses pressure distribution designed in accordance with section 1-906 of these Rules or the existing primary system is a mound wastewater disposal system.
- (B) if no fully complying replacement area can be located on the lot that existed prior to subdivision, the variance provisions of section 1-806 of these Rules and the Vermont Water Supply Rules shall apply.

§1-311(b)(5) Special Permit Standards for the Subdivision of Improved Lots

- (5) each lot must have permanent legal access to the primary and any replacement areas that serve the lot; and
- (6) any unimproved lot created by the subdivision is permitted or meets the requirements for a permit exemption.

§1-312 Special Permit Standards for Public Schools

- (a) Design flows for the expansion of wastewater systems serving existing public schools may be based on the historical rate of wastewater system loading upon a demonstration that there currently is sufficient capacity for periods of peak demand and there is a strong likelihood of sufficient capacity for future periods of peak demand.
- (b) Replacement area requirements for wastewater systems in Subchapter 8 of these Rules may be waived for existing public schools if the system design includes sufficient safety factors to protect the primary area. A mound wastewater disposal system sized to handle 100% of the design flows or any other type of soil-based disposal system that is sized to handle 150% of the required design flows are two examples of systems with sufficient safety factors that protect primary area.

§1-313 Special Permit Standards for Campgrounds

- (a) In addition to meeting the potable water supply and wastewater system permitting standards described in these Rules, the following permitting standards shall apply:
 - (1) Each individual campsite shall be at least 2,500 square feet in size, with a minimum width of 25 feet. Each campsite shall be dry, clean and well drained during normal weather conditions.
 - (2) Potable water shall be available at faucets or from approved water supply risers or both. No water supply riser shall be located within 10 feet of a sewer connection. A faucet shall be provided within 400 feet of any dependent campsite. Common drinking vessels at such faucets are not allowed. Dependent campsites are all campsites that do not have individual water and sewer connections and all campsites used for camping units without interior plumbing.
 - (3) If water from a piped system is not available, water may be obtained from a spring or a well that is developed and protected in a manner approved by the Secretary.
 - (4) When showers or baths are provided, all plumbing shall conform to the Vermont Plumbing Rules.

§1-313(a)(5) Special Permit Standards for Campgrounds

- (5) At least one dumping station shall be provided per campground, unless all campsites have individual sewer connections or the campground consists entirely of tent sites (which excludes all use by camping units with interior plumbing). Each dumping station shall serve no more than 100 dependent campsites, and shall be supplied with piped water under pressure for flushing and cleaning of the concrete apron after each use.
- (6) All dependent campsites shall be within 400 feet of a toilet facility. These may be either water carried toilets, vault type privies, composting toilets, or incinerating toilets. One toilet or privy seat shall be provided to serve each group of 10 or fewer dependent campsites.

§ 1-314 Special Permit Standards for Amending Permits when Land is Added to a Lot

- (a) When adding land to a lot already subject to a permit under these Rules, if the permittee wants to amend the permit even though the addition of land to a lot does not require a permit, that amendment shall be processed as an administrative amendment. The permit amendment shall acknowledge the addition of land and shall not require plans, a design certification, or installation certification. If the existing permit includes unfulfilled permit requirements, such as inspection requirements, those requirements shall be satisfied prior to issuance of the permit amendment unless completion of those requirements are authorized to be done at a different time by the permit amendment.

§ 1-315 Special Permit Standards for the Conversion of a Single Family Residence from Seasonal to Year-Round Use

- (a) Notwithstanding any other provisions of these Rules, a single family residence on its own individual lot that converts from seasonal to year-round use may be granted a permit or permit amendment under these Rules provided
 - (1) (A) the potable water supply and wastewater system serving the residence are in full compliance with these Rules; or
 - (B) the potable water supply and/or wastewater system serving the residence are not in full compliance with these Rules. In this situation, an assessment shall be performed by a designer in order to determine the degree of non-compliance. Based on this assessment, the designer may prepare a design that uses the variance provisions of §1-806 of these Rules. No permit may be issued under this section that allows the use of a holding tank;
 - (2) there is no increase in the number of bedrooms; and
 - (3) no other actions for which a permit is required under this Rules are taken or are caused to be taken.

Subchapter 4 - Appeals; Declaratory Rulings; Revocations; Enforcement

§ 1-401 Administrative Reconsideration of Permitting Decisions

- (a) An applicant, or following issuance of a permit, a permittee or any person whose interests are directly affected by the permitted project, may request, in writing, that a decision made in a Regional Office be reviewed by the Regional Office Programs Manager. The decision shall be issued in writing within 30 days.
- (b) Any person who has requested a reconsideration under subsection (a) of this section may, within 30 days of the date of the decision, request that the decision of the Regional Office Programs Manager be reviewed by the Director using the following procedures:
 - (1) The person shall submit a written request for reconsideration to the Director. This request must specify which aspects of the decision are at issue, the reasons why the person believes the decision to be in error, and the decision requested of the Director.
 - (2) As soon as possible but no later than 15 days after receipt of the request, the Director shall convene a meeting with affected persons, their representatives and Division personnel. The Director may call on other individuals within or outside the Department who have expertise appropriate to the case to assist in her/his review.
 - (3) The Director shall issue a written decision within 15 days of the meeting. This time period may be extended if the affected persons agree.
- (c) Any person who requested a reconsideration under subsection (b) above may, within 30 days of the date of the decision, submit a request for reconsideration of the Director's decision to the Commissioner using the following procedure:
 - (1) The person shall submit a written request for reconsideration to the Commissioner. This request must specify which aspects of the decision are at issue, the reasons why the person believes the decision to be in error, and the decision requested of the Commissioner.
 - (2) The Commissioner may hold additional meetings at her/his discretion or act on the basis of the record.
 - (3) The Commissioner shall issue a written decision within 30 days from the date of the request or the last meeting held on the matter, whichever is later. This written decision shall constitute the final decision by the Secretary.

§ 1-402 Appeal of Final Agency Action

- (a) A person aggrieved by a final act or decision, other than an enforcement decision, of the Secretary under these Rules may appeal to the Environmental Court in accordance with 10 V.S.A. Chapter 220.

§ 1-403 Declaratory Rulings

- (a) **General:** On petition of the Division or of a person who may be affected by the enabling statutes for this Rule or by this Rule itself, the Secretary shall render a declaratory ruling as to the applicability of any enabling statutory provision or this Rule as provided for in 3 V.S.A. §808.
- (b) **Content of Petition for Declaratory Ruling:** The petition shall contain:
 - (1) the name, address, and telephone number of the petitioner;
 - (2) the signature of the petitioner;
 - (3) identification of the specific statutory provision or section of this Rule in question;
 - (4) a statement of the controversy or uncertainty involved;
 - (5) a statement of the petitioner's interest in the subject matter, including the reasons for the submission of the petition;
 - (6) a statement of the petitioner's contentions; and
 - (7) a memorandum of legal authorities in support of such position or contention.
- (c) **Hearing:** Although in the usual course of disposition of a petition for a declaratory ruling a hearing will not be required, the Secretary may require a hearing in response to a request or by his/her own motion.
- (d) **Hearing Procedure:** Hearings on petitions for declaratory rulings shall be conducted in accordance with the provisions of 3 V.S.A. §809-814, and this section, except that the burden of proceeding and proof that the facts in the petition are correct shall be upon the petitioner.
- (e) **Secretary's Action:** The Secretary shall issue a decision within 30 days of the receipt of a petition for declaratory ruling unless a hearing is held, in which case the Secretary shall issue a decision within 30 days following the close of the hearing. This decision shall constitute the final decision of the Secretary.
- (f) **Record of Declaratory Rulings:** All declaratory rulings shall be in writing. The Department shall maintain a file of all declaratory rulings and make copies of the rulings available to the public upon request.

§ 1-404 Revocation of Permits

- (a) **General:** The Secretary may revoke a permit either in response to a petition or on his or her own motion. The Division may file a petition and may participate in revocation proceedings.

- (b) **Bases for revocation:** The bases for revocation are:
 - (1) violation of a permit condition;
 - (2) false or misleading information submitted in support of the permit;
 - (3) untrue or incorrect design or installation certifications and/or design or installation related information that do not reflect the exercise of reasonable professional judgment;
 - (4) violation or failure to comply with the provisions of these Rules or authorizing statutes;
 - (5) a petition to revoke submitted by a municipality based on the expiration of the municipality's approval to connect to its wastewater treatment plant or public water supply; or
 - (6) a petition to revoke submitted by the permittee.

- (c) **Petition for Revocation:** All petitions for revocation shall be addressed to the Secretary, shall be copied to the permittee and the landowner(s), and shall include:
 - (1) the name, address, and telephone number of the petitioner;
 - (2) the signature of the petitioner;
 - (3) identification of the specific statutory provision, rule, permit condition, or expired municipal approval in question;
 - (4) a statement of the petitioner's interest in the matter and the petitioner's contentions, including the alleged basis for the revocation of the permit; and
 - (5) a statement that a copy of the petition for revocation has been sent by the petitioner to the permittee and landowner(s).

- (d) **Party Status:** The Secretary shall determine the right of the petitioner or other persons requesting party status to participate in the proceedings. In determining party status, the Secretary shall consider whether a person or his/her property is directly affected by the permitted project. The Division and the municipality in which the project at issue is located are automatically parties in a revocation proceeding.

§ 1-404(e) Revocation of Permits

- (e) **Notice of Revocation Hearing:** Notice of a Petition for Revocation of a permit shall be sent to the permittee, the municipality in which the project is located, and all other potentially affected parties. The notice shall be issued at least two weeks prior to hearing and shall include the following information:
- (1) the legal authority for revocation;
 - (2) a brief statement of facts upon which the proposed action is based;
 - (3) a statement that the Secretary will hold a hearing for the purpose of determining whether the permit shall be revoked; and
 - (4) the date, time, and place where the hearing will be held.
- (f) **Hearing:** The hearing in a contested case shall be conducted by the Secretary. Any party to the revocation proceedings shall either appear in person or shall be represented by an attorney. The burden of proceeding and of proving that the permit should be revoked shall be upon the party petitioning for revocation. The admissibility of evidence in all revocation proceedings shall be determined under criteria set forth in 3 V.S.A. §810. Upon the request of a party, a hearing shall be transcribed by a qualified stenographer or recorded on an electronic sound device at the election of the party. If transcription by a stenographer is requested, the request shall be in writing and filed at least 10 days before the hearing. Costs shall be borne by the requesting party. The requesting party shall provide one copy of the transcript to the Secretary without cost; other parties wishing a copy shall reimburse the requesting party on a prorated basis.
- (g) **Examination of Evidence, Decision and Order:** The examination of evidence, decision and order shall be governed by the provisions of 3 V.S.A. §§811 and 812. The final decision shall be made within 30 days after the close of the hearing. This decision shall constitute the final decision of the Secretary. Copies shall be sent to the permittee, other parties, the legislative body of the municipality, and all affected municipal and regional planning commissions.
- (h) **Voluntary Revocation:** Notwithstanding the other provisions of this section, the permittee may voluntarily waive the right to have a hearing, in which case the permit may be administratively revoked by the Secretary.
- (i) **Recording:** If the final decision of the Secretary is to revoke the permit, that revocation decision shall be recorded and indexed, by the party who petitioned for revocation, in the land records for the municipality in which the project is located upon close of the appeal period, or upon final resolution of any appeal, whichever is later.

§1-405 Enforcement

- (a) The Secretary may initiate an enforcement action against a person, in accordance with the provisions of 10 V.S.A. Chapter 201 and/or 10 V.S.A. Chapter 211, if the Secretary determines that such person:
- (1) has taken, or caused to be taken, an action that requires a permit or permit amendment under these Rules without first obtaining the required permit or permit amendment;
 - (2) has taken, or caused to be taken, an action that is in non-compliance with a permit or permit amendment issued under these Rules;
 - (3) is, or has been, in non-compliance with any order or assurance of discontinuance which addresses compliance with these Rules;
 - (4) has certified a design, installation or related design or installation information and, as a result of the person's failure to exercise reasonable professional judgment, submits design or installation information that is untrue or incorrect, or submits a design or installs a wastewater system or potable water supply that does not comply with these Rules; or
 - (5) has otherwise not complied with the provisions of these Rules.

Subchapter 5 – Municipal Regulations of Potable Water Supplies and Wastewater Systems

§1-501 Statewide Uniform Technical Standards

- (a) After June 30, 2007, those provisions of existing municipal ordinances and zoning bylaws that establish technical standards and criteria for the design, construction, operation, and maintenance of potable water supplies and wastewater systems are superseded (i.e. no longer in effect) by the technical standards and criteria of these Rules and the Vermont Water Supply Rules. Municipalities may continue to have ordinances and/or bylaws that:
- (1) are not specifically regulating potable water supplies and/or wastewater systems, but rather regulating development in general, (ex: setbacks);
 - (2) only regulate the use and/or operation of municipally owned water and/or sewage treatment plants; and
 - (3) require submission of copies of plans and documents used to obtain a state permit under these Rules to the municipality;
 - (4) require a certificate of occupancy that is based on full compliance with a state permit issued under these Rules;
 - (5) require notice of, and have the option to observe, any soil testing such as the digging of test pits; and
 - (6) require time of sale inspections.

Note: These are merely examples of what a municipality may still regulate as of July 1, 2007 without being delegated. Other options may exist so long as they do not revise the technical standards and criteria of these Rules and the Vermont Water Supply Rules.

§1-502 Ordinances and Bylaws in Delegated Municipalities

- (a) After June 30, 2007, municipalities that have been delegated the authority to implement the permit program established by these Rules may continue to have ordinances and zoning bylaws that regulate potable water supplies and wastewater systems only to the extent that such ordinances and bylaws:
- (1) eliminate some or all of the permit exemptions contained in this chapter;
 - (2) establish requirements for the processing of permits, including but not limited to, informal appeals of municipal acts or decisions, suspension or revocation of permits, and other procedural requirements, that are consistent with the provisions of these Rules and the Vermont Water Supply Rules.

§1-503 Existing Municipal Permits Remain in Effect

- (a) Notwithstanding the fact that local ordinances and bylaws are superseded after June 30, 2007, as described in section 1-501 of this Subchapter, all permits issued under those municipal ordinances or bylaws shall remain in effect unless and until such permit is superseded by another permit issued under the provisions of these Rules.

Subchapter 6 – Delegation

§1-601 Purpose

- (a) The purpose of this subchapter is to set forth the requirements that municipalities must comply with in order to receive delegation of the permitting and enforcement authorities of this chapter. In order to receive delegation, a municipality must demonstrate that it has sufficient authority, organization, technical expertise and enforcement authorities to adequately administer the permit program in accord with these Rules.
- (b) A municipality may not request partial delegation of the wastewater system and potable water supply permit program under 10 V.S.A. §1976.
- (c) The Secretary will not issue permits under these Rules in a delegated municipality.

Note: A municipality cannot receive delegation to regulate public water supplies.

§1-602 Request for Delegation

- (a) Application:
 - (1) A municipality requesting the delegation of the permitting and enforcement program authorized by this chapter shall apply in writing on forms approved by the Secretary.
 - (2) The application shall include:
 - (A) the name and address of the municipality and the name of the authorized representative or chair of the local legislative body who is submitting the application on behalf of the municipality;
 - (B) signature of the authorized representative of the local legislative body of the municipality;
 - (C) the name, address and phone number of the designer responsible for the municipal program;
 - (D) a copy of any contract between the municipality and the designer if not a municipal employee;
 - (E) a copy of the appointment of the sewage officer, if any;
 - (F) a description of the process for accepting, reviewing and processing applications by the municipality;
 - (G) a copy of the agreement signed by the authorized representative or chair of the local legislative body committing to administer the program in accord with these Rules; and,

§1-602(a)(2)(H) Request for Delegation

- (H) for municipalities cooperating to run the program, separate delegation applications from each municipality for delegation authority, with a copy of the inter-municipal cooperative agreement signed by the chair of each local body indicating the process agreed upon and the roles and responsibilities of the member municipalities.
- (I) authority for the Secretary or his/her designee to enter the municipal property during normal working hours to review documents related to the delegation of the program and to assure compliance with the Rules.

§1-603 Performance Expectations

- (a) Municipalities receiving and retaining delegation under this subchapter shall:
 - (1) at all times administer the program in compliance with these Rules and with related procedures established by the Secretary to clarify, interpret or properly implement the Rules.
 - (2) process permit applications and amendments in a prompt and expeditious manner, generally within 30 to 45 days of receipt.
 - (3) only issue permits that have been reviewed and found to comply with these Rules by a designer employed by the municipality.
 - (4) not, if employing a design firm as the reviewer for the municipality, accept projects designed by employees of the firm for review.
 - (5) issue permits for sewerage connections only after receipt of the approved sewage allocation for the project from the owner of the wastewater treatment facility. A municipality shall not authorize connections that are beyond the reserve capacity of the wastewater treatment facility as determined by the Secretary. The municipality must send a copy of its authorization to connect to an indirect discharge system to the Secretary. In addition, if required by the Agency, the municipality must send a copy of its authorization to connect to a municipally owned sewerage collection system;
 - (6) provide copies to the Secretary of each permit or denial issued;
 - (7) maintain the items in the permit tracking system required by the Secretary;
 - (8) if delegation is revoked pursuant to section 1-607 of these Rules, promptly provide copies of all documents and required permit tracking data related to the permits processed during the period of delegation to the Secretary. Electronic or microfilm copies will be acceptable; and
 - (9) notify the Secretary if the designer or sewage officer is replaced or if additional designers or sewage officers are authorized to act for the municipality.

§1-603(b) Performance Expectations

- (b) Upon delegating the authority to implement these Rules to a municipality, the Secretary shall deliver electronic copies of the historical permitting documents for permits issued by the State for projects in the municipality for use in administering the permit program.
- (c) The Secretary shall promptly provide implementation documents established for the state permit program to delegated municipalities for their use in implementing the delegated program. Documents clarifying implementation documents shall be provided to delegated municipalities.

§1-604 Application Fees

- (a) Fees for permit applications under this chapter in municipalities with valid delegation of the program shall be established by the municipality in an amount sufficient to support the municipal services provided by the delegated program.
- (b) Municipalities whose delegation authority is revoked, voluntarily or otherwise, shall remit to the state the application fees for any permit application that reverts to the state for issuance.

§1-605 Enforcement

- (a) Municipalities shall take timely enforcement actions in accordance with 10 V.S.A. Chapter 201 to assure compliance with these Rules.
- (b) Penalties imposed through enforcement actions taken by the municipality shall be retained by the municipality.
- (c) Notwithstanding municipal delegation, in instances where a delegated municipality does not or cannot address non-compliance, the Secretary, after consultation with the municipality, may institute enforcement proceedings. In no case shall a program delegation usurp the authority of the Secretary to protect human health and the environment.

§1-606 Annual Report

- (a) An annual report shall be submitted by the delegated municipality to the Secretary on the forms provided by February 15th of the year following delegation and annually thereafter by the same date. The report shall cover the preceding calendar year or portion thereof and shall provide information on:
 - (1) number of projects permitted;
 - (2) number of projects denied;
 - (3) types of supplies and systems;
 - (4) number of failed supplies and systems;

§1-606(a)(5) Annual Report

- (5) number of failed supplies and systems replaced;
- (6) causes of failure, if known, and method of repair;
- (7) number of permit violations;
- (8) number of enforcement actions initiated, the number completed, and the results of those enforcement actions;
- (9) number of designers referred to the Board of Professional Engineering for discipline;
- (10) number of designers who are not professional engineers referred to the Agency for discipline; and
- (11) such other data as the Secretary, in consultation with the Agency of Commerce and Community Development and the Technical Advisory Committee, may require in order to fulfill the reporting requirements of Act 133 section 15 (j), if such data is integral to the permit applications processed by the municipality.

§1-607 Revocation of Delegation

- (a) Basis for revocation
 - (1) The Secretary may revoke delegation to a municipality for the following reasons:
 - (A) violation of the delegation agreement;
 - (B) false or misleading information submitted in support of an application for delegation;
 - (C) issuing permits that do not comply with these Rules; or
 - (D) failure to take timely and appropriate enforcement actions under these Rules
 - (2) Delegation shall not be revoked solely based upon a disagreement regarding fees that are appropriate to support the program.
 - (3) Delegation shall not be revoked solely on the basis of independent actions of the municipality's designer. If the Agency suspends or revokes the license of the municipality's designer, the municipality shall promptly act to replace the designer. Permits shall not be issued without review by a designer on behalf of the municipality.
 - (4) Prior to commencing revocation proceedings, the Secretary shall work with the delegated municipality to achieve compliance with these Rules.

§1-607(b) Revocation of Delegation

- (b) Process for revocation
 - (1) Upon investigation of a complaint or on his/her own motion, the Secretary shall send a Notice of Pending Revocation to the subject municipality briefly outlining the proposed basis for revocation of delegation. If the proposed basis for revocation involves actions by a designer, the designer will also be sent the Notice.
 - (2) If municipalities have contracted together to perform delegated activities, the Secretary will determine whether all the delegations are affected by the reasons for revocation, and may pursue revocation of delegation of one or all of the delegated municipalities as he or she deems appropriate.
- (c) Party Status: The Secretary shall determine the right of the complainant or other persons requesting party status to participate in the proceedings. The local legislative body of the municipality that is the subject of the proposed revocation is a party by right.
- (d) Notice of Pending Revocation Hearing:
 - (1) Notice of a Pending Revocation of Delegation shall be sent to the delegated municipality(ies). If the reasons for revocation involve any actions by a designer contracted to perform reviews for the municipality, the designer will also be sent the notice. The Notice shall be issued at least two weeks before the hearing and shall contain:
 - (A) the legal authority for the revocation;
 - (B) a brief statement of the issues upon which the proposed action is based;
 - (C) notice that the Secretary is holding a hearing for the purpose of determining whether the delegation shall be revoked; and
 - (D) the date, time and place the hearing will be held, which shall be in the region of the municipality(ies).
- (e) Hearing: The hearing for revocation of a municipal delegation shall be conducted by the Secretary. Any party to the revocation proceedings shall either appear in person or shall be represented by an attorney. The burden of proceeding and of proving that the permit delegation should be revoked shall be upon the party petitioning for revocation. The admissibility of evidence in all revocation proceedings shall be determined under criteria set forth in 3 V.S.A. §810. Upon the request of a party, a hearing shall be transcribed by a qualified stenographer or recorded on an electronic sound device at the election of the party. If transcription by a stenographer is requested, the request shall be in writing and filed at least 10 days before the hearing. Costs shall be borne by the requesting party. The requesting party shall provide one copy of the transcript to the Secretary without cost; other parties wishing a copy shall reimburse the requesting party on a prorated basis.

§1-607(f) Revocation of Delegation

- (f) Voluntary revocation: The delegated municipality may voluntarily waive the right to submit a petition and/or have a hearing prior to the Secretary revoking delegation.
- (g) Appeal of a decision to revoke delegation: Appeal of a decision to revoke delegation shall be to the Environmental Court in accordance with 10 V.S.A. Chapter 220.
- (h) Applications in process: Applications in process by a municipality requesting voluntary revocation shall be processed by the municipality in accord with the delegation agreement prior to the revocation of delegation. No additional applications shall be accepted by the municipality while the voluntary revocation is proceeding. Applications in process by a municipality that has received a Notice of Pending Revocation shall continue to be processed by the municipality until such time as delegation is revoked.

§1-608 Audit of Delegated Programs

- (a) The Secretary shall audit the programs delegated to the town at least once within the first two years of delegation to assure compliance with these Rules. Such audits shall at a minimum review a random sample of permits issued, inspections made and enforcement actions taken to determine if there is a reasonable level of consistency with the review procedures being used in the regional office. The Secretary may also perform audits for quality control, information gathering, or in response to a complaint.
- (b) A town shall make reasonable accommodation to allow audits to be performed at any time during normal working hours and shall maintain the records so that such an audit will not be delayed.

Subchapter 7 – Designer Licensing

§1-701 General Requirements

- (a) No person shall design a potable water supply or wastewater system that requires a permit, or requires a designer's certification, under these Rules without first obtaining a designer's license from the Secretary, except for professional engineers who meet the requirements of subsection (b) of this section.
- (b) A professional engineer shall be deemed to have a valid designer's license under this section, without going through the licensing process, provided that:
 - (1) the engineer is practicing within the scope of his or her engineering specialty; and
 - (2) if the engineer designing soil-based disposal systems after June 30, 2003, the engineer, prior to designing:
 - (A) submits evidence to the Vermont Board of Professional Engineering that demonstrates that he or she has satisfactorily completed a college-level soils identification course with specific instruction in the areas of soils morphology, genesis, texture, permeability, color, and redoximorphic features; or
 - (B) passes a soils identification test administered or approved by the Secretary; or
 - (C) retains one or more designers who have taken the course specified in this subsection or passed the soils identification test, whenever performing work regulated under these Rules. The name of the designer responsible for the soils identification for the project shall be included as part of any application or certification
- (c) No person shall review or act on permit applications for a potable water supply or wastewater system that he or she designed or installed.

§1-702 Scope of Authority for Designers Who Are Not Professional Engineers

- (a) Designers who are not professional engineers may prepare designs and the associated applications, for any project that requires a permit under these Rules, subject to the limitations of the class of license that they hold and the limitations described in this section. These designers may:
 - (1) design one or more soil-based disposal systems serving one or more buildings or structures or campgrounds, each of which has a design flow of 1350 gallons per day or less and that is expected to serve no more than 24 people;

§1-702(a)(2) Scope of Authority for Designers Who Are Not Professional Engineers

- (2) design a connection to a municipal or private sewage collection system from an individual building, structure, or campground, any of which has a design flow of 1350 gallons per day or less, that is expected to serve no more than 24 people. The individual building sewer connection may be of any length and may include a pumping station when connected to a gravity flow collection system;
 - (3) design one or more potable water supplies serving one or more buildings or structures or campgrounds, each of which has a design flow of 1350 gallons per day or less and that is expected to serve no more than 24 people;
 - (4) prepare designs and any associated applications for municipal approval required by a municipal sewage ordinance adopted pursuant to chapter 102 of Title 24 or municipal zoning bylaw provided that the design is limited to the type of wastewater system and/or water supply for which they are authorized under this section;
 - (5) perform reviews for a municipality of applications required by a municipal sewage ordinance adopted pursuant to chapter 102 of Title 24 or municipal zoning bylaw; and
 - (6) prepare design certifications and installation certifications provided the design is limited to the type of wastewater system and/or potable water supply for which they are authorized under this section.
- (b) Notwithstanding the authorities described above, designers who are not professional engineers shall not design the following types of soil-based disposal systems, municipal connections or water supplies:
- (1) soil-based disposal systems subject to the Indirect Discharge Rules;
 - (2) soil-based disposal systems using innovative/alternative systems or products that have received pilot or experimental use approval;
 - (3) soil-based disposal systems using innovative/alternative systems or products that have received general use approval when the approval specifies that the design must be prepared by a professional engineer;
 - (4) any soil-based disposal system disposing of non-domestic wastewater unless the Secretary has determined it to be compatible with domestic type wastewater. Domestic type wastewater includes, but is not limited to, wastewater associated with toilet use, bathing, clothes washing, cooking, and building maintenance. Examples of wastewater that is non-domestic includes process water, cooling water, and water used for building maintenance that has the potential to be contaminated with materials used in industrial processes.

§1-702(b)(5) Scope of Authority for Designers Who Are Not Professional Engineers

- (5) connections to a pressure sewer line that connect to a municipal or private sewerage collection system;
- (6) connections to a municipal or private sewage collection system for the disposal of non-domestic wastewater unless the Secretary has determined it to be compatible with domestic type wastewater. Domestic type wastewater includes, but is not limited to, that associated with toilet use, bathing, clothes washing, cooking, and building maintenance. Examples of wastewater that is non-domestic includes process water, cooling water, and that used for building maintenance that has the potential to be contaminated with materials used in industrial processes;
- (7) any water source or distribution system subject to the Vermont Water Supply Rules as a Public Water System;
- (8) any connection into an existing public water supply other than an individual service line serving a building or structure or campground with a design flow of 1350 gallons per day or less;
- (9) any water supply connection that includes a fire hydrant or fire suppression system with more than 2 sprinkler heads; and
- (10) water treatment systems.

§1-703 Classes of Designer Licenses

- (a) In addition to the restrictions for designers who are not professional engineers described in subsection 1-702(b) of these Rules, there are different classes of designer licenses that authorize designers to do different types of work. These classes are:
 - (1) Class 1 – a professional engineer who is authorized to do all aspects of site evaluation, application preparation, certification, and application review for a municipality, provided that he or she complies with subsection 1-701(b) of these Rules;
 - (2) Class A – a designer who can do all aspects of site evaluation, application preparation, certification, and application review for a municipality, except the following:
 - (A) design site modifications, as described in section 1-912 of these Rules;
 - (B) design storage and dose systems, as described in section 1-921 of these Rules;
 - (C) design wastewater disposal systems using the two-year time of travel approach, as described in section 1-920 of these Rules;

§1-703(a)(2)(D) Classes of Designer Licenses

- (D) design any type of potable water supply other than a single source serving only one single family residence;
 - (E) design gravity storage tanks for potable water supplies;
 - (F) design innovative/alternative systems approved under Subchapter 10 of these Rules unless the specific approval authorizes Class A designers to design the product or system; and
 - (G) review applications for a municipality that include designs that a Class A designer is not authorized to design.
- (3) Class B – a designer who is authorized to do all aspects of site evaluation, application preparation, certification, and application review for a municipality, except for the following:
- (i) design storage and dose systems, as described in section 1-921 of these Rules; and
 - (ii) design potable water supplies that serve anything other than single family residences on their own lots until he or she has taken and passed an exam administered by the secretary regarding the design, construction, and operation of potable water supplies.

Note: Designers licensed under these Rules are permitted to design water and wastewater systems to the limits that they are tested and licensed under these Rules. Licensure under these Rules does not constitute authority to design, provide specification, or consulting services for any work beyond water and wastewater systems. Designers licensed solely under these Rules are not licensed to prepare plans, designs for other civil works including, but not limited to, stormwater systems, grading plans, roadways, access drives, culvert or bridge design, boundary surveys, or subdivision plans or any other services which constitute the practice of engineering or surveying as determined by the Boards of Professional Engineering or Land Surveying.

§1-704 Application for License; Examinations

- (a) A person who wants a Class A or Class B designer’s license must:
- (1) submit a completed and signed application form, provided by the Secretary. The Secretary must receive the application at least three weeks prior to the date of the required examination to ensure processing can be completed with sufficient notice to the applicant. Applications arriving less than three weeks prior to the examination will be processed to the extent possible;
 - (2) pay the fee for designers as specified in 3 V.S.A. §2822; and

§1-704(a)(3) Application for License; Examinations

- (3) complete and pass the examination administered or approved by the Secretary.
- (b) Examinations for Class A and Class B designers shall consist of both written and field examinations prepared or approved by the Secretary. The examinations shall be offered at least once per year at a time and place publicly announced at least six weeks before the examination and shall be adequate to distinguish between Class A and Class B licenses.
- (c) When the Secretary makes a decision to issue or deny a designer's license, notice shall be furnished in writing to the applicant within ten (10) days of the decision.

§1-705 License Renewal

- (a) Class A and Class B designers shall maintain their licenses by annually filing a request for renewal, accompanied by the applicable fee, and if required that year, an affidavit of proof of continuing education. Expiration of a license for a period exceeding 2 years shall require re-examination prior to re-licensing.
- (b) Renewals shall not be granted unless the continuing education requirements are met; except that a provisional license may be granted for a period not to exceed 6 months based on a date-specific schedule that will allow a designer to fulfill the continuing education requirements. No designer may be granted more than one provisional license in a four year period.
- (c) All Class A and B designer licenses shall expire annually on December 31st unless renewed.
- (d) Notwithstanding the other requirements of this section, designers certified as site technicians prior to April 26, 1977 shall remain licensed provided they pay the licensing fees necessary to maintain their licenses without expiration and provided that they fulfill the continuing education requirements. In addition, these designers: are subject to the imposition of conditions, suspension or revocation; are not entitled to a Class B certification without first passing the examination; and are subject to all other provisions related to designers who are not professional engineers.

§1-706 Continuing Education

- (a) All Class A and Class B designers shall complete at least 12 hours of continuing education related to the design, construction, operation, or maintenance of wastewater systems and potable water supplies every 2 years. Proof that the required continued education has been completed will be required for all renewals starting December 1, 2006. Of the 12 hours required, at least 4 hours shall consist of soil related, in-field courses. All courses must be attended in person. Viewing of recordings of courses or on-line courses shall not count towards the continuing education requirements. The Secretary will provide sufficient training sessions to allow for fulfillment of this requirement. The Secretary may also recognize training provided by others as meeting this requirement. It is recommended that pre-approval be requested to ensure that training provided by others will be considered acceptable. In order to demonstrate completion of the continuing education requirements, the designer shall

§1-706(a) Continuing Education

submit an affidavit, using the form provided by the Secretary, every other year at the time of license renewal.

§1-707 Complaints; Disputes

- (a) The Secretary may review, on a random basis or in response to a complaint, the testing procedures employed by a designer, the systems designed by a designer, the designs approved or recommended for approval by a designer, and any work associated with the performance of these tasks. This review authority shall apply to all types of designers, including professional engineers.
- (b) If there is a dispute between the Secretary and a professional engineer concerning the design prepared by the engineer or the judgment exercised by the engineer, the engineer may request that the disputed issues be reviewed by a professional engineer employed or retained by the Secretary. The Secretary shall grant all such requests for review.

§1-708 Disciplinary Actions; Enforcement

- (a) The Secretary, after a hearing conducted in accordance with Chapter 25 of Title 3, may suspend, revoke or impose conditions on a designer's license, except one held by a professional engineer. Notice of that revocation shall be included in the next Environmental Notice Bulletin. This proceeding may be initiated on the Secretary's own motion or upon a written request which contains facts or reasons supporting the request for the imposition of conditions, suspension, or revocation. Conduct specified in 3 V.S.A. §129(a) as constituting unprofessional conduct by a licensee is cause for imposing conditions on a designer's license or for the suspension or revocation of a license. In response to a complaint, or on his or her own motion, the Secretary shall refer deficiencies in design or installation performed by a professional engineer under these Rules to the Board of Professional Engineering for further investigation and potential disciplinary action.
- (b) In addition to licensure actions, the secretary may initiate an enforcement action against a designer as specified in subchapter 4 of these Rules.

Subchapter 8 - General Requirements for Wastewater Systems and Potable Water Supplies

§1-801 General Requirements for Wastewater Systems and Potable Water Supplies

- (a) This Subchapter applies to all soil-based disposal systems with a design flow of less than 6500 gallons per day and sewerage connections of any size.
- (b) This Subchapter applies to design flows for all potable water supplies that are not public water supplies. All other requirements related to potable water supplies, such as standards for construction and location, are contained in the Vermont Water Supply Rules.
- (c) New projects and projects with increases in design flow must be designed and constructed in accord with these Rules. Replacement systems shall be constructed in accordance with these Rules, but are eligible for variances as provided in §1-806 of these Rules.
- (d) A soil-based disposal system(s) may be located on the lot to be improved or on other land to which the lot owner has permanent legal access. Proof of permanent legal access will be required prior to issuance of any permit, at the time of initiation of construction, or at the time of the transfer of any lot with an off-lot soil-based disposal system.
- (e) If a project involves the construction, modification, replacement or construction of only a wastewater system or only a potable water supply, but not both, the permit that is issued shall only address the changes to the system or the supply that are being made.
- (f) When designing projects under these Rules, a designer shall review not only the project itself but also all potable water supplies and wastewater systems, in existence or permitted at the time the permit application for the project is deemed complete, that are potentially affected by the proposed project. This review shall, at a minimum, assure that the project will not adversely affect such potable water supplies and/or wastewater systems.
- (g) Wastewater systems regulated by these Rules may be subject to provisions from different sections and appendixes. Applicants, installers, and particularly designers are encouraged to become familiar with this Subchapter and Subchapter 9 and the appendixes as there are general requirements, such as isolation distances, that apply to all systems and specific requirements, such as those for mound wastewater disposal systems, that apply to only certain types of systems.
- (h) No new soil-based disposal system with a design flow exceeding 1,000 gallons per day may be approved in a Class A watershed. The design flow of an existing soil-based system that discharges to Class A waters may not be increased if the total design flow will exceed 1,000 gallons per day. In addition, in order for a permit to be issued, there must be no more than one soil-based disposal system per lot and no more than one lot per application.

§1-801(i) General Requirements for Wastewater Systems and Potable Water Supplies

- (i) Wastewater systems that discharge sewage to manure pits are prohibited under these Rules.
- (j) Wastewater systems designed to dispose of 6,500 gallons or more per day of sewage may be under the jurisdiction of the Vermont Indirect Discharge Rules. For such systems, the applicant shall contact the Secretary for a jurisdictional ruling. If the project is under the jurisdiction of the Indirect Discharge Rules, an Indirect Discharge Permit will be required for the treatment and disposal system and a permit issued under this Subchapter will be required for the building or structure or campground connected to that system.
- (k) Wastewater systems designed to use land application for disposal of non-sewage wastes may be under the jurisdiction of the Indirect Discharge Rules. For such systems the applicant shall contact the Secretary for a jurisdictional ruling. If the project is under the jurisdiction of the Indirect Discharge Rules, an Indirect Discharge Permit will be required for the land application of those wastes and a permit issued under this subchapter will be required for the building or structure or campground generating the waste. Any approval for land application of non-sewage wastes will be based on the Vermont Guidelines for the Land Application of Dairy Processing Wastes or other guidance documents approved by the Secretary.
- (l) Wastewater systems designed for the subsurface disposal of non-sewage wastes may be under the jurisdiction of the Underground Injection Control Rules. For systems under those rules, an Underground Injection Control Permit will be required unless the waste is deemed to be compatible with sewage and is disposed of in a wastewater system permitted under this Subchapter.

§1-802 Piped Water and Lavatory Required

- (a) All water produced by a potable water supply shall be delivered through a piped system.
- (b) All buildings or structures and campgrounds shall have at least one (1) lavatory, unless an exemption applies.
- (c) The Secretary may waive some or all of the requirements of this section for buildings or structures, other than single family residences on their own lots, and for campgrounds if he or she determines that the imposition of the requirements would be unreasonable due to the briefness or infrequency of occupancy of a particular building or structure, or class of building or structure, or due to the availability of a nearby potable water supply. Notwithstanding the Secretary's waiver:
 - (1) If the owner or operator of a building or structure, or a campground, elects to have a potable water supply, and/or water delivered through a piped system, and/or a lavatory, even though the requirement(s) have been waived, any such supply, piping and lavatory must comply with the requirements of these Rules; and

§1-802(c)(2) Piped Water and Lavatory Required

- (2) Any waiver granted under this section shall not supersede any other federal, state or local laws concerning potable water supplies, piped systems, and lavatories for employees or the general public in particular buildings or structures, or classes of buildings or structures, nor shall it supersede labor agreements.

§1-803 Piped Wastewater Disposal and Toilet Required

- (a) All wastewater produced by a building or structure or campground shall be disposed of through a pipe to a wastewater disposal system, unless an exemption applies.
- (b) All buildings or structures shall have at least one (1) toilet.
- (c) The Secretary may waive some or all of the requirements of this section for buildings or structures, other than single family residences, and for campgrounds if he or she determines that the imposition of those requirements would be unreasonable due to the briefness or infrequency of occupancy of a particular building or structure, or class of buildings or structures, or due to the availability of a nearby wastewater system. Notwithstanding the Secretary's waiver:
 - (1) If the owner or operator of a building or structure, or a campground, elects to have a wastewater system and/or a toilet, even though the requirement(s) have been waived, then any such system and toilet must comply with the requirements of subsection (a) of this section; and
 - (2) Any waiver granted under this section shall not supercede any other federal, state or local laws concerning wastewater systems and toilets for employees or the general public in particular buildings or structures, or classes of buildings or structures, nor shall it supercede labor agreements.

§1-804 Primary Wastewater Disposal Systems and Replacement Wastewater Areas

- (a) All projects that require a permit under these Rules shall have a primary wastewater disposal system.
- (b) All projects that require a permit under these Rules that use a soil-based disposal system as the primary system shall also have a designated replacement area where a new wastewater disposal system may be constructed except as otherwise provided in this section or in other sections of these Rules.
- (c) There are three (3) options for meeting the replacement area requirement. These options are:
 - (1) The identification of a replacement area that meets the design flow requirements for the building or structure or campground;

§1-804(c)(2) Primary Wastewater Disposal Systems and Replacement Wastewater Areas

- (2) No replacement area will be required if the primary system is sized at the time of design, and at the time of construction, to handle design flows that are 150% of the design flows for the building or structure or campground and the system uses pressure distribution designed in accordance with section 1-906 of these Rules; or
- (3) No replacement wastewater area will be required if the primary system is a mound wastewater disposal system that is designed to handle 100% of the design flows for the building or structure or campground.

Note: When designing a wastewater system to handle 150% of the design flows, only the leachfield is required to be sized at 150%. Designers may, when looking at all components of the wastewater system, design other components of the system to handle 150% of the design flow if they deem it to be appropriate.

§1-805 Minimum Site Conditions

- (a) No site may be improved by the construction of a wastewater system unless the site meets one of the following three sets of requirements regarding the minimum requirements for the site. Please note that these are only the requirements for the site and that requirements related to any specific type of wastewater system must also be met. Depending on the site conditions, an inground system, an at-grade system, or a mound system may be approvable. There is no presumption that a design using the performance based design approach must include the use of a filtrate system. Also note that even if a site meets these minimum requirements, additional fill material may be needed in order to meet the requirements for separation distance to bedrock or the seasonal high water table. As an example, a site with only 24” of naturally occurring soil to bedrock, where a non-filtrate disposal system is proposed, would require the addition of 24” of fill material on top of the naturally occurring soil so that the separation from bedrock to the bottom of the crushed stone is at least 48”.
- (b) Prescriptive Approach
 - (1) Sites that meet the following requirements may be improved using a prescriptive approach.
 - (A) There shall be at least 24” of naturally occurring soil with a percolation rate of 120 min/inch or less over bedrock.
 - (B) There shall be at least 24” of naturally occurring soil with a percolation rate of 120 min/inch or less above the seasonal high water table.

§1-805(b)(2)(C) Minimum Site Conditions

- (C) The maximum ground slope shall not exceed 30% for wastewater systems on subdivided lots in existence before June 14, 2002. The maximum ground slope shall not exceed 20% for wastewater systems on lots that are subdivided on or after June 14, 2002. The limitation on maximum slope shall not apply to replacement systems that are subject to the variance provisions of Section 1-806 of these Rules.
- (D) The wastewater system shall not be located in a floodway. In addition, if the site is located in a mapped special flood hazard area, the wastewater system must be located, designed, and constructed in a manner that avoids impairment to the system and contamination from the system during flooding. Refer to Flood Resistant Management Design guidance from FEMA 348: Protecting Building Utilities from Flood Damage.

(c) Enhanced Prescriptive Approach

- (1) Sites that meet the following requirements can be improved using the enhanced prescriptive approach.
 - (A) There shall be at least 18” of naturally occurring soil with a percolation rate of 120 min/inch or less over bedrock.
 - (B) The site must have at least 12”, or the thickness of the “A” soil horizon plus 4”, whichever is greater, of naturally occurring soil above the seasonal high water table. Sites with less than 18” of naturally occurring soil above the seasonal high water table must lower the water table as described below:
 - (i) A site may be approved without pre-testing of the drain when a designer prepares a plan incorporating drainage of the site and asserts that the drainage will lower the seasonal high water table to provide at least 18” of permeable soil below the surface of the naturally occurring soil, and the Secretary agrees with the designer’s assertion; or
 - (ii) if the Secretary does not agree, the designer may demonstrate through construction of a drainage system and the performance of groundwater monitoring in accordance with §1-903 below, that the seasonal high water table is lowered to at least 18” below the surface of the naturally occurring soil.
 - (C) The ground slope is at least 3% but does not exceed either 30% (for wastewater systems on subdivided lots in existence before June 14, 2002) or 20% (for wastewater systems on lots that are subdivided on or after June 14, 2002). The limitation on maximum slope shall not apply to replacement systems that are subject to the variance provisions of Section 1-806 of these Rules.

§1-805(c)(1)(D)

Minimum Site Conditions

- (D) The wastewater system shall not be located in a floodway. In addition, if the site is located in a mapped special flood hazard area, the wastewater system must be located, designed, and constructed in a manner that avoids impairment to the system and contamination from the system during flooding. Refer to Flood Resistant Management Design guidance from FEMA 348: Protecting Building Utilities from Flood Damage.
 - (E) The linear loading rate is not more than 2 gal/day/ft.
 - (F) The approvable site conditions must continue at least 25' downhill from the system and shall be measured from the toe of any fill used as part of a system.
- (d) Performance Based Approach
- (1) Sites that meet the following requirements may be improved using the performance-based approach.
 - (A) There shall be at least 18" of naturally occurring soil above bedrock.
 - (B) Sites that do not meet the above requirements for prescriptive designs or enhanced prescriptive designs for depth to seasonal high water table may demonstrate compliance with the Rules, based on a detailed and site specific analysis. The analysis must demonstrate that the system will function during all portions of the year while maintaining at least 6" of naturally occurring unsaturated soil above the calculated level of the effluent plume. The induced groundwater level may rise to less than 6" below the surface of the naturally occurring ground directly under a mound type system, and may rise into the mound fill itself, provided that the 6" distance is maintained at the toes and beyond. Any system based on this approach will require additional fill in order to maintain the required separation between the bottom of the crushed stone or other application surface and the induced water table. The analysis may be based on site specific hydraulic conductivity testing or on a desktop hydrogeologic analysis. All desktop hydrogeologic analyses shall be based on conservative assumptions. The level of information required in order to determine compliance with the Rules will be related to site specific conditions with more "limited" sites requiring more detailed information.
 - (C) The maximum ground slope shall not exceed 20% for wastewater systems that are on lots subdivided on or after June 14, 2002. For systems built on other lots, the maximum ground slope shall not exceed 30%, unless the Secretary has granted a specific approval to exceed 30%. The limitation on maximum slopes shall not apply to replacement systems that are subject to the variance provisions of Section 1-806 of these Rules.

§1-805 (d)(1)(D) Minimum Site Conditions

- (D) A site specific approval to construct a wastewater system on a subdivided lot in existence before June 14, 2002 with a ground slope exceeding 30% in the area of the wastewater system may be granted by the Secretary upon a request from a designer that:
 - (i) provides specific instructions on the method of construction;
 - (ii) Explains how the stability of the site will be maintained during and after construction with specific attention to erosion prevention and sediment control; and
 - (iii) Provides site-specific guidance as needed for safe construction.
- (E) The wastewater system shall not be located in a floodway. In addition, if the site is located in a mapped special flood hazard area, the wastewater system must be located, designed, and constructed in a manner that avoids impairment to the system and contamination from the system during flooding. Refer to Flood Resistant Management Design guidance from FEMA 348: Protecting Building Utilities from Flood Damage.

(e) Erosion prevention and sediment control

An erosion prevention and sediment control plan shall be submitted with each application involving construction of a wastewater system when the ground slope exceeds 20%. The plan shall address site stability in the area of the wastewater system before, during, and after construction. The plan shall include specifications for construction, surface water diversions if needed, and re-vegetation to prevent soil erosion.

§ 1-806 Variances

- (a) Variances from the technical standards of these Rules for replacement wastewater systems and potable water supplies may be granted in the following circumstances:
 - (1) Replacement wastewater systems and replacement potable water supplies shall be constructed in accordance with the requirements for new systems and supplies whenever possible.
 - (2) Replacement systems that serve lots, buildings or structures, or campgrounds under these Rules may be granted the minimum necessary variances from the technical standards when full compliance cannot be obtained or when it would not be cost effective, meaning the value of the incremental increase in environmental and human health protection does not outweigh the cost of achieving the incremental increase.

§ 1-806(a)(3) Variances

- (3) A wastewater system does not have to be a failed system in order to qualify for a variance.
- (4) Any replacement system or supply must result in equal or better environmental and human health protection than the previous system or supply.
- (5) Variances may not be granted if they would allow a replacement wastewater system and/or potable water supply to remain a failed system or supply.
- (6) Variances will not be granted for replacement systems or supplies when:
 - (A) the replacement system or supply is for a project that requires a permit under these Rules but never obtained the permit, unless the project qualifies for the exemption described in section 1-304(a)(1) of these Rules; or
 - (B) the replacement system or supply will allow an increase in design flow.
- (b) Requests for variances shall be accompanied by plans and specifications for the wastewater system and/or potable water supply for which a variance is being requested and a statement of the grounds for the request.
- (c) Approval of a variance under this section shall not relieve the applicant of the responsibility to comply with all other applicable State and local laws, rules, bylaws or ordinances.
- (d) Variances related to a potable water supply are also governed by the Vermont Water Supply Rules.

§1-807 Isolation Distances

(a) All wastewater systems that are permitted under this Subchapter shall be designed so that they meet the following isolation distances:

Minimum Isolation Distances Item	Horizontal Distance (feet)		
	Leachfield	Septic Tank	Sewer
Drilled well	(b)	50	50
Gravel pack well, shallow well or spring	(b)	75	75
Lakes, ponds, and impoundments	50 ¹	25	25
River, streams	50	25	10
Drainage swales, roadway ditches	25	--	--
Main or municipal water lines	50	50	(d)
Atmospheric Water Storage Tanks	50	50	50
Service water lines	25	25	(d)
Roadways, driveways, parking lots	10	5	(c)
Top of embankment, or slope greater than 30%	25	10	--
Property line (a)	25 ²	10	10
Trees	10	10	10
Other disposal field or replacement area	10 ³	--	--
Foundation, footing, or curtain drains	35 ⁴	10	--
Public Community Water Supply (e)	(f)	(f)	(f)
Suction water line	100	50	50

These distances may be reduced when evident that the distance is unnecessary to protect an item or increased if necessary to provide adequate protection.

Note: See footnotes and criteria on the following page.

§1-807 Isolation Distances

Footnotes (General Criteria Regarding Isolation Distances)

- (a) Isolation distances apply regardless of property line location and ownership.
- (b) Separation between potable water supplies and leachfields shall be determined by the methods in the Vermont Water Supply Rule, Appendix A, Part 11, §11.4.
- (c) Sewers under roads, driveways, or parking lots may require protective conduits or sleeves.
- (d) Separation of pressure water lines considered as "service connections" and sewer lines shall adhere to the Vermont Plumbing Rules. Separation of pressure water lines (considered to be part of a public water system as defined by the Vermont Water Supply Rule) and sewer lines shall adhere to the requirements of the Vermont Water Supply Rule.
- (e) This refers to Public Community Water Systems, as defined in the Vermont Water Supply Rule.
- (f) Contact the Department of Environmental Conservation's Water Supply Division, 103 South Main Street, Waterbury, Vermont for isolation distances relative to a public community water supply.

Footnotes (Specific Criteria for Isolation Distances)

- 1. The isolation distance to surface waters shall be measured from the nearest portion of the leachfield, which will be the toe of the system for mound and at-grade systems. The isolation distance must be satisfied on a year-round basis, therefore the edge of the surface water is the annual high water level.
- 2. For mound wastewater disposal systems, the limit of mound fill must be 25 feet from any downhill property line and 10 feet from all property lines on the side or uphill.
- 3. No leachfield or replacement area shall be closer than 10 feet to one another, except as allowed for absorption trench systems in §1-907(m) of these Rules.
- 4. If a curtain or foundation drain is downslope of the leachfield, the leachfield cannot be closer than 75 feet to the drain. If the curtain or foundation drain is upslope of the leachfield, it shall be 35' if possible, and a minimum of 20 feet to the leachfield. The isolation distances for mound systems shall be from the edge of the minimum basal area or the edge of the absorption bed or trench, whichever is closer. These distances may be reduced if the designer provides adequate data and analysis to show that effluent from the soil-based disposal system will not enter the drain. Conversely the distance may be increased if it is determined that effluent will enter the drain at the minimum separation distance.

§1-808 Design Flow

- (a) Wastewater design flows shall be determined based on Tables 1-3 (pages 66-72). Directions for calculating reductions in design flow based on plumbing fixture type and connection to large wastewater disposal systems are included in the Table. Potable water supply design flows are determined per Subsection 1-808(g) below. Based on the design changes listed in Tables 1 and 2, that are reduced from those in the 1996 version of these Rules, it may be possible to add more residential or camping units to an existing potable water supply and/or wastewater system when the supply and/or system conform to design requirements of these Rules and/or the applicable Vermont Water Supply Rules.
- (b) When determining the flows for a particular project, the Secretary may determine that there is sufficient justification for requiring higher or lower flow values. When making this determination, the Secretary shall consider: the nature and design of the project; whether multiple units will be interconnected; past experience on existing projects; metered flows; the design safety factor allowances in Table 1 figures; and potential for fluctuations in flows.
- (c) Flow metering used to support a request for an increase in the amount or type of uses for an existing project, or to support new projects, will require at least six months of daily meter readings. The metering period shall include the peak use periods if there is a seasonal variation, such as for a campground or ski area. The strength of the wastewater must also be determined when needed to size the leachfield or any treatment devices, or to determine any adjustments in leachfield loading rates that may be required. Any decision to adjust design flows based on flow metering must consider data concerning peak flow and long term effects on the wastewater system. Any increase in the number of units, such as bedrooms, people, or restaurant seats for an existing project that is based on metered flows, shall only be allowed when the connection is to an existing supply or system that complies with the design requirements of these Rules and the applicable Vermont Water Supply Rules.
- (d) For projects without a specific design flow in Tables 1-3, such as food processing plants, the Secretary will determine a design flow for the specific project. The Secretary's determination will be based on available information related to the equipment and from metering information from similar projects that is submitted by a designer or that is available from other sources. The strength of the wastewater must also be determined when needed to size the leachfield or any treatment devices, or to determine any adjustments in leachfield loading rates that may be required.
- (e) When collection and building sewers exceed 500 feet in total length, the design flow shall include an allowance for infiltration. New collection systems shall be estimated at 300 gallons/inch of diameter/mile of pipe/day, except when a designer provides project specific information that supports a reduction to not less than 200 gallons/inch of diameter/mile of pipe per day. When a reduction is granted, the acceptable level of leakage for the post construction leakage testing must also be proportionately reduced.

§1-808(f) Design Flow

- (f) A soil-based disposal system constructed to serve a new project, or a project with an increase in design flow may be reduced in size when composting or incinerating toilets are used. Systems for residential units will be granted a 25% reduction. The reduction in size for other systems will be determined on a case by case basis.

- (g) For potable water supplies that are not public water supplies, design flows shall be determined using this section of the Rules. For water supplies that are public water supplies, design flow shall be determined in accord with Section 2.2 and Table A2-1 of the Vermont Water Supply Rules. The design flow for a water supply may be different than wastewater design flows if the water supply is a public water supply. The design flow for the potable water supply may also differ from the wastewater design flow when the design basis of the two systems is different. Examples include:
 - (1) The wastewater flow is based on a connection to a wastewater system with a design capacity of 50,000 gallons per day or more and the water supply is an individual supply.
 - (2) The wastewater flow is based on connection of 5 or more units into a single wastewater system and the water supply is an individual supply for each unit.

Note: In the event of a conflict between these Rules and the Water Supply Rules, these Rules shall govern if the potable water supply is not a public water supply.

Table 1

Design Flow for Residential Units

- (a) The design flow for single family residential units shall be calculated on the following requirements:
 - (1) The design flow for each person shall be 70 gallons per person per day;
 - (2) the first three bedrooms shall be assumed to have two persons per bedroom;
 - (3) each additional bedroom may be assumed to have one person per bedroom. When a building will be subject to rental use or when it is likely there will be extended or frequent high occupancy use, the system should be sized for at least 2 persons per bedroom; and
 - (4) the design flow for a single-family residence on its own individual lot shall be based on a minimum of two bedroom.

- (b) When five or more single family residential units are connected to a single soil-based disposal system, a designer may choose to use the following design flows that are based only on the number of residential units without regard for the number of bedrooms:

§1-808 Design Flow Table 1 – Continued

Number of Single Family Units	Project Design Flow
5 units	1575 gallons per day
6 units	1830 gallons per day
7 units	2065 gallons per day
8 units	2280 gallons per day
9 units	2565 gallons per day
10 units	2800 gallons per day
11 units	3036 gallons per day
12 units	3264 gallons per day
13 units	3484 gallons per day
14 units	3696 gallons per day
15 units	3900 gallons per day
16 units	4112 gallons per day
17 units	4369 gallons per day
18 units	4518 gallons per day
19 units	4712 gallons per day
20 units	4900 gallons per day
20+ units	# of units X 245 gallons per day

Note: Single family residential units with only one bedroom, such as condominiums and apartment buildings will not benefit from the use of the design flows listed above. Single family residential units, with two bedrooms each, will benefit from use of the table when 11 or more units are connected to a single soil-based disposal system.

Note: Wastewater disposal systems with a design capacity of 6500 GPD or more may also require an Indirect Discharge Permit.

- (c) Single family residential units connected to a wastewater disposal system with a design capacity of at least 50,000 gallons per day may use a design flow of 210 gallons per unit per day, regardless of the number of bedrooms.
- (d) There is no reduction allowed in Table 1 design flows based on the use of low flow plumbing fixtures as the design flow assumes their use.
- (e) Multi-unit elderly housing projects may be calculated on 1.5 person per unit

§1-808 Design Flow

Table 2

Campgrounds (also see camps)	Open 7 mo/yr Or Less	Open more than 7 mo/yr
Campgrounds that allow only tents and camping units with no interior plumbing		
Central toilets and showers 4 people per site	75 gpd/site	100 gpd/site
Campgrounds that allow only tents and camping units with no interior plumbing		
Central toilets without showers 4 people per site	60 gpd/site	75 gpd/site
Campground sites that allow camping units with interior plumbing		
Served by central toilet facilities and dumping stations	50 gpd/site for central facilities plus 25 gpd/site for the dumping station	90 gpd/site for central facilities plus 35 gpd/site for the dumping station
Served by an individual sewer hook-up	75 gpd/site	125 gpd/site
Seasonal RV site with individual sewer hook-up		
RV owned by the occupant	75 gpd/site	125 gpd/site
RV not owned by the occupant	125 gpd/site	175 gpd/site
Cabins with RV type plumbing		
4 people per site	125 gpd/site	175 gpd/site
Cabins with conventional plumbing Minimum of 4 people per site		
With or without kitchen	50 gpd/person	50 gpd/person
With or without kitchen but with laundry facilities	70 gpd/person	70 gpd/person

§1-808 Design Flow**Table 2 – Continued**

Campgrounds	Open 7 mo/yr Or Less	Open more than 7 mo/yr
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Park Model RV

For first bedroom	140 gpd/site	140 gpd/site
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For additional bedroom	100 gpd/site	140 gpd/site
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Mobile home used as vacation facilities

For first bedroom	140 gpd/site	140 gpd/site
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For additional bedrooms	100 gpd/site	140 gpd/site
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Note: There is no reduction allowed in Table 2 design flows based on the use of low flow plumbing fixtures as the design flow assumes their use.

§1-808 Design Flow

Table 3

OTHER ESTABLISHMENTS	GALLONS/PERSON/DAY ^{a,b} (unless otherwise noted)
Assembly Areas, Conference Room	5
Airports (per passenger)	5
Bathhouses and Swimming Pools	5
Bowling Alley (no food service)(per lane)	75
Cafeterias (per seat)	50
Camps: Construction camps (semi permanent)	50
Day camps (no meals served)	15
Resort Camps (Night & Day) with limited plumbing ...	50
Churches: Sanctuary seating x 25%	5
Church suppers	8
Country Clubs (per resident member)	100
Country Clubs (per non resident member present)	25
Day Care Centers:	
Without meals:	15
With one meal:	20
With two meals:	25
Dentists:	
Staff Member	35
Per Chair	200
Doctor's Office:	
Staff Member	35
Patient.....	10
Room Rentals:	
Boarding Houses	50
Addition for non resident boarders	10

§1-808 Design Flow

Table 3- Continued

GALLONS/PERSON/DAY a, b
(unless otherwise noted)

Rooming Houses (per occupant bed space)	40
Factories (gallons per person, per shift, exclusive of industrial waste).....	15
Gyms: Per Participant.....	10
Spectator	3
Hairdressers: Operator	10
Per Chair	150
Hospitals (per bed space)	250
Hotels with Private Baths(per person sleeping space) ^c	50
Institutions other than hospitals (per bed).....	125
Laundries, self service (gallons per machine)	500
Mobile Home Parks:	
For wastewater systems serving 4 or fewer trailers (per space)	450
For wastewater systems serving 5 or more trailers (per space)	250
Motels with bath, toilet (per person sleeping space) ^c	50
Picnic Parks (toilet wastes only/picnicker)	5
Restaurants (toilet and kitchen wastes/seat, including restaurant and bar seats)	30
Additional per seat for restaurant serving 3 meals per day	15
Restaurants (fast food - see cafeterias).....	50
Schools:	
Boarding	100
Day, without gyms, cafeterias, or showers	15
Day, with gyms, cafeterias, and showers	25
Day, with cafeteria, but without gyms or showers ...	20

§1-808 Design Flow

Table 3-Continued

GALLONS/PERSON/DAY ^{a,b}
(unless otherwise noted)

Service Stations (first set of gas pumps)	500
(each set thereafter)	300
Sewer Line Infiltration ^d (where applicable)	300 gal/in pipe/dia/mile/day
Shopping Centers/Stores: ^c	
Large Dry Goods	5 GPD/100 ft ²
Large Supermarkets with meat department without garbage grinder	7.5 GPD/100 ft ²
Large Supermarkets with meat department with garbage grinder	11 GPD/100 ft ²
Small Dry Good Stores (in shopping centers)	100 GPD/store
Theaters:	
Movie (per auditorium seat).....	5
Drive in (per car space)	5
Veterinary Clinic (3 or less doctors):	
without animal boarding	750/clinic
with animal boarding	1,500/clinic
Workers:	
Construction (at semi permanent camps)	50
Day at schools and offices (per shift)	15

Note: These Rules change design flows for certain categories. It may be possible to add more residential or camping units to an existing potable water supply and/or wastewater system when the supply and/or system conform to current design requirements.

^a Use eighty (80) percent of design flows for projects to be connected to a wastewater system with a design capacity of 50,000 gallons per day or greater. Note that this design flow reduction applies only to the wastewater flow and DOES NOT apply to a project's associated potable water supply design flows if the water supply is regulated as a public transient, non-transient, or community water supply.

^b A 10% reduction in the design flow may be used when the plumbing includes standard water saving designs. Toilets must be 3.5 gallons per flush or less and showers and faucets must be 2 gallons per minute or less

^c Does not include laundry or restaurant waste.

^d The infiltration design flow is not reduced when water saving plumbing fixtures are used or when a connection is made to a wastewater system with a design flow of 50,000 gallons per day or greater. Any reduction shall be based the requirements of subsection 1-808(e) of this section.

Note: Elderly housing may be calculated at 1.5 people per bedroom

Subchapter 9 – Specific Technical Standards for Wastewater Systems

§1-901 Building Sewers, Sewage Collection Systems, and Lift Stations

Appendix 1-A contains guidelines that provide acceptable criteria for the design of these components. Other design standards may be used if approved by the Secretary.

§1-902 Soil and Site Evaluations

(a) General

A designer shall conduct a soil and site evaluation. The designer shall prepare a soil and site evaluation report including the necessary tests and investigations. These tests and investigations may include, but are not limited to, soil excavation, percolation testing, site and terrain investigation, groundwater levels, water supply investigations, and hydrogeologic investigations.

(b) Soil and Site Evaluations

A designer shall conduct soil excavations in locations chosen to accurately establish the soil conditions across the primary and, when a replacement area is required, replacement wastewater areas. The minimum number of excavations will be two for the primary and two for the replacement area, unless no replacement area is required or unless a proposal to use fewer excavations is approved by the Secretary on a site specific basis. More excavations will be necessary to properly evaluate a site for systems with design flows greater than 600 gallons per day or when initial investigation identifies a highly varied soil condition. The Secretary will allow fewer excavations if the designer demonstrates that the soils are uniform. Primary and, when a replacement area is required, replacement areas shall be tested to a depth sufficient to demonstrate that, when installed, the proposed soil-based systems will meet the isolation distances to bedrock, seasonal high water table, and impervious soil. The Secretary may require additional investigations and excavations to be conducted within each proposed leachfield area to determine uniform suitability of soils or adequacy of depth over bedrock, impervious soils, and the seasonal high water table. Excavations shall be conducted prior to percolation tests to determine at what depth the percolation test shall be conducted. All soils information derived from excavations for the project shall be submitted including excavations that are not used as the basis of any particular soil-based disposal system design. See §1-305 and Appendix 6-A of these Rules for details of what must be submitted with a permit application.

- (1)** The location of each excavation shall be individually identified and accurately shown on the site plan.
- (2)** A soil profile description shall be written for each excavation. The thickness of the different soil horizons shall be indicated. Horizons shall be differentiated on the basis of color, texture, soil mottles, density, structure and bedrock. Depth shall be measured from the ground surface. The estimated elevation of the seasonal high water table shall be specified. Absence of a seasonal high water table shall also be specified. Soil mottles shall be described in accordance with Appendix 2-A.

§1-902(b)(3) Soil and Site Evaluations

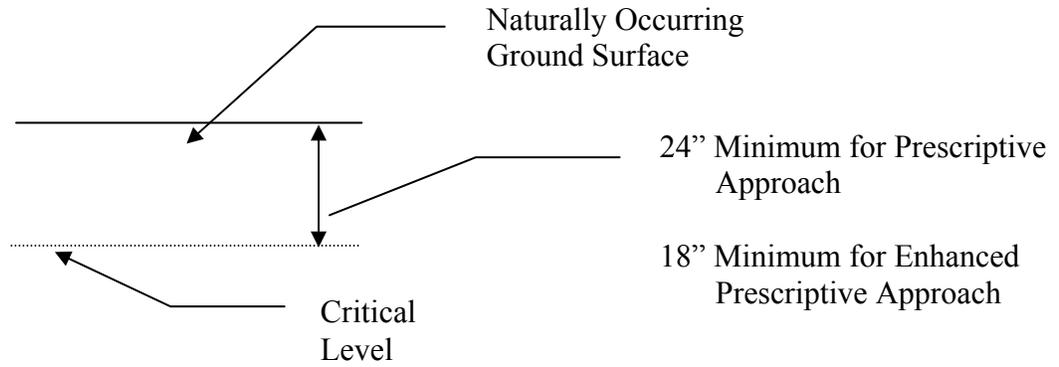
- (3) Percolation tests shall be conducted in representative locations within the proposed leachfield areas using the procedures in Appendix 4-A. At least two or four percolation tests are required, with two in the primary area and, when a replacement area is required, two in the replacement area unless a lesser number is approved by the Secretary. The Secretary may require more tests for systems larger than 600 GPD, or when the soils downslope of the leachfield areas are in question.

§1-903 Groundwater Level Monitoring

- (a) Monitoring of the groundwater level may be used in lieu of a determination of the elevation of the seasonal high water table based on soil mottling. Once the elevation of the seasonal high water table is determined, the determination may be used for two purposes. The first is to determine if the site is suitable for wastewater disposal under the Rules. If it is determined that the site is suitable, the second use of the information is to help decide what type of system may be used; an in-ground system, an at-grade system, or a mound system. All portions of the monitored area must comply with the Rules. Testing must include the most limited portions of the monitored area.
- (b) Critical level determination of site suitability - Each monitoring program begins with a determination of the critical level. It must be determined that the seasonal high water table is at or below this level in order to meet the Rules. A site to be used for wastewater disposal under the **prescriptive approach** must have at least 24" from the surface of the naturally occurring soil down to the seasonal high water table. A site using the **enhanced prescriptive approach** must have at least 18" from the surface of the naturally occurring soil down to the seasonal high water table. A site using the **performance-based approach** must first determine the amount of rise in the groundwater table that will occur when the effluent from the leachfield is added to the existing water table. This rise is called induced groundwater mounding. The critical level will be 6" plus the calculated induced groundwater mounding. For example, if the induced groundwater mounding in the water table is 8", the critical level will be 14" (based on 6" of unsaturated soil plus an 8" induced rise in the water table).
- (c) While the critical levels noted in subsection (b) are based on meeting minimum site standards, the question is sometimes whether an at-grade system can be used in lieu of a mound wastewater disposal system or an in-ground system in lieu of an at-grade system. For these cases, as shown in figure 9.3 below, the critical level will be 36" below the bottom of the leachfield for a system using septic tank effluent or 24" below the bottom of the leachfield when using filtrate effluent. As an example, if a shallow in-ground system using filtrate effluent with the bottom of the leachfield 8" below ground surface is proposed, the critical level will be $24''+8'' = 32''$ below the ground surface.

§1-903 Groundwater Level Monitoring

Figure 9.1 Critical Levels for Site Suitability
Prescriptive and Enhanced Prescriptive Based Designs



§1-903 Groundwater Level Monitoring

Figure 9.2 Critical Level for Site Suitability Performance Based Designs

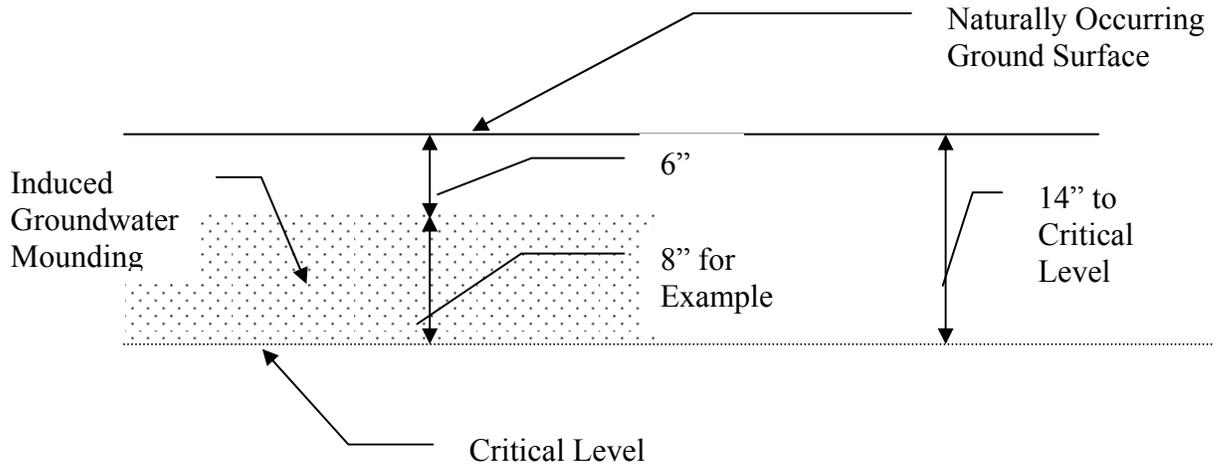
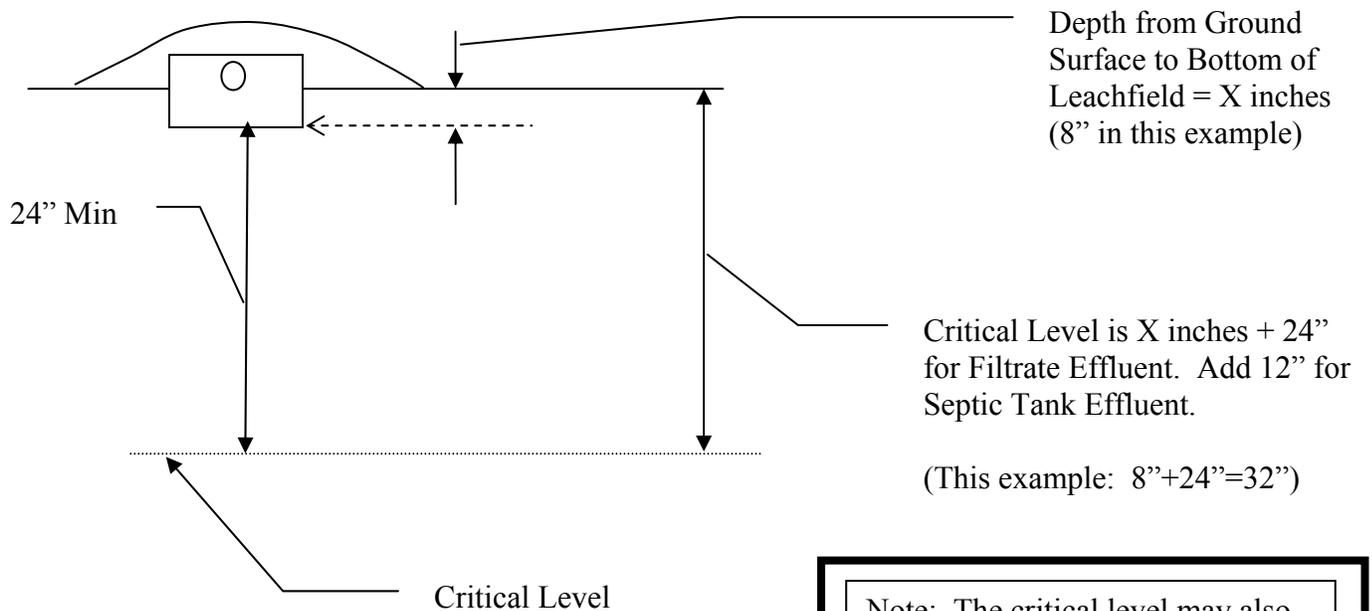


Figure 9.3 Critical Level Based on Location of the Bottom of the Leachfield



Note: The critical level may also be affected by induced groundwater mounding. See §1-903(d) below.

- (d) Induced groundwater mounding
- (1) Filtrate disposal systems with linear loading rates greater than 4.5 gallons/day/linear foot, and performance based systems, shall calculate the induced groundwater mounding under the leachfield. In addition to maintaining at least 2' of permeable soil between the bottom of the leachfield and the seasonal high groundwater table, filtrate disposal systems shall maintain at least 18" between the bottom of the leachfield and the top of the induced groundwater mounding. Wastewater systems using septic tank effluent shall maintain at least 36" of permeable soil between the bottom of the leachfield and the top of the induced groundwater mounding. If the induced groundwater mounding for a filtrate disposal system is more than 6" above the seasonal high water table level, the critical level will be more than 24" below the bottom of the leachfield. As an example, for filtrate disposal systems, if the induced groundwater mounding is 8", the critical level will be 26" below the bottom of the leachfield ($8''+18'' = 26''$).
 - (2) Mound wastewater disposal systems with design flows of greater than 1000 gallons/day and in-ground and at-grade systems with design flows greater than 2000 gallons/day shall calculate the induced groundwater mounding under the leachfield. The system shall maintain at least 36" of unsaturated soil between the bottom of the leachfield and the top of the induced groundwater mounding. As an example, if the induced groundwater mounding is 8" the critical level will be 44" below the bottom of the leachfield ($8''+36'' = 44''$).
- (e) Monitoring Procedure
- (1) A minimum of four monitor wells will be required for each area tested unless otherwise approved by the Secretary. Some sites will require more monitor wells to establish compliance with the site requirements. It is strongly recommended that the Secretary be consulted if a groundwater monitoring program will be conducted. If the monitoring program has been approved by the Secretary, the designer may be assured that the number and location of the wells will be regarded as sufficient to provide a definitive answer as to whether or not the site complies with the Rules. The designer should apply no later than February 1st to allow sufficient lead time for review and approval of a monitoring plan. Any proposal for monitoring groundwater levels must include a property access agreement so that Agency personnel may inspect the site during the monitoring period. Any groundwater monitoring program must consider drainage patterns, soil textures, relief watershed, monitor installation procedures, monitor locations, and a monitoring schedule.
 - (2) Data collected from groundwater monitoring shall be evaluated against weather conditions over the period of measurement and data from other sites. In years with unusual seasonal groundwater patterns, actual monitoring data may not be representative of long term seasonal high groundwater. If a site is monitored for more than one year, all data must be submitted and the decision will be based on the most restrictive year not discounted because of unusual conditions.

§1-903(e)(3)**Groundwater Level Monitoring**

- (3) The monitoring period shall be from March 1 until May 31. Groundwater level readings shall be taken at least once every 7 days during the monitoring period. If the water level reaches or exceeds the critical level the readings shall be taken at least once every 4 days until the water level falls below the critical level. Each reading shall be considered to represent the water level existing for $\frac{1}{2}$ of the time since the previous reading plus $\frac{1}{2}$ of the time until the next reading. For example, if the readings were 7 days apart, each reading would represent the 3 $\frac{1}{2}$ days before and the 3 $\frac{1}{2}$ days after a particular reading.
- (4) The Secretary may consider information from a groundwater monitoring program that does not include the entire monitoring period. The results will be accepted only upon a conclusive demonstration by the designer that the results accurately represent the seasonal high water table during the monitoring period.
- (5) Each reading shall be recorded as the number of days represented, as described in (3) above. The groundwater monitoring program demonstrates that the critical level is maintained if:
 - (A) the groundwater level does not rise above the critical level for more than a total of 30 days during the monitoring period;
 - (B) the groundwater level does not rise more than 6" above the critical level for more than a total of 20 days during the monitoring period;
 - (C) the groundwater level does not rise more than 12" above the critical level for more than a total of 10 days during the monitoring period;
 - (D) the groundwater level never rises more than 18" above the critical level; and
 - (E) the seasonal high water table or, if calculated, the induced groundwater mounding, never rises to less than 6" from the naturally occurring ground surface and, if calculated, the induced groundwater mounding never rises to less than 6" below the bottom of a leachfield receiving filtrate effluent.
- (f) On some sites, due to low permeability soils, perched water tables may form in upper soil horizons. For the purpose of any wastewater system designed under these Rules, a perched water table is the seasonal high water table. The designer may analyze these in the same manner as any other type of groundwater table.

§1-904 Septic Tanks

- (a) All-soil based disposal systems, including graywater disposal systems, shall include a septic tank. The septic tanks shall be sized as noted below:

Minimum Sizes for Septic Tanks

Design Flow, Gal/Day Liquid Capacity Below the Invert of the Outlet *

Less than 667 Gal/Day	1,000 gallons
667 - 1500 Gal/Gay	1.5 times design flow
1,500 – 6500 Gal/Day	1,125 + 75% of design flow

* Unless a smaller tank can be justified by the designer.

Note: When an internal pump is installed within the septic tank, the capacity of the tank must be increased to allow for the dose volume and any emergency storage capacity that will be provided within the septic tank.

- (b) Use of garbage grinders is strongly discouraged. The septic tank capacity shall be increased by a minimum of 25% if a garbage grinder is used.
- (c) All septic tanks shall be installed with access risers to grade. Covers must be tight fitting and must be designed to prevent entry by children.
- (d) Septic tanks shall be watertight, structurally sound, and constructed of materials not subject to extensive corrosion or decay.
- (e) All septic tank installations shall include an effluent filter that has been tested and shown to prevent the passage of solids larger in size than 1/8th inch.
- (f) Specifications and Maintenance. See Appendix 3-A

§1-905 Grease Interceptor

- (a) An approved grease interceptor shall be installed in the waste line leading from sinks, drains, dishwashers, and other fixtures or equipment in restaurants, cafeterias, bars or clubs, hotels, factories, or school kitchens or other establishments where grease would be a particular concern, except when the wastewater will be disposed of in a municipal wastewater treatment plant.

Note: A municipal system receiving wastewater from the types of fixtures described above may have its own grease control requirements. Nothing in this rule exempts a person from complying with any municipal ordinance or policy regarding grease control requirements for wastewater being disposed of in a municipal wastewater treatment facility. The applicant is encouraged to contact the municipal officials as early in the design process as possible.

§1-905(b)

Grease Interceptor

(b) A grease interceptor designed in accordance with the method described below, derived from the 1997 Uniform Plumbing Code, will be considered acceptable for soil-based systems. Alternative designs may be reviewed and approved based on a demonstration of equal or greater grease removal. Grease removal is very case specific and the designer should consider all of the factors in preparing a design for a grease interceptor, including the effects of ultra hot water.

(1) Number of Meals per peak hour X Wastewater Flow Rate X Retention Time X Storage Factor = Size Requirement in liquid capacity.

(A) Number of meals served at peak operating hour (Seating Capacity) X Peak Factor

(i) Where peak factor for fast food restaurants is1.33

(ii) Where peak factor for all other food service types is. 1.0

(B) Wastewater flow rate:

(i) With dishwasher 6 gallon flow

(ii) Without dishwasher 5 gallon flow

(iii) Single Service kitchen 2 gallon flow

(iv) Food waste disposer 1 gallon flow

(C) Retention times

(i) Commercial kitchen waste/dishwasher 2.5 hours

(ii) Single service kitchen 1.5 hours

(D) Storage factors

(i) Fully equipped commercial kitchen ...8 hour operation .. 1

(ii)16 hour operation .. 2

(iii) 24 hour operation .. 3

(iv) Single service kitchen 1.5

(2) The minimum size grease interceptor shall be 1000 gallon capacity

§1-905(b)(3)**Grease Interceptor**

- (3) Construction requirements:
 - (A) The tank shall be watertight, structurally sound, and constructed of materials not subject to extensive corrosion or decay.
 - (B) The inlet and outlet baffles shall extend from 12" above the bottom of the tank and to well above the waterline and shall allow airflow back into the building plumbing system.
 - (C) Each compartment of the tank shall have an access riser to grade. The cover shall be tight fitting and designed to prevent entry by children.
- (4) For the purposes of this Section, a single service kitchen is one where the food preparation consists of heat and serve only and that uses service items not expected to be used again on the premises or, if reused, the items are not washed on the premises. Operations with grills, frying machines, or cooking devices other than those used to heat food are not single service kitchens.

Note: The Vermont Plumbing Rules may require installation of an interior grease trap. If required, it will not substitute for the grease interceptor required by these Rules.

§1-906**Dosing and Pressure Distribution System Design**

- (a) Dosing is recommended for all soil-based disposal systems and is required when the design flow requires more than 500 linear feet of distribution piping.
- (b) Dosing may be accomplished by pumps, siphons, or other devices that can provide sufficient flow and pressure to meet the design requirements of the distribution system.
- (c) Any soil-based disposal system using pressure distribution shall be dosed. The system shall be designed to maintain a minimum pressure of 1 psi (or 2.3 feet of head) at the end of each distribution line. There shall be a maximum of a 10% difference in the per-square foot loading rate between any two trenches or beds within a system. No trench or bed shall be loaded at a rate exceeding that permitted based on the percolation rate and any factors associated with advanced treatment except when approved as an innovative or alternative system. There shall be a maximum 10% difference in the discharge rate between any two orifices in a single trench or bed. The design shall provide even distribution throughout the leachfield. The minimum dose volume shall be 5 times the volume of the distribution network that must be filled during each dosing cycle. There shall be at least 4 dosing cycles per day based on the design flow of the soil-based disposal system. There shall be at least one orifice for each 25 SQFT of leachfield area unless there is a specific requirement in these Rules for additional orifices.

§1-906 (d) Dosing and Pressure Distribution System Design

- (d) Pressure distribution pipe shall be smooth, rigid pipe and the pipe network shall be designed to allow for periodic cleaning. The distribution pipe shall be constructed so that there is access to the piping system for flushing of the piping system.
- (e) All distribution pipe shall be laid level. Distribution pipe serving separate absorption trenches or absorption beds may be installed at different elevations provided that the design ensures even distribution.
- (f) The minimum orifice diameter shall be 1/8". An septic tank effluent filter that prevents passage of particles larger than 1/8" shall be used to protect the pump, siphon, or other dosing device and the distribution piping. The orifices may face up or down. If the orifices are on the upper side of the pipe, they shall be protected by orifice shields. One or more additional orifices may be placed in the bottom of the pipe to facilitate drainage in situations where freezing of the distribution pipe is possible.
- (g) Alternative designs proposed by a designer that result in equal distribution may be approved by the Secretary.

§1-907 Absorption Trenches

- (a) All absorption trench disposal fields shall comply with all isolation requirements set forth in §1-807 in addition to the isolation requirements in this subsection.
- (b) Absorption trenches shall have a maximum width of 48".
- (c) The size of an absorption trench is calculated as the bottom area of the trench. The amount of area is calculated based on the second slowest percolation rate in the proposed area of the trench, using the following formula:

$$LR = \frac{3}{\sqrt{t}}$$

where LR is the loading rate in gallons per square foot of absorption trench per day and t equals the percolation rate in minutes per inch. The size of the absorption trench is determined by dividing the design flow in gallons per day by the loading rate in gallons per day per square foot. The result is the number of square feet of bottom area required. The minimum acceptable value for t is 4 min/inch and the maximum acceptable value for t is 60 min/inch. The maximum loading rate is 1.5 gallons per day per square foot.

- (d) Absorption trenches shall extend no deeper than 36" below ground surface.
- (e) Absorption trenches may be installed on slopes of up to 20% on lots subdivided on or after June 14, 2002. For systems built on other lots, slopes of up to 30% or more than 30% may be approved on a case by case basis using a performance based approach. When a system is proposed on a slope of more than 20%, the plans shall meet the requirements of section 1-805(e) of these Rules.

§1-907 (f) Absorption Trenches

- (f) When installed, the bottom of any absorption trench shall be at least 36" above the seasonal high water table, 36" above any impervious soil layer, and 48" above bedrock. On sloping sites, the measurements shall be taken from the deepest portion of the absorption trench. For systems with design flows of 2000 gpd or more, it shall be determined that the induced groundwater mounding associated with the system will be at least 36" below the bottom of the absorption trench. This determination shall be based on a site specific analysis using either the desk top hydrogeologic analysis or a site specific test. For example, sites with highly permeable soil and with a seasonal high water table significantly more than 36" below the bottom of the absorption trench are possible candidates for such a determination.
- (g) The bottom of any absorption trench shall be level.
- (h) Absorption trenches shall have crushed stone extending a minimum of 2" above and 12" below the distribution pipe. Exception: Absorption trench systems that use the loading rate calculations for absorption beds shall have a minimum of 6" of crushed stone below the distribution pipe. Absorption trenches shall extend a minimum of 6", or the depth of stone below the distribution pipe, whichever is greater, below the ground surface on the downslope edge of the trench.
- (i) Absorption trench systems may be constructed using prefabricated leaching chambers with a minimum H-10 structural loading rating, instead of crushed stone. Distribution pipe must be used in any chamber system.
- (j) The distribution piping must be 4" rigid, perforated pipe that is laid level, or small diameter pipe under pressure. If the distribution piping is more than 100' in length, it must be dosed. The ends of all pipes must be capped except for those at the same elevation, which should be connected.
- (k) A layer of filter fabric shall be placed over the top of the crushed stone.
- (l) Each absorption trench shall be covered with a minimum of 6" and a maximum of 12" of permeable soil, with the uppermost 2"- 4" being topsoil.
- (m) Absorption trenches shall be designed at least 6' on center when measured on a horizontal plane, but in no case shall there be less than 4' of naturally occurring, undisturbed soil between adjacent absorption trenches. Primary and replacement absorption trenches may be interfingered. There shall be at least 4' of naturally occurring, undisturbed soil between the primary and replacement absorption trenches.
- (n) Absorption trenches on sloping ground shall be laid parallel to the ground contours.
- (o) A distribution box shall be installed when multiple absorption trenches are used. Flow equalization devices that can be adjusted to maintain equal distribution during the life of the wastewater system shall be installed in the pipes leading to each absorption trench. The distribution box shall be constructed with an at-grade access. The designer shall consider the need for protection against freezing and shall include design details as needed.

§1-907 (p) Absorption Trenches

- (p) A reduction in the leachfield area may be allowed for absorption trenches and chamber trenches, where the depth of crushed stone exceeds the normal 12 inch depth below the distribution pipe. These design factors do not apply to gravel less systems. The reductions are as follows:

PERCENTAGE OF STANDARD DISPOSAL FIELD AREA REQUIRED

For absorption trenches

Depth of Crushed Stone Below Distribution Pipe	Trench Width 12"	Trench Width 18"	Trench Width 24"	Trench Width 36"	Trench Width 48"
18 inches	60%	64%	66%	71%	75%
24 inches (max)	50%	54%	57%	62%	66%

- (q) No absorption trench shall be constructed in fill material except in accordance with the site modification requirements in §1-912 or §1-913.
- (r) Absorption trenches shall not be constructed in soils with a percolation rate that is slower than 60 min/inch. Construction of absorption trenches in soils with a percolation rate that is faster than 1 min/inch requires a site modification as described in §1-912(e).
- (s) All piping from the building or structure to the septic tank, from the septic tank to a distribution box, or to a pump or siphon chamber, and to the absorption trench shall be non-perforated, rigid pipe. The pipe penetrations shall be sealed to prevent leakage.
- (t) After the absorption trench area has been excavated, any smeared surfaces shall be scarified with a rake. Construction equipment not needed to construct the leachfield shall be kept off the area to be used to prevent undesirable compaction of the soils. Construction shall not be initiated when the soil moisture content is high. If a fragment of soil from about 9" below the surface can easily be rolled into a wire, the soil moisture content is too high for construction purposes.

§1-908 Absorption Beds

- (a) All absorption bed systems shall comply with all isolation requirements set forth in §1-807 in addition to the isolation requirements in this subsection.
- (b) Leachfields that are wider than 48" are referred to as absorption beds.
- (c) The basis of design is the bottom area of the absorption bed. No reduction in area is allowed for extra stone under the distribution pipe.
- (d) The maximum capacity for any single absorption bed is 2000 gallons per day.

§1-908 (e) Absorption Beds

- (e) An absorption bed shall not be constructed in soils with a percolation rate slower than 60 minutes/inch. An absorption bed constructed in soils with a percolation rate faster than 1 minute/inch requires a site modification as described in §1-912 (e)
- (f) Absorption beds shall extend no deeper than 36” below ground surface.
- (g) When installed, the bottom of any absorption bed shall be at least 36” above the seasonal high water table, 36” above any impervious soil layer, and 48” above bedrock. On sloping sites, the measurements shall be taken from the deepest portion of the absorption bed. For absorption bed systems with design flows of 2000 gpd or more, it shall be determined that the induced groundwater mounding associated with the system will be at least 36” below the bottom of the system. This determination shall be based on a site specific analysis using either the desk top hydrogeologic analysis or a site specific test.
- (h) The bottom of any absorption bed shall be level.
- (i) Absorption beds on sloping ground shall be laid parallel to the ground contours.
- (j) A large length to width ratio is recommended.
- (k) Absorption beds shall have a minimum of 2” of crushed stone over the distribution piping and a minimum of 6” of crushed stone below the distribution piping. Absorption beds shall extend a minimum of 6”, or the depth of the stone below the distribution piping, whichever is greater, below the ground surface on the downslope edge of the bed.
- (l) All distribution piping shall be laid level. The piping shall be 4” rigid, perforated pipe unless small diameter pipe under pressure is used. Any length of pipe greater than 100’ shall be dosed.
- (m) Absorption bed systems may be constructed using prefabricated leaching chambers with a minimum H-10 structural loading rating, instead of crushed stone. Distribution pipe must be used in any chamber system.
- (n) There shall be a layer of filter fabric over the top of the crushed stone.
- (o) Each absorption trench shall be covered with a minimum of 6” and a maximum of 12” of permeable soil, with the uppermost 2”-4” being topsoil.
- (p) Absorption beds shall not be constructed in fill except in accordance with §1-912 or §1-913.

§1-908(q)**Absorption Beds**

- (q) Absorption beds shall be sized on the bottom area only. The design shall be based on the second slowest percolation rate for the site. The loading rate shall be determined by the formula:

$$LR = 0.8 \times \frac{3}{\sqrt{t}}$$

where LR is the loading rate in gallons per square foot of absorption bed per day and t equals the percolation rate in minutes per inch. The size of the absorption bed is determined by dividing the design flow in gallons per day by the loading rate in gallons per day per square foot. The result is the number of square feet of bottom area required. The minimum useable value for t is 4 min/inch and the maximum acceptable value for t is 60 min/inch. The maximum acceptable loading rate is 1.2 gallons per day per square foot.

- (r) Absorption beds shall not be installed on land with a slope greater than 10%. The area between the downslope edge of the wastewater system and the point where the ground begins to exceed a slope of 30% may have a slope of up to 30%, even though the slope under the leachfield is restricted to no more than 10%.
- (s) All distribution lines within the absorption bed shall be uniformly spaced no more than 6' apart. The maximum distance from a distribution line and the edge of the absorption bed shall be 3'.
- (t) Primary and replacement absorption beds shall be separated by at least 10 feet.
- (u) All piping from the building or structure to the septic tank, from the septic tank to a distribution box, or to a pump or siphon chamber, and to the absorption bed shall be non-perforated, rigid pipe. The pipe penetrations shall be sealed to prevent leakage.
- (v) After the absorption bed area has been excavated, any smeared surfaces shall be scarified with a rake. Construction equipment not needed to construct the leachfield shall be kept off the area to be used to prevent undesirable compaction of the soils. Construction shall not be initiated when the soil moisture content is high. If a fragment of soil from about 9" below the surface can easily be rolled into a wire, the soil moisture content is too high for construction.

§1-909**Spray Disposal Systems**

- (a) A spray disposal system is a wastewater system disposing of treated wastewater into the native soil by surface application to the land using aerial dispersion (sprinklers) to distribute the sewage evenly. The maximum size wastewater system approvable under these Rules is 6499 gallons per day of design flow. Larger systems are reviewed under the Indirect Discharge Rules.

§1-909 (b) Spray Disposal Systems

- (b) Wastewater shall be treated to provide an effluent with not more than 30 mg/l BOD₅ and 30 mg/l TSS. Disinfection with 20-minute chlorine contact time immediately prior to spraying and a 1.0 ppm chlorine residual at the spray nozzle, or a 4.0 ppm total residual chlorine (or other equivalent disinfection method acceptable to the Secretary) shall be required.

- (c) A soil and site evaluation shall be conducted under the supervision of a designer. The designer shall prepare a soil and site evaluation report in the following specific areas to properly locate and design a spray disposal system. The soil and site evaluation shall also include the designer's written opinion regarding the suitability of the soil and site to satisfactorily treat and dispose of the proposed volume of wastewater.
 - (1) An acceptable full time spray disposal site should have a fragipan or other impeding layer (silt or clay) beneath a more permeable overburden to prevent direct recharge to an unconfined aquifer or bedrock. A relatively flat site with impermeable soils at the ground surface may sometimes be utilized for spray disposal at lower than normal wastewater applications. Such application rates should be consistent with seepage and evaporation rates expected in the area.
 - (2) There shall be sufficient soil investigations on the site to establish that the fragipan or impeding layer is continuous on the site. Investigations shall also indicate the nature of the soil overlying the impeding layer. Soils investigations shall include, but are not necessarily limited to: in place densities, sieve analysis, horizontal and (when necessary) vertical permeability analysis.
 - (3) Groundwater recharge areas within bedrock or unconfined aquifer areas shall not be considered acceptable spray disposal sites.

- (d) A hydrogeologic investigation shall be conducted on each spray disposal site by a qualified hydrogeologist. Such an investigation shall include the submission of data in the following specific areas.
 - (1) The character and thickness of unconsolidated sediments overlying bedrock at the site shall be provided. The saturated zones in the soil profile shall be indicated, including possible perched water tables, and regional or artesian aquifers at the site. Geophysical testing can be utilized.
 - (2) The direction of ground water movements to and from the site, and points or areas of ground water discharge or recharge shall be determined and located on a contour map for local and regional ground water regimes.
 - (3) All surface waters and potable and non-potable water supplies within 500 feet of the proposed spray disposal site shall be located on a contour map and, for potable and non-potable water supplies, the following information shall be obtained through house to house survey, well drilling records, observations, or whatever other means are necessary:

- (A) owner of the water supply, whether it is in use or not, and its use as to potable, industrial or agricultural;
 - (B) type of water supply: drilled well, dug well, spring, surface water;
 - (C) well boring logs when available, depth of casing, depth to aquifer material, and material i.e., gravel, bedrock, and if available, the predominant bedrock material.
 - (D) Any possible effects of the spray disposal system on quality or quantity of any local or regional aquifers, and water supplies shall be evaluated. Hydraulic relationships between the spray disposal site and identified water supplies shall also be evaluated and addressed as to the possible effects on the quality or quantity of the supply.
- (e) The maximum spray disposal site application shall be 2 inches per week over the actual wetted area, with a minimum of 24 hours of rest between applications. The capacity of full time spray disposal sites shall be calculated on the basis of lateral flow downslope over the impeding layer while maintaining a minimum of one (1) foot of unsaturated soil between the ground surface and the resulting water table. Calculations of spray field capacity shall be made using recognized subsurface flow equations. The maximum hourly wastewater application rate shall be 0.25 inches per hour based on the actual wetted area. The maximum acceptable slope for a spray disposal site shall be 25 percent. There shall be a minimum of 5 feet between the wetted area of laterals of sprinklers in the direction of surface water runoff. Spraying during the winter shall be conducted during daylight hours, when air temperatures exceed 10 ° F. The pumping system shall be sized to deliver the average daily wastewater flow to the spray field in not more than eight (8) hours. The spray disposal and storage system shall be sized so that the system can operate effectively without having to spray during the spring run off months.
- (f) There shall be no spray disposal of sewage that discharges to Class A waters. Class A waters are identified and listed in the Vermont Water Quality Standards. Other controls regarding isolation distances for spray disposal systems are:
- (1) the wetted area from any sprinkler in a spray disposal system shall not be closer than 100 feet to the edge of any surface water;
 - (2) spray disposal areas shall be well isolated from road, habitation, and other places open to the general public. Isolation distances are dependent upon the intended use and disposition of the treated wastewater, degree of treatment provided, and local meteorological, vegetative and topographical system. The wetted area shall not be permitted closer than 200 feet from habitation, property lines, roads, or areas frequented by the public;
 - (3) no portion of a spray disposal area shall be permitted closer than 200 feet to any potable or non-potable water supply; and

§1-909(f)(4) Spray Disposal Systems

- (4) the spray disposal area shall be restricted from the public access by fencing and posting of signs, or other means acceptable to the Secretary, so that the public will be warned against entering the area and possible direct contact with the spray area.

- (g) Any planned multiple use of the spray disposal area will be evaluated on its own merits, and approvals granted at the discretion of the Secretary, with such conditions and additional controls as required. When waivers to specific requirements of these Rules are necessary in order to approve a multiple use, (e.g., waiver of isolation distance requirements for snowmaking on ski trails or irrigation of golf courses), the waiver will be granted upon a showing by the applicant that the environmental and human health concerns, addressed in this section, have been adequately addressed in the multiple use design.

- (h) When required by the Secretary, full time spray disposal systems shall have a storage capacity capable of storing a minimum of two months of wastewater . Seasonal spray disposal system facilities shall have sufficient storage capacity to allow for effective operation with a minimum acceptable storage capacity being 30 days of flow.

- (i) A detailed Operation and Maintenance Manual on the complete wastewater system shall be submitted for review and approval. All sludge removed from the wastewater treatment plant shall be disposed of at locations approved by the Residuals Management Section of the Department. The permittee(s) shall comply with the reporting procedures specified in the Certification from the Residuals Management Section or approved Sludge Management Plan. Monitoring and operation for a spray disposal system shall be as required in §1-910 of these Rules.

§1-910 Monitoring and Operations

Monitoring and operation of wastewater systems shall adhere to the requirements of paragraphs (a) and (b) below:

- (a) The required operation and maintenance of a wastewater system that depends only on a septic tank shall be those activities considered necessary to maintain an effective wastewater system. At the discretion of the Secretary, the owner may be required to install and maintain a ground water sampling and monitoring program considered necessary to detect contamination and degradation of ground water and surface water and water supplies with the results submitted to the Secretary in accord with the permit conditions.

- (b) The treatment facilities of spray disposal systems shall be supervised by an operator licensed under the Vermont Wastewater Treatment Facility Operators Certification Program with the applicable certification, and the facilities shall be operated and maintained in a manner satisfactory to the Secretary. Operation reports, including flows received, volumes disposed of, and results of testing necessary to maintain plant efficiency and to demonstrate the reliability of the treatment system, shall be submitted to the Secretary on a monthly basis. Owners of such spray disposal systems where the Secretary has required the installation of groundwater monitors shall

§1-910 (b) Monitoring and Operations

maintain a groundwater sampling and analysis program to detect contamination and degradation of ground or surface water and potable and non-potable water supplies.

§ 1-911 Construction

Wastewater systems and potable water supplies shall be constructed in accord with the permitted design. The designer or the installer shall provide the installation certification required in §1-308 of these Rules. When the installation is different from the permitted design, a designer shall specify any deviations from the approved plans, specifications, or permit conditions in record drawings along with recommendations that the project be accepted as is, based on his or her certification of the revised design, or shall specify that alterations must be made to bring the project into compliance with the Rules. If alterations must be made, an installation certification must be completed after the alterations are complete. When the Secretary determines that the scope, complexity, or size, of the proposed facility justifies it, construction shall be accomplished under the supervision of a designer.

§1-912 Site Modifications

- (a) Depending upon the severity of site limitations, it may be possible to convert marginal or unsuitable sites to sites that comply with the specific requirements of these Rules. Applicants may submit plans for the treatment and disposal of wastewater that involve modifications to an existing site intended to bring a non-conforming site into conformance with standards applicable for the type of wastewater system proposed. Cuts or fills that change the elevation of the naturally occurring ground surface 1' or less shall not be considered site modifications for the purposes of this section.
- (1) Site conditions that may be improved by some degree of site modification are shallow depth to impervious layer, shallow depth to seasonal high ground water level, shallow depth to bedrock and excessive slope.
 - (2) Acceptable site modifications may include the installation of curtain drains to lower the water table, mound system construction, at-grade systems, filtrate disposal systems, and regrading of the site.
 - (3) Restrictions placed on site modifications apply only in cases where the site modifications are necessary to overcome limitations of an otherwise unacceptable site. The restrictions do not apply to modifications designed to enhance the functioning of a system on a complying site.
- (b) Application Procedures and Standard Requirements
- (1) All site modifications must be designed by a Class 1 or Class B designer.
 - (2) All plans for site modifications shall be submitted on an accurate contour map with a maximum of two (2) foot contour intervals. A scale of not greater than 20 feet per inch is recommended. A plan may be rejected if the scale is not adequate for review. Existing and proposed ground contours shall be shown along with a permanent benchmark.

§1-912(b)(3)

Site Modifications

- (3) A permit for the construction of a site modifications may be dependent upon the final site testing.
 - (4) Site modifications will not be permitted on sites with less than 24” of native soil over bedrock or ledge or other strata having a percolation rate slower than 120 minutes per inch except in accord with §1-805.
 - (5) Site modifications will not be permitted on sites having a seasonal high water table within two (2) feet of the ground surface. Exceptions:
 - (A) sloping sites with a seasonal high ground water table 18” or more from the ground surface may be approved for a mound wastewater system no larger than 600 gallons per day, if the designer concludes, and the Secretary agrees, that a curtain drain will lower the seasonal high water table to 24” or more. Mound wastewater disposal systems using trenches shall not use more than two trenches per system; and
 - (B) wastewater systems using enhanced prescriptive or performance based designs as described in sections §1-805 (c) and (d).
 - (6) Site modifications shall be constructed under the supervision of a Class 1 or Class B designer in accordance with the approved plans. Upon completion of construction, the supervising designer shall provide the certification required in §1-308 of these Rules. Failure to construct the site modifications under the supervision of a designer shall be a basis for revoking approval for the project.
 - (7) For site modifications involving flows of more than 2,500 gpd, the Secretary may require such additional design or construction specifications as may be necessary to insure the proper functioning of the system.
- (c) Curtain or Dewatering Drains.
- (1) Curtain or dewatering drains may be used to lower seasonal high water tables, that prevent compliance with the required wastewater disposal system design requirements.
 - (2) Drains are highly dependent upon their design and construction and site conditions for continued adequate performance. Prior to designing such drains, it is recommended that the designer consult such references as Drainage of Agricultural Land by the USDA Natural Resources Conservation Service and these Rules for design requirements and expected performance standards.

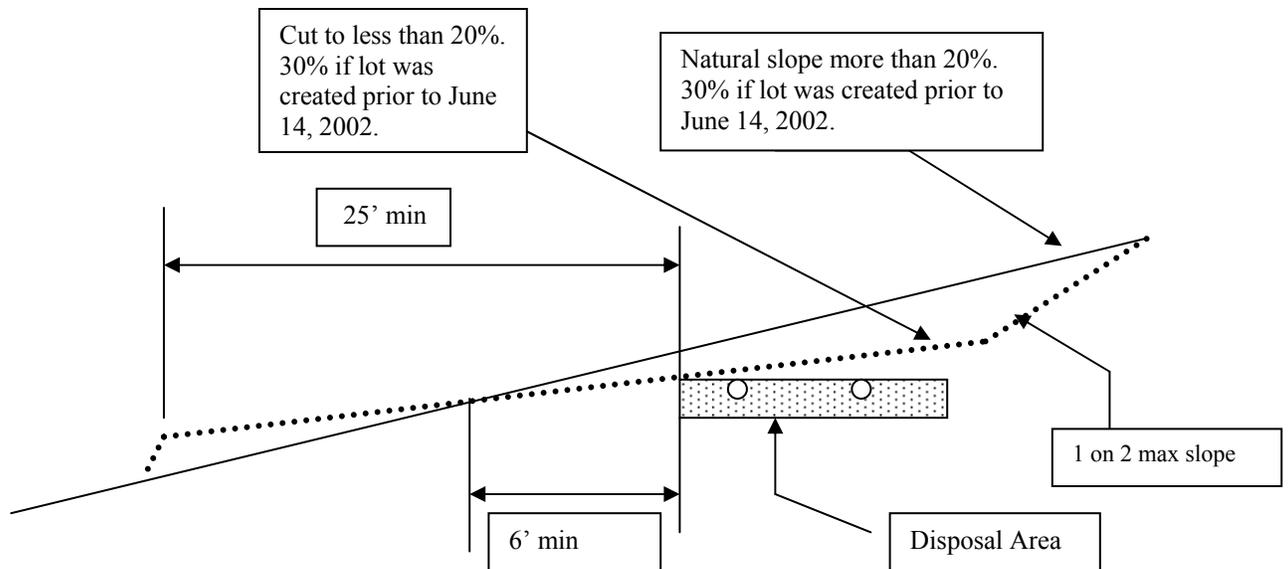
- (3) When a drain is proposed to lower a seasonal high water table, it must be installed and tested during spring conditions to demonstrate its effectiveness before approval of the wastewater system, unless the Secretary concludes that the designer has provided sufficient evidence to show that the drain will work effectively and that spring testing is not necessary. Subdivision (b)(5)(A) of this section also gives specific guidance for small mound systems.
- (4) The designer shall submit a plan to the Secretary that shows the drain and the proposed location of the wastewater system. After the permit has been issued the drain must be installed and tested before construction can commence, unless an exception has been granted in accordance with subsection (3) above.
- (5) A plan that includes the location of monitoring wells and the schedule of measurement shall be submitted to the Secretary.
- (6) Design Criteria
 - (A) All design criteria must be detailed as to plan, profile, discharge location, and typical section. When considered necessary to establish the effectiveness of the proposed drain, the Secretary may request supporting information, including permeability and sieve analysis of the soils at the site.
 - (B) The drain shall be constructed of material sufficient to transmit the water from the site and to prevent clogging of the drain and decrease of its effectiveness. The acceptable material shall be crushed stone, perforated or other porous pipe, and filter fabric material to prevent clogging. Other designs of graded material to prevent clogging may be approved when supported with sufficient information.
 - (C) If the curtain or foundation drain is downslope of the leachfield, the leachfield shall not be closer than 75 feet to the drain. If the curtain or foundation drain is upslope of the leachfield, it shall be a minimum of 20 feet, 35' if possible, to the leachfield. These distances may be reduced if the designer provides adequate data and analysis to show the effluent from this system will not enter the drain, or increased if effluent will enter the drain.
 - (D) All sites using drains shall have monitors installed to monitor their effectiveness. The location and design of the monitors shall be detailed on the plans.
 - (E) The outlet of all drains shall be constructed to prevent erosion and clogging. Rodent guards are required.

(d) Excessive Slope

- (1) In some cases, sites with steep slopes may be regraded and reshaped to provide adequate leachfield sites (see the limitations on slope in §1-805). Prior to regrading, soil excavations shall be performed to show that there will be a sufficient amount of soil over the seasonal high water table and ledge after the regrading (Figure 9.4 page 94).
 - (A) The modification for primary and replacement areas shall be complete and soil excavation and percolation tests performed before construction can commence on any regraded site.
 - (B) The leachfield shall not be installed in the fill area of a regraded site, though the area of fill may be used as a portion of the required 25 foot separation from the crown of a natural slope. There shall be a minimum of 6 feet of natural soil between the edge of a system and the downslope side of the regraded area.
 - (C) An erosion prevention and sediment control plan that meets the requirements of §1-805(e) of these Rules shall be submitted as part of the application.

§1-912

Site Modifications Figure 9.4
Natural slope more than 20%



(e) **Rapidly Permeable Soils**

For soils with a percolation rate of faster than one minute per inch, treatment shall be provided with (1) a mound wastewater disposal system; or (2) an absorption trench or absorption bed system backfilled with at least one foot of sandy fill material between the bottom of the crushed stone and the native soil. The fill shall have a percolation rate of three minutes per inch or slower. The application rate shall be based on the percolation rate of the fill in place.

§1-913 **Mound Wastewater Disposal Systems**

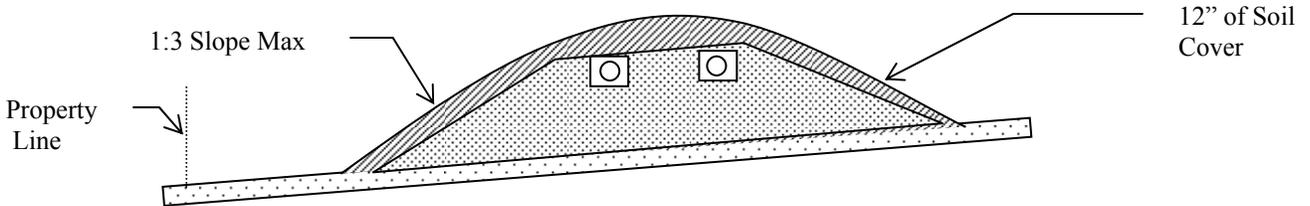
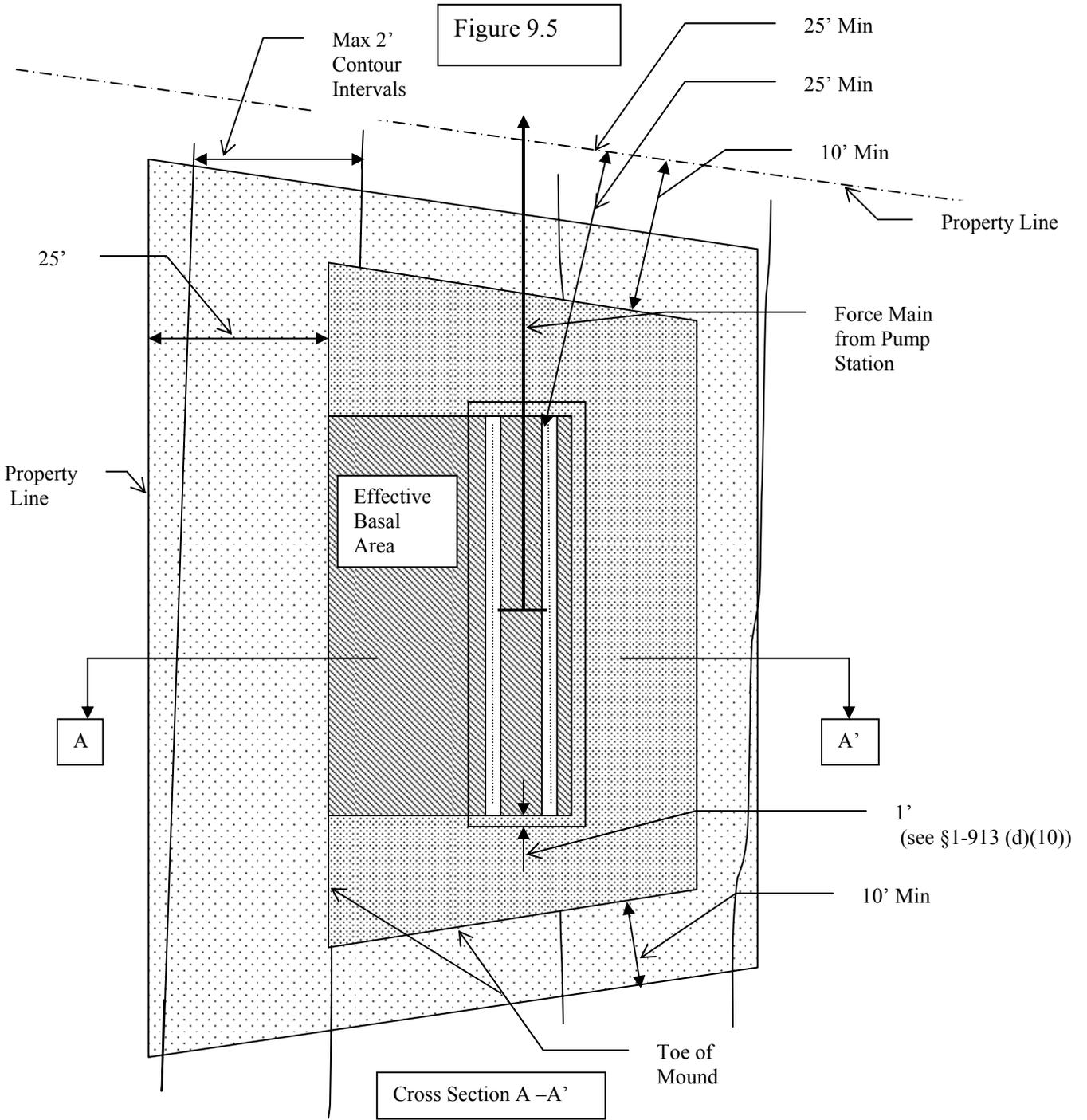
- (a) Mound wastewater disposal systems may be considered whenever site conditions preclude the use of a subsurface system. Not all sites will meet the minimum requirements for use of a mound system. Due to the nature of a mound wastewater disposal system, the selection of mound location, size of mound, and construction techniques must be thoroughly considered and the criteria established in this section must be carefully followed. See Figure 9.5 on page 97.
- (1) All mound wastewater disposal systems must be designed by a Class 1 or Class B designer.
 - (2) The designer shall prepare a contour map using a contour interval of not more than two feet. A scale of not greater than 20 feet per inch is recommended. All details of the mound wastewater disposal system, including but not limited to, toe of slope, surface drains, curtain drains, existing and proposed contours, and trench details shall be shown on the plans.

§1-913(a)(3) Mound Wastewater Disposal Systems

- (3) The plans shall show that there is sufficient area separate from the primary mound site on the lot to allow for construction of a replacement mound that meets all requirements, if a replacement area is required. The toe of the replacement mound shall not be closer than 10 feet to the toe of the primary mound on the sides or closer than 25 feet on the uphill or downhill side. Separation distances to non-mound systems shall be measured from the toe of the mound to the nearest portion of the adjacent leachfield.
 - (4) For mound wastewater disposal systems serving projects generating more than 1,000 gallons per day of wastewater, a hydrogeologic study of the site must be conducted to demonstrate the capability of the site to dispose of the volume of sewage to be generated. The ground water level at the downhill toe of the mound shall be raised no closer than 12” below the ground surface and the induced groundwater mounding beneath the mound shall be no closer than 36” below the bottom elevation of the leachfield within the mound unless using a performance based design per §1-805 of these Rules and /or when disposing of filtrate effluent per §1-916 of these Rules. A site specific test may be conducted if a desktop hydrogeologic analysis is insufficient for an approval.
- (b) Site requirements
- (1) Soils where the seasonal high water table, bedrock, or other strata having a percolation rate slower than 120 minutes per inch occurs within twenty four inches of natural grade, are not suitable for mound wastewater disposal systems. These limitations may be different if the enhanced prescriptive or the performance based approach is used. The site must be free of these limitations beyond the toe of a mound (primary and replacement) for a distance of twenty five (25) feet in the downslope direction and ten (10) feet on all other sides.
 - (2) Mound wastewater disposal systems may be constructed upon undisturbed naturally occurring soils. Mounds may also be approved for sites where the naturally occurring soil has been removed in which case the remaining naturally occurring soil needs to comply with the soil and siting criteria for mound wastewater disposal systems. In rare circumstances, a mound system may be approved for a site where the naturally occurring soil satisfies all of the minimum site requirements for a mound but where fill material not meeting the mound fill requirements has been placed over the naturally occurring soil. A detailed evaluation is required to determine that the non-mound fill is clean mineral soil, with a percolation rate of 120 minutes per inch or less, and that the fill material will not tend to cause horizontal flows that would lead to surfacing of the effluent. The percolation rate of the fill material must be considered in addition to that of the naturally occurring soil and may be a limiting factor. A minimum of 12” of mound fill will be required above the fill material not meeting the mound fill standards.
 - (3) A crest site is preferred; no mound wastewater disposal system shall be located in a depression, which could act as a natural surface or ground water collection area.

§1-913(b)(4) Mound Wastewater Disposal Systems

- (4) Generally, sites with large trees, numerous smaller trees or large boulders are unsuitable for a mound wastewater disposal system because of difficulty in preparing the surface and the reduced infiltration area beneath the mound. Rock fragments, tree roots, stumps and boulders occupy space, within the mound area, thus reducing the amount of soil for proper operation. If no other site is available, then it is recommended to cut the trees at ground level, leaving the stumps. A larger mound area may be necessary if too many stumps are involved, so that sufficient soil is available to accept the effluent.
- (5) The minimum isolation distance to drinking water supplies, per §1-807, shall be measured from the edge of the minimum required effective basal area of the mound wastewater disposal system or from the edge of the absorption trench or bed within the mound system, whichever is closer.
- (6) Mound wastewater disposal systems shall be located at least 50 feet from any surface water, including but not limited to, streams, watercourses, lakes, or impoundments as measured from any toe of the mound.
- (7) Mound wastewater disposal systems shall be located a minimum distance of 10 feet, as measured from the toe of the mound, from buildings, driveways, or any other subsurface obstruction except that this distance shall be 25 feet in the downgradient direction from the mound. Mound wastewater disposal systems shall be located a minimum distance of 10 feet, as measured from the toe of the mound or 25 feet as measured from the edge of the leachfield within the mound, whichever is greater, from property lines except that the distance from the downgradient toe of the mound to property lines shall be a minimum of 25 feet. The land area 25 feet downgradient of the elevated sand mound is the effluent dispersal area and soil in this area may not be removed or disturbed except as specified in these Rules.
- (8) Separation may be required between mound wastewater disposal systems to prevent hydraulic interference in the disposal area.



	Naturally occurring soils that meet the minimum site conditions per § 1-805
	Sand fill § 1-913 (c)
	Soil less permeable than sand fill with 2-4" of topsoil to be seeded and mulched

§1-913(c) Mound Wastewater Disposal Systems

(c) Fill Material: The fill material from the natural soil plowed surface to the top of the trench or bed shall be clean washed silica sand meeting one of the following sieve requirements:

(1)

<u>Sieve Number</u>	<u>Opening (mm)</u>	<u>Percent Passing, by Weight</u>
3/8	9.500	85 - 100
40	0.420	25 - 75
60	0.240	0 - 30
100	0.149	0 - 10
200	0.074	0 - 5

(2)

<u>Sieve Number</u>	<u>Opening, (mm)</u>	<u>Percent Passing, by Weight</u>
4	4.750	95 - 100
8	2.380	80 - 100
16	1.190	50 - 85
30	0.590	25 - 60
50	0.297	10 - 30
100	0.149	2 - 10

(3)

<u>Sieve Number</u>	<u>Opening (mm)</u>	<u>Percent Passing by Weight</u>
3/8	9.500	85 - 100
40	0.420	30 - 50
200	0.074	0 - 5

(4) The fill material must meet the specifications (1), (2), or (3) above. Interpolation of analyses is not permitted. Fill material (2) is ASTM Specification C 33 and is intended for manufactured material. The Secretary may approve other fill material that is proposed by the designer.

(5) Mound wastewater disposal systems approved under the September 10, 1982 Environmental Protection Rules may use the fill material allowed under this subsection without redesign.

§1-913(d) Mound Wastewater Disposal Systems

(d) Design

- (1) There shall be a minimum of one (1) foot of fill material and sufficient naturally occurring soils to meet the requirements in §1-805 of these Rules between the bottom elevation of the leachfield within the mound wastewater disposal system and the highest elevation of the limiting soil conditions.
- (2) Sufficient depth of fill material shall be placed to provide for 48" of vertical separation between the bottom elevation of the leachfield within the mound wastewater disposal system and creviced or permeable bedrock.
- (3) Sufficient depth of fill material shall be placed to provide for 36" of vertical separation between the bottom elevation of the leachfield within the mound wastewater disposal system and the seasonal high water table. For mound wastewater disposal systems with design flows of 1000 gpd or more, a designer shall determine that the induced groundwater mounding will be at least 36" below the bottom of the leachfield within the mound wastewater disposal system. This determination shall be based on a site specific analysis using either the desk top hydrogeologic analysis or a site specific test.
- (4) The effective basal area is the area within the sand fill that is downslope of the long dimension of the leachfield constructed within the mound wastewater disposal system.
- (5) The minimum isolation distance to drinking water supplies, per §1-807, shall be measured from the edge of the minimum required effective basal area of the mound wastewater disposal system or the edge of the absorption trench or bed, whichever is closer.
- (6) Mound wastewater disposal systems shall utilize pressure distribution. A seepage bed with a maximum 10' width or absorption trench(es) which may include multiple trenches with a total width exceeding 10' shall be used. Mound wastewater disposal systems shall not be installed on land with a slope greater than 20% if the lot was subdivided on or after June 14, 2002. Mound wastewater disposal systems on other lots may be approved on slopes up to 30% and, subject to additional permitting requirements may be approved on slopes exceeding 30% (see restrictions in §1-805). When a system is proposed on a slope of more than 20%, an erosion prevention and sediment control plan shall be prepared in accordance with section 1-805(e) of these Rules. The area between the downslope edge of the wastewater system and a point where the ground slope exceeds 30% may have a slope of up to 30%, even though the slope under the leachfield is restricted to no more than 20%. The mound systems shall be installed with the long dimension of the system parallel to the land contour. Spacing between trenches shall be no less than 4'. For trench designs, the minimum trench length shall be twice the dimension across the top of the mound from the outside to outside of the trenches.
- (7) The maximum application rate in an absorption trench or absorption bed bottom area shall be 1.0 gallons/day/square foot.

§1-913(d)(8) Mound Wastewater Disposal Systems

- (8) The minimum required effective basal area of the mound wastewater disposal system, for soils with a percolation rate of 61 to 120 minutes per inch, is to be calculated using a maximum application rate of 0.24 gallons/day/square foot.
 - (9) The minimum required effective basal area of the mound wastewater disposal system for soils with a percolation rate of 0 to 60 minutes per inch is to be calculated using a maximum application rate of 0.74 gallons/day/square foot.
 - (10) The area of sand fill shall be sufficient to extend one (1) foot beyond the edge of the required absorption trenches or the absorption bed before the sides are shaped to the acceptable slope.
 - (11) The maximum acceptable slope for toe slopes of mound wastewater disposal systems shall be 1 on 3. The mound fill shall extend beyond the effective basal area.
- (e) Pressure Distribution System Design
- (1) Pressure distribution shall be required for all mound wastewater disposal systems.
 - (2) The leachfield shall be dosed a minimum of four times per day and not more than once in any thirty minute period. The size of the dosing pump or siphon shall be selected to maintain a minimum pressure of one pound per square inch or 2.3 feet of head at the end of each distribution line. The pump or siphon and the distribution piping shall be protected with an effluent filter that prevents the passage of any particle larger than 1/8".
 - (3) The pressure distribution pipe shall be rigid plastic pipe, Schedule 40 to 80 with a minimum of diameter of one (1) inch. The pipe shall provide a single row of holes, minimum 1/8-inch diameter, on center along the length of the pipe with the last hole in the end cap. A design that assures uniform distribution throughout the leachfield is required. There shall be a minimum of one opening in the distribution piping per 25 square feet of leachfield area. There shall be a maximum of a 10% difference in the per-square foot loading rate between any two absorption trenches within a system. There shall be a maximum 10% difference in the discharge rate between any two orifices in a single absorption trench or absorption bed. The design shall provide even distribution throughout the leachfield. The minimum dose volume shall be 5 times the volume of the distribution network that must be filled during each dosing cycle. All joints and connections shall be solvent welded.
 - (4) The pressure distribution pipe shall be placed in crushed stone with the orifices upward, and the holes shall be covered with an orifice shield or the orifices shall be directed downward. One or more additional orifices may be added to allow drainage of the piping when freezing may be a problem. The material used to cover the top of the stone shall be one layer of filter fabric.

§1-913(e)(5) Mound Wastewater Disposal Systems

- (5) The ends of all distribution pipes shall be capped.
 - (6) The distribution pipe shall be constructed so that there is access to the piping system for flushing of the piping system.
- (f) Construction
- (1) A Class 1 or Class B designer shall review the mound wastewater disposal system through the critical stages of construction. Upon completion of construction, the designer shall submit a report in writing to the Secretary, including the certification required in §1-308 of these Rules. Upon completion of plowing of the mound area and prior to the placing of the fill material, the designer shall inspect the site preparations. This shall be specifically addressed in the designer's report. Upon completion of the installation of the distribution piping, the network shall be tested with clean water to assure that distribution is complete and meets the requirements in subsection (e) of this section.
 - (2) A plan showing the locations of the tests required under this section and any calculations shall be included with the designer's report.
 - (3) To prevent compaction, construction equipment shall not be moved across the plowed surface or the effluent dispersal area (see §1-913(b)(7)). However, after placement of a minimum of six (6) inches of sand fill over the plowed area, construction equipment may be driven over the protected surface to expedite construction. Construction and/or plowing shall not be initiated when the soil moisture content is high. If a sample of soil obtained from approximately nine (9) inches below the surface can be easily rolled into a wire, the soil moisture content is too high for construction purposes.
 - (4) Aboveground vegetation shall be closely cut and removed from the ground surface throughout the area to be used for the placement of the fill material. The area shall then be plowed to a depth of seven (7) to eight (8) inches, parallel to the land contour with the plow throwing the soil upslope to provide a proper interface between the fill and natural soils. Tree stumps shall be cut flush with the surface of the ground and roots shall not be pulled. Once plowing is completed, the area should be fenced to prevent vehicles and equipment from entering the plowed area, unless the fill material is going to be in place within 24 hours of the plowing. If the site cannot be plowed, a backhoe bucket fitted with chisel teeth may be used to "till" the site by creating furrows that are parallel to ground contour.
 - (5) The area surrounding the mound wastewater disposal system shall be graded to provide diversion of surface run off waters.

§1-913(f)(6) Mound Wastewater Disposal Systems

- (6) Construction should be initiated immediately after preparation of the soil interface by placing the sand fill. After construction of the distribution system, but prior to covering the distribution system, a designer shall direct the testing of the distribution system. After successful testing of the distribution system, any necessary additional stone and the filter fabric shall be installed and the system completed. The entire mound wastewater disposal system is to be covered with topsoil native to the site, or of similar characteristics, to support vegetation found in the area. The installer shall crown the entire mound wastewater disposal system with a cover of soil less permeable than the mound fill, covering with 12" on the sides of the mound. Native soil from the site is normally suitable for cover material, though the top 2- 4" of this cover must be topsoil. The entire mound shall be seeded or sodded to assure stability of the installation. This grass cover shall be maintained and should be mowed on at least an annual basis.

§1-914 At-grade Systems

- (a) At-grade systems may be used on some sites that are not suitable for in ground systems because of inadequate depths to seasonal high water table, bedrock or impermeable soil. At-grade systems are constructed by tilling the ground surface and placing the crushed stone directly on the tilled surface. The crushed stone is not placed subsurface as in an in ground system and no sand is placed under the crushed stone as in a mound wastewater disposal system. Figures 9.6 and 9.7 (pages 107-108) show the layouts of typical at-grade systems.
- (b) Site Requirements:
 - (1) Sites with either a high groundwater level or soil strata having a percolation rate slower than 60 minutes per inch (mpi) or faster than 1 mpi within 36 inches of natural grade are not suitable for at-grade systems. Also, soils that have bedrock within 48 inches of natural grade are not suitable. At-grade systems for filtrate disposal shall have at least 24 inches of soil, with a percolation rate between 1 minute per inch and 60 minutes per inch, above the seasonal high water table and bedrock. The site must be free of these limitations beyond the edge of the fill for a distance of 10 feet on all sides. At-grade systems shall not be located in a depression or swale that could act as a natural surface water collection or runoff area.
 - (2) Generally, sites with large trees, numerous small trees or large boulders are unsuitable for at-grade systems because of the difficulty in preparing the ground surface and the reduced infiltration area. If no other site is available, all trees shall be cut flush with the ground, leaving the stumps. Stumps shall not be removed as removal of the stumps creates channels where the roots existed and may allow inadequately treated wastewater to reach groundwater or bedrock. A larger area shall be designed if numerous stumps and/or boulders are involved so that sufficient soil surface is available to accept the wastewater.

§1-914(b)(3)**At-grade Systems**

- (3) The maximum slope allowable for at-grade systems is 20% percent, except as permitted on a site specific basis (see §1-805). The area between the downslope edge of the wastewater system and a point where the ground begins to exceed a slope of 30% may have a slope of up to 30%, even though the slope under the leachfield is restricted to no more than 20%.
 - (4) Cut sites that meet the other site requirements for at-grade systems are acceptable.
 - (5) Filled sites may be approved by the Secretary for at-grade systems on a case by-case basis where the existing original soil under the fill meets the other site requirements for at-grade systems.
 - (6) At-grade systems are not allowed on sites having a percolation rate faster than 1 mpi within the 3 feet of soil below the bottom of the system. Replacing the excessively drained soil with filter sand is not allowed for at-grade systems.
 - (7) At-grade systems shall comply with the isolation distances in §1-807 of these Rules with the leachfield measurements taken from the edge of the crushed stone.
- (c) Site Evaluation:
- The site shall be evaluated in accord with §1-902 of these Rules.
- (d) Design:
- (1) A designer shall prepare a one foot interval contour map having a scale of 20 feet per inch or less. In addition, all of the required application information in §1-305 and Appendix 6-A of these Rules shall be submitted.
 - (2) The loading rate shall be based on the second slowest percolation rate using the following formula: $(3/\sqrt{t})(0.8)$ where t is the second slowest percolation rate in minutes per inch. The maximum loading rate shall be 1.0 gallons per day per square foot. The effective infiltration area is the area upon which at least 6 inches depth of crushed stone is placed. It does not include the downslope area of the crushed stone that is less than 6" thick, the side slope fill areas or the portion of the crushed stone that is upslope of the distribution pipe on sites with slopes of greater than 3%. All at-grade system sizing calculations shall be submitted with the application.
 - (3) At-grade systems shall be laid out parallel to ground contour and should be designed to be long and narrow to minimize the linear loading rate. The maximum width of the effective infiltration area shall be 6 feet and the minimum width of the effective infiltration area shall be 3 feet.

§1-914(d)(4) At-grade Systems

- (4) A minimum length to width ratio of 2:1 shall be provided for at-grade systems. The system length and width shall be determined by measuring from the outer edges from the six-inch depth of the crushed stone. The width dimension includes the separation distance (6 ft. minimum) between individual infiltration areas for at-grade systems having more than one infiltration area. The width does not include the two feet of crushed stone upslope from the distribution pipe for at-grade systems on slopes of greater than 3%. See figure 9.7 (page 108)
- (5) A minimum of 6 inches of crushed stone shall be placed under the distribution pipe and at least 2 inches of crushed stone shall be placed above the crown of the distribution pipe. Filter fabric shall be placed over the top of the crushed stone. The crushed stone shall be covered with a minimum of 12 inches of permeable soil, with a maximum of 18" of soil, the upper 2 to 4 inches of which shall be topsoil and the remainder of a fine sandy loam to medium sand texture. All four sides of the fill area shall be designed to slope away at a pitch that is not steeper than 1:3. The design shall indicate that a vegetated cover is to be maintained over all portions of the system.
- (6) The distribution pipe shall be placed in the center of the effective infiltration area on sites with less than 3% slopes (figure 9.6, page 107) and placed at the upper side of the effective infiltration area on sites with slopes that are greater than 3%. (figure 9.7, page 108).
- (7) On sites with slopes that are greater than 3% , only the area directly under the distribution pipe to the downslope limit of the 6 inch depth of crushed stone shall be used to meet the effective infiltration area square footage requirement (figure 9.7, page 108).
- (8) All at-grade systems shall be pressurized and dosed by pump or siphon as described in §1-906 of these Rules. Pressure distribution hydraulic calculations including, but not limited to, friction loss, elevation head and pump/siphon sizing shall be included with the application.
- (9) Where more than one effective infiltration area is used, there shall be at least 6 feet of separation between the tail edges of the crushed stone in each effective infiltration area (figure 9.7, page 108). Primary and replacement infiltrative areas shall not be interfingered unless the areas are at least 25' apart, as measured from the edge of the crushed stone.
- (10) At-grade systems receiving more than 2,000 gpd of design wastewater flow shall require a hydrogeologic analysis showing that a minimum of 36 inches of unsaturated native soil is maintained between the bottom of the crushed stone and the induced groundwater mounding beneath the system. At-grade systems that are closer than 25 feet to each other as measured from the edge of stone aggregate shall be evaluated as one system for purposes of determining the need to conduct a hydrogeologic analysis.

- (11) For at-grade systems receiving 3,000 gpd or more of design wastewater flow, dual-alternating at-grade systems shall be required. The dual alternating system requirement applies if either the primary or the replacement systems have design flows of 3,000 gpd or more.
 - (12) At-grade systems that are closer than 25 feet to each other as measured from the edge of stone aggregate shall be evaluated as one system for purposes of determining the need to have dual alternating at-grade systems. Exception: A hydrogeologic analysis may be used to demonstrate that systems located less than 25' apart are hydraulically independent.
 - (13) Where primary and replacement at-grade systems are placed next to each other, the systems shall be at least 10 feet apart when placed end to end, as measured from the stone aggregate, and at least 25 feet apart, as measured from the stone aggregate, when placed in the same flow path as determined from the edge of the filled area.
 - (14) A surface water diversion swale shall be constructed upgradient of all at-grade systems on sites with slopes that are greater than 3%.
 - (15) The area 25 feet downgradient of the at-grade system, as measured from the lower edge of the fill, shall not be disturbed by any construction activity including, but not limited to, building construction, roadways and parking areas.
 - (16) Where subsurface drains (including building perimeter drains) are located downslope of an at-grade system, the crushed stone shall be at least 75 feet from the drain.
- (e) Construction Practices:
- (1) The surface water diversion swale (mandatory for sites with slopes of more than 3%) shall be installed prior to constructing the at-grade system to keep surface water runoff away from the system while it is under construction.
 - (2) Construction of the at-grade system and/or tilling shall not take place when the soil moisture is high in the system area. If the soil at 9 inches below grade can be rolled into the shape of a wire, the soil moisture content is too high for construction to begin.
 - (3) To prevent compaction, construction equipment shall not be moved across and downslope of the at-grade system area before or after tilling.

- (4) Vegetation shall be cut close to the ground and removed from the area to be tilled. Tree stumps shall be cut flush with the ground and the roots left in place. On wooded sites, the forest litter shall be raked off if more than an inch thick. The at-grade system area shall be tilled, preferably by mold board or chisel plow to a depth of 6 to 8 inches, parallel to the ground contour. During plowing, the soil should be thrown upslope to provide a proper interface between the soil and stone aggregate. If the site cannot be plowed, a backhoe bucket fitted with chisel teeth may be used to “till” the site by creating furrows that are parallel to ground contour.
- (5) The forcemain may be installed before tilling or after tilling when the forcemain enters the system at the upslope side of the system. When the forcemain enters the system at the downslope side, the forcemain should be installed before tilling. If practical, forcemains should connect to the distribution pipe from the ends of the distribution pipe or from the upslope side of the system. In either situation, the forcemain shall be installed by working from the upslope edge of the system.

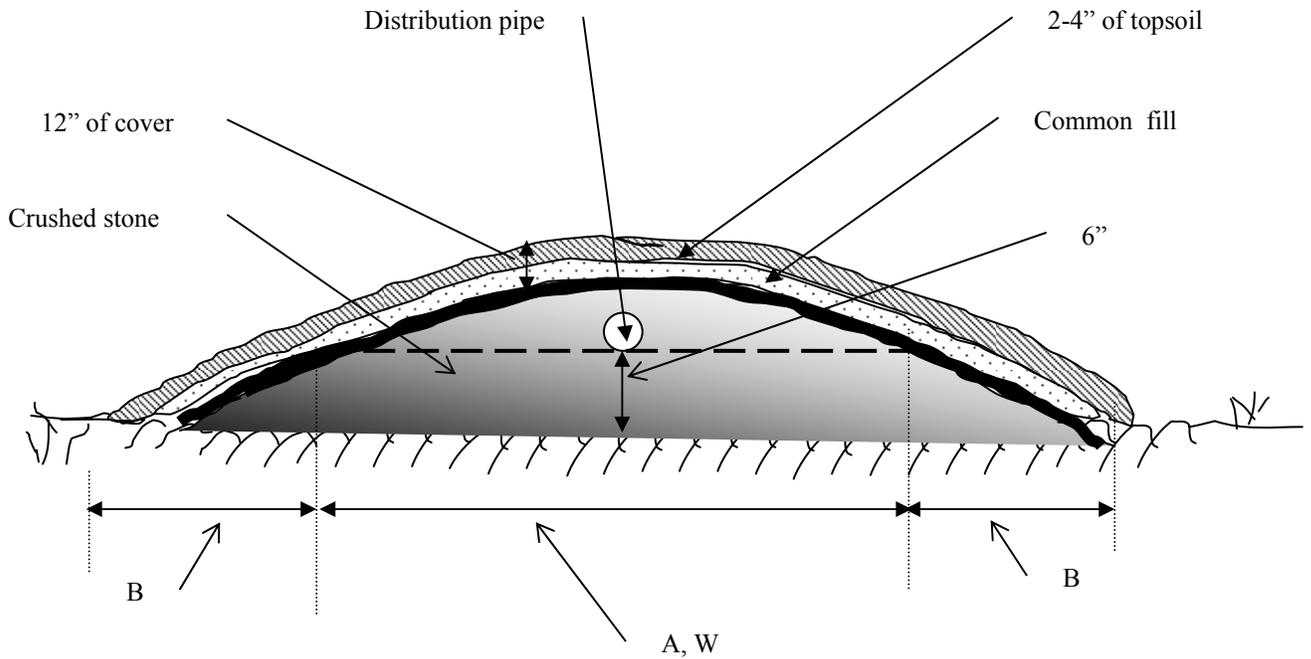
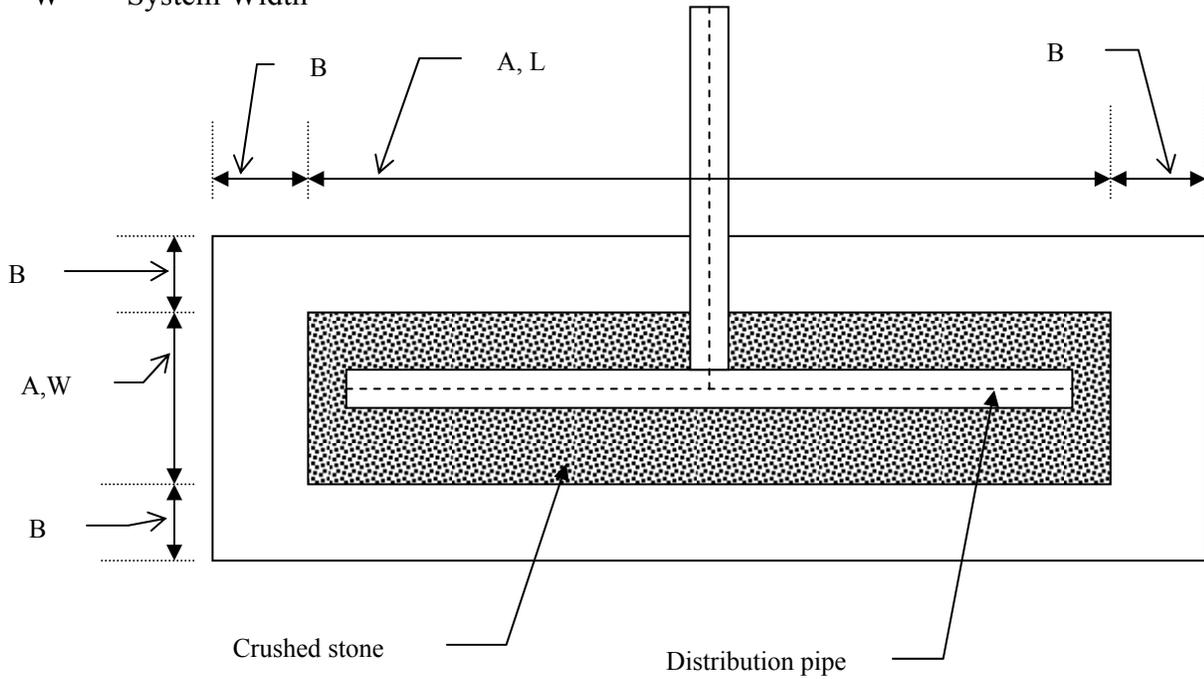
Note: At-grade system diagrams are shown on the next two pages

§1-914 At-grade Systems

Figure 9.6

Plan and Cross Sectional Views of an At-Grade System Having One Infiltration Area on a Level Site (less than 3%).

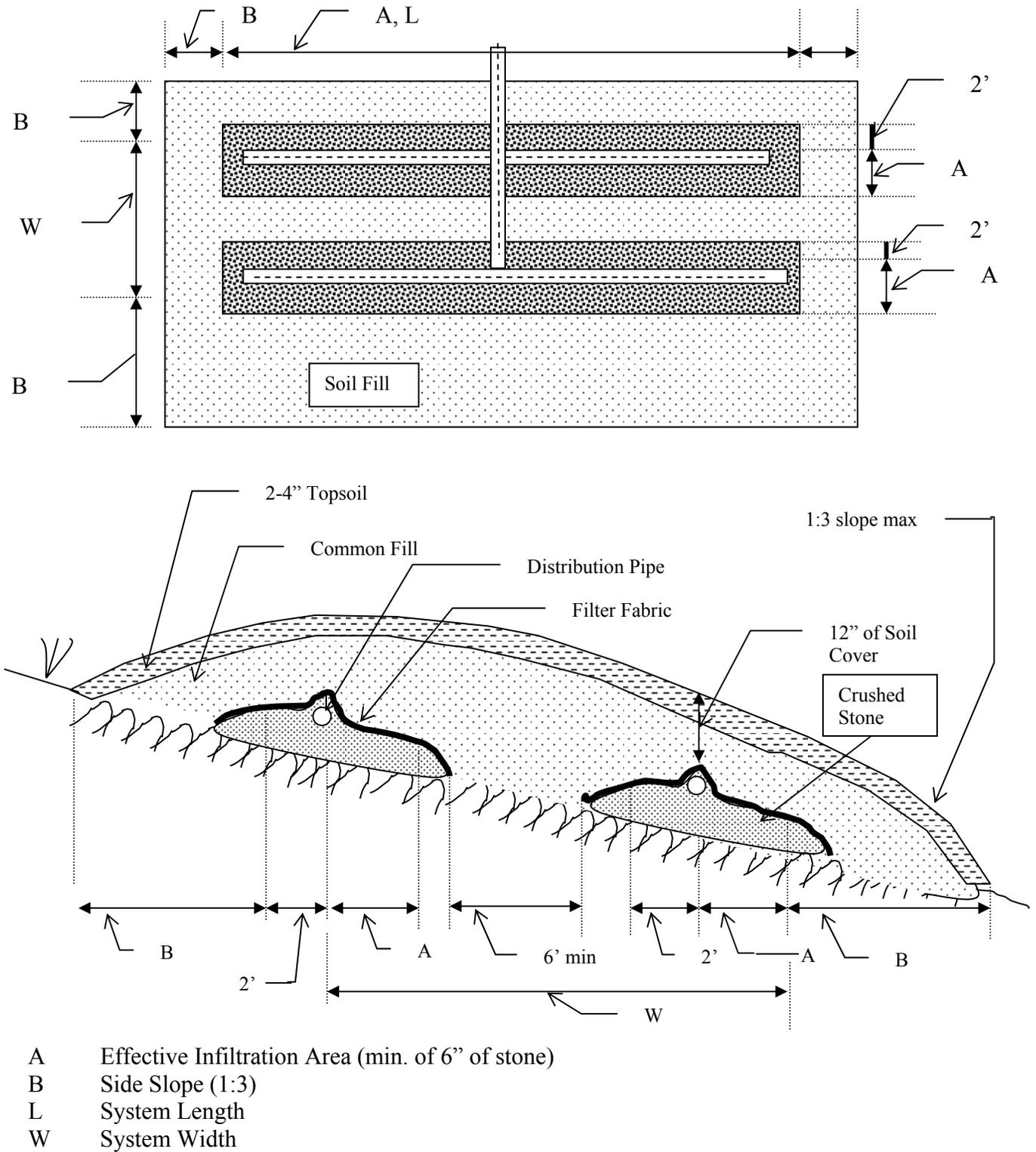
- A Effective Infiltration Area System Length
- B Side Slope (1:3)
- L Length
- W System Width



§1-914 At-grade Systems

Figure 9.7

Plan and Cross Sectional Views of an At-Grade System with Two Infiltrative Areas on a Sloping Site (greater than 3%).



§1-914(e)(6) At-grade Systems

- (6) Upon completion of the tilling and before placing the stone aggregate, a Class 1 or Class B designer shall inspect the site preparations.
- (7) Construction should begin immediately after the tilling by placing the stone aggregate. The pressure distribution pipe shall be laid level on top of the stone and caps installed at the ends of the pipe. Upon completion of the distribution piping, the designer shall test the system with clean water. The test shall show that a minimum pressure of 2.3 feet of head is present at the ends of the pipe and that the distribution requirements in §1-906 of these Rules are met. After connecting the distribution pipe to the forcemain, the distribution pipe shall be covered with at least 2 inches of clean stone aggregate. The stone aggregate shall be covered completely with filter fabric.
- (8) The filter fabric shall be covered with a minimum of 12 inches of soil but not more than 18 inches, with the upper 2 to 4 inches of soil being topsoil and the remainder of the fill being of a fine sandy loam to medium sand texture. The soil cover shall be placed at a maximum slope of 1:3. A vegetated cover free of large brush and trees shall be maintained over the system.
- (9) Prior to use of the at-grade system, a Class 1 or Class B designer shall submit a written report that includes the installation certification required by section §1-308 of these Rules. The report shall specifically address the inspection of the site preparations and include numerical results of the orifice discharge rate comparison and pressure test.

§ 1-915 Sand Filters

Sand filters are intended for use in conjunction with a filtrate disposal system (see §1-916 of these Rules). They allow for a reduction in the final disposal requirements due to the additional treatment of the wastewater. This subsection addresses the use of two different sand filter types: the intermittent sand filter and the recirculating sand (gravel) filter.

(a) General Requirements

- (1) Wastewater Strength
 - (A) Intermittent sand filters may be used for residential and for other low strength domestic wastewater.
 - (B) Recirculating sand filters may be used for low and moderate strength wastewater.

§ 1-915(a)(1)(C) Sand Filters

- (C) Wastewater from a septic tank shall be considered low strength when it meets the following standard:
 - (i) BOD₅<230 mg/l;
 - (ii) TSS < 150 mg/l; and
 - (iii) Oil & Grease <25 mg/l.
 - (D) Wastewater from a septic tank shall be considered moderate strength when it meets the following standard:
 - (i) BOD₅ <400 mg/l;
 - (ii) TSS < 150 mg/l; and
 - (iii) Oil & Grease <25 mg/l
- (2) Container Design & Construction
- (A) The filter container shall be water tight to prevent groundwater from infiltrating into the filter container and to prevent wastewater exfiltration from the filter container.
 - (B) Reinforced concrete shall be used, unless other materials having equivalent function, workmanship, watertightness and at least a twenty (20) year service life are specified.
 - (C) Flexible membrane liner materials may be used, provided they comply with the following requirements:
 - (i) they have properties that are at least equivalent to thirty (30) mil un-reinforced polyvinyl chloride;
 - (ii) they have field repair instructions and extra liner material that are provided to the purchaser with the liner;
 - (iii) they have factory fabricated “boots” suitable for field bonding onto the liner to facilitate the passage of piping through the liner in a waterproof manner; and
 - (iv) they are compatible with the wastewater being treated.
 - (D) All tanks associated with a sand filter, including septic and dosing tanks and any pumping vaults, shall have an at-grade access provided by a watertight manhole or riser not less than eighteen (18) inches in diameter, unless otherwise approved by the Secretary and shall be designed to be resistant to entry by children.

§ 1-915(a)(2)(E) Sand Filters

- (E) After installation all components, including septic tanks, pump chambers, recirculation tanks and filter containers, shall be tested by filling to a point at least two inches, but not more than three inches, above the point of riser connection to the top of the tank, chamber, or container. During the test there shall not be a measurable leakage over a twenty-four (24) hour period.
 - (F) Notwithstanding subdivision (a)(2)(E) above, the Secretary may approve other leakage testing methods.
- (3) Siting Requirements
- (A) Filters must be protected from both groundwater and surface water infiltration.
 - (B) For the purpose of determining the minimum isolation distance to other site features, the filter container shall be comply with the isolation distances set forth in §1-807 of these Rules for septic tanks.
- (4) Monitoring
- (A) Wastewater Quality: The sand filter shall be designed for wastewater sample collection before and after the sand filter.
 - (B) Wastewater Quantity: All sand filters shall have the capability of measuring and recording the wastewater flow and the flow to the filter.
- (5) Annual inspections of each sand filter by a Class 1 or Class B designer are required. A written report shall be submitted to the Secretary within 30 days of the inspection. At a minimum, the following items shall be addressed in the inspection report:
- (A) use and age of system including the average daily flows;
 - (B) the recirculation ratio;
 - (C) mechanical or electrical malfunctions;
 - (D) neglect or improper use; and
 - (E) flushing of the laterals.
- (6) Operation & Maintenance Manuals: A user's manual for the sand filter shall be developed and/or provided along with record drawing(s) at the time that the sand filter installation is completed. These materials, at a minimum, shall contain the following information:
- (A) diagrams of the components and their location;

§ 1-915(a)(6)(B) Sand Filters

- (B) an explanation of how the sand filter functions, operational expectations, and owner responsibility;
 - (C) specifications of the electrical and mechanical components installed (occasionally components other than those specified on the plans are used);
 - (D) names and telephone numbers of the designer, the local health authority, the supplier/installer, and/or the management entity to be contacted in the event of a failure;
 - (E) information on the periodic maintenance requirements of the sand filter, including the septic tank, the dosing and recirculating/mixing tanks, the sand filter unit, the pumps, the switches, the alarms, the filtrate disposal system, and other information as appropriate;
 - (F) information on “trouble shooting” common operational problems that might occur. This information should be detailed and complete as needed to assist the system owner make accurate decisions about when and how to attempt corrections of operational problems and when to call for professional assistance;
 - (G) information on the disposal of discarded filter media in accord with state and local requirements; and
 - (H) for proprietary sand filter units, a complete maintenance and operation document shall be developed and provided by the manufacturer. This document shall include all the appropriate items mentioned above, plus any additional general and site specific information useful to the system owner, and/or the maintenance person.
- (b) Intermittent Sand Filters: In addition to the applicable requirements of subsection (a) of this section, the following system specific criteria shall apply to the design of intermittent sand filters:
- (1) Underdrain system
 - (A) The base of the filter container shall be level or constructed at a grade of one (1) percent or less towards the underdrain piping.
 - (B) The underdrain piping shall be installed in the interior of the filter container at the lowest elevation. The piping shall be on a grade of one (1) percent or less to the point of passage through the filter container.
 - (C) The underdrain piping and filter container bottom shall be covered with a minimum of six (6) inches of clean washed $\frac{3}{4}$ " - $1\frac{1}{2}$ " stone.
 - (D) Other types of underdrain systems may be proposed and approved after review by the Secretary.

§ 1-915(b)(2) Sand Filters

(2) Filter Media

- (A) A minimum of twenty four (24) inches of approved sand filter soil media shall be placed over the underdrain system. The sand filter soil media complying with the specification listed below shall be approvable:

<u>Sieve #</u>	<u>Opening (mm)</u>	<u>Percent Passing Number (by Weight)</u>
3/8	9.500	100
4	4.750	95 - 100
8	2.380	80 - 100
16	1.190	45 - 85
30	0.590	15 - 60
50	0.297	3 - 15
100	0.149	0 - 4

- (B) Other filter media may be proposed, provided a designer submits to the Secretary technical justification for the substitution of materials. The Secretary shall review and may approve the proposed substitution.
- (C) The size of the sand filter shall be based on a maximum loading rate of 1.25 gallons per day per square foot.

(3) Distribution System

A pressurized distribution system shall be constructed in accord with the following requirements:

- (A) above the filter media there shall be a minimum of three (3) inches of washed, clean 3/4" to 1 1/2" stone aggregate below the distribution laterals, and sufficient stone above the laterals equal to or covering the orifice shields to provide a smooth even cover;
- (B) distribution laterals shall be spaced on maximum thirty (30) inch centers. Orifices shall be placed such that there is at least one orifice for each six (6) square feet of sand surface area;
- (C) the ends of the distribution laterals shall be designed and constructed with a means to perform flushing of the piping, collectively or individually, through the operation of a non-corroding and accessible valve. The flushed wastewater must be discharged to the septic tank or into the sand filter;
- (D) the diameters of the distribution manifold and laterals shall not be less than one half (1/2) inch diameter and shall be constructed of schedule 40 or 80 (or equivalent) piping;

§ 1-915(b)(3)(E) Sand Filters

- (E) the orifices shall not be less than 1/8" in diameter. All orifices shall be covered by a removable, protective, durable, non-corroding shield; and
 - (F) other types of distribution systems may be proposed by a designer and used upon approval by the Secretary.
- (4) Filter Dosing
- (A) The dose volume shall not exceed ten (10) percent of the daily design flow.
 - (B) The system shall not dose more than once in a 30-minute period.
 - (C) Head calculation shall include maximum static lift, pipe friction and a residual head of five (5) feet at the furthest orifice.
 - (D) There shall be no more than a ten (10) percent flow variation between any two orifices.
 - (E) The pumping system shall be protected from solids by a filter apparatus that will not allow the passage of solids larger in size than 1/8 inch.
 - (F) The pump station designed to dose the filter shall be designed with storage equal to the one (1) day design flow above the high water alarm.
- (5) Internal Pump Option
- (A) Where the effluent from a sand filter is to be discharged by means of a pump to another treatment unit, a distribution unit, or to an a leachfield, the design and construction of the filter may include provisions for an internal pump station, providing the following conditions are met:
 - (i) the location, design, and construction of the pump station do not conflict with the requirements of these Rules for design, construction and operation of a sand filter system;
 - (ii) the pump and related apparatus shall be housed in a corrosion resistant vault designed to withstand the stresses placed upon it so that it will not allow the migration of drain media, sand, or underdrain media to its interior. The vault shall have a durable, attached floor. The vault shall provide watertight access to finished grade with a diameter large enough to remove, replace, or service any equipment in the vault shall and be designed to receive treated effluent from an elevation equal to that of a gravity discharging sand filter;

§ 1-915(b)(5)(A)(iii) Sand Filters

- (iii) the depth of underdrain media and the operating level of the pump cycle and alarm shall not allow effluent to come within two inches of the bottom of the sand filter media. The pump off level shall not be lower than the invert of the perforations of the underdrain piping; and
- (iv) an internal sand filter pump shall be electronically linked to the sand filter dosing apparatus in such a manner as to prevent wastewater from entering the sand filter in the event the internal sand filter pump fails.

(c) Recirculating Sand (Gravel) Filters

Recirculating Sand Filters are recommended for domestic wastewater of low to moderate strength. They are not recommended for seasonal residences or projects designed for periodic use. Projects that will experience periodic shut downs should take into account the cooling effect on the recirculating effluent and the effect of the filters going anaerobic and becoming odoriferous as a result.

In addition to the applicable requirements of subsection (a) of this section, the following standards apply to recirculating sand filters:

- (1) Underdrain system
 - (A) The base of the filter container shall be level or constructed at a grade of one (1) percent or less towards the underdrain piping.
 - (B) The underdrain piping shall be installed in the interior of the filter container at the lowest elevation. The piping shall be on a grade of one (1) percent or less to the point of passage through the filter container.
 - (C) The underdrain piping and filter container bottom shall be covered with a minimum of six (6) inches of washed clean $\frac{3}{4}$ " - $1\frac{1}{2}$ " stone aggregate.
 - (D) Other types of underdrain systems may be proposed and approved after review by the Secretary.
- (2) Filter Media
 - (A) A minimum of thirty six (36) inches of approved filter media shall be placed above the underdrain system.

§ 1-915(c)(2)(B) Sand Filters

- (B) The filter media shall be a soil material complying with the following sieve analysis:

<u>Sieve</u>	<u>Opening (mm)</u>	<u>Percent Passing Number (by Weight)</u>
3/8	9.500	100
4	4.750	60 - 100
8	2.380	7 - 75
16	1.190	0 - 5
30	0.590	0 - 3
50	0.297	0 - 2

- (C) Other filter media may be proposed provided a designer submits to the Secretary technical justification for the substitution of materials. The Secretary shall review and may approve the proposed substitution.
- (D) The size of the recirculating sand filter shall be based on either a hydraulic loading rate or wastewater strength as described below. The maximum loading rate is the lesser of subdivision (i) or (ii) below.

- (i) The maximum hydraulic loading rate shall be 5 gallons per day per square foot.
- (ii) The maximum loading rate based on waste strength, (expressed as gallons per square foot per day) shall be determined using the formula:

$$\text{Loading Rate (gal/sqft/day)} = \frac{5 \text{ gal/sqft/day} \times 230 \text{ mg/l}}{\text{BOD}_5 \text{ mg/l}}$$

where BOD₅ equals the wastewater strength of the septic tank effluent for the particular project. In particular, non-residential wastewater may exceed 230 mg/l of BOD₅.

(3) Distribution System

A pressurized distribution system shall be constructed in accordance with the following requirements:

- (A) there shall be a minimum of three (3) inches of washed, clean ¾” to 1½” stone aggregate that is below the distribution laterals and above the filter media, and sufficient stone covering the orifice shields to provide a smooth even cover;
- (B) distribution laterals shall be spaced on maximum twenty-four (24) inch centers. Orifices shall be placed such that there is at least one orifice for each four (4) square feet of sand surface area;

§ 1-915(c)(3)(C) Sand Filters

- (C) the ends of the distribution laterals shall be designed and constructed with a means to perform flushing of the piping, collectively or individually, through the operation of a non corroding and accessible valve. The flushed wastewater must be discharged to the septic tank or into the sand filter;
 - (D) the diameters of the distribution manifold and laterals shall not be less than one half (1/2) inch diameter and shall be constructed of schedule 40 or 80 (or equivalent) piping;
 - (E) the orifices shall not be less than 1/8" in diameter. All orifices shall be covered by a removable, protective, durable, non-corroding shield; and
 - (F) other types of distribution systems may be proposed by a designer and used upon approval by the Secretary.
- (4) Recirculation/Dilution Tank and Dosing: The recirculation tank receives septic tank effluent and overflow from the filter. The recirculation tank shall have sufficient capacity to provide one (1) day's emergency storage above a high water alarm level. The recirculation tank and dosing system shall comply with the following requirements:
- (A) the system shall be designed with a minimum recirculation ratio of not less than four (4). The recirculation ratio is the daily volume of recycled effluent divided by the design flow;
 - (B) the filter should be wetted 48 times per day and not more than once in a thirty (30) minute period. The minimum resting period between doses shall be twenty (20) minutes;
 - (C) the minimum wet volume in the recirculation tank should be at least eighty (80) percent of the design flow;
 - (D) the system shall be designed so that one hundred (100) percent of the filter effluent returns to the recirculation tank when the liquid volume of the tank is less than eighty (80) percent of the design flow. In addition to a high water alarm, a low water alarm shall be designed and installed to shut down the pump and notify the owner of the system when the liquid level of the recirculation tank is less than fifty (50) percent of the design flow;
 - (E) head calculations shall include maximum static lift, pipe friction and a residual head of five (5) feet at the furthest orifice;
 - (F) there shall be no more than a ten (10) percent flow variation between any two orifices; and

§ 1-915(c)(4)(G) Sand Filters

- (G) The pumping system shall be protected from solids by a filter apparatus that will not allow the passage of solids larger than 1/8" in diameter.

§1-916 Filtrate Disposal Systems

- (a) Filtrate effluent disposal systems may be used when some form of treatment in addition to that which occurs in the septic tank is used as part of the wastewater system. The loading rates may be increased and the isolation distances required from the bottom of the leachfield to bedrock and the seasonal high water table may be reduced when applying treated effluent with less than 30 mg/l of BOD₅ and less than 30 mg/l of TSS.
 - (1) Filtrate effluent disposal systems shall be designed to hydraulically transmit the filtrate away from the filtrate disposal system. The minimum site conditions for filtrate effluent disposal systems are the same as for wastewater systems using only septic tanks for treatment prior to disposal of the wastewater.
 - (2) All types of soil-based disposal systems permitted by §1-907, §1-908, §1-913, and §1-914 are acceptable as filtrate effluent disposal systems. Design and construction requirements related to methods, materials, and location are unchanged except as specifically noted in this section.
 - (3) The following requirements refer to design variations based on the type of soil-based disposal system:
 - (A) filtrate effluent disposal systems may be constructed in soils having a percolation rate faster than 120 minutes per inch. Section 1-912(e) of these Rules shall be followed for soils with a percolation rate faster than 1 minute per inch;
 - (B) filtrate effluent disposal systems may be designed with a loading rate of up to twice that permitted for the system when septic tank effluent is applied;
 - (C) systems using filtrate effluent may reduce the 48" separation from the bottom of the leachfield to bedrock to a minimum of 24";
 - (D) systems using filtrate effluent may reduce the 36" separation from the bottom of the leachfield to the seasonal high water table to 24". When a hydrogeologic analysis is required, or is performed by choice, there shall also be at least 18" from the bottom of the leachfield to the induced water table; and

§1-916(a)(3)(E) Filtrate Disposal Systems

- (E) the linear loading rate of any filtrate effluent disposal system shall be calculated using a site specific hydrogeologic analysis that demonstrates that the separation from the bottom of the leachfield to the induced groundwater mounding is met, except that systems using the prescriptive approach with a linear loading rate that does not exceed 4.5 gallons per day may be permitted without a hydrogeologic analysis. The analysis may be a desktop hydrogeologic analysis or based on site specific testing. The hydrogeologic analysis shall demonstrate that:
- (i) the distance between the bottom of the leachfield and the seasonal high water table or induced groundwater mounding, as specified in §1-903(d)(1) of these Rules, is maintained. This distance may include both naturally occurring soil and approved fill material; and
 - (ii) the induced groundwater mounding is at least one (1) foot below grade at the downhill toe of the filtrate effluent disposal system, except for systems using a performance based design that must maintain at least 6” from the induced groundwater mounding to the ground surface.

Note: Filtrate effluent disposal systems designed using linear loading rates not exceeding 4.5 gallons per day, on sites with at least 24” of naturally occurring soil above the seasonal high water table, bedrock, and any impermeable soil layer, located more than twenty five (25) feet apart may be considered hydraulically isolated from each other for the purpose of this subsection.

- (4) All filtrate effluent disposal systems shall use pressure distribution.

§1-917 Constructed Wetland Treatment Systems

- (a) A constructed wetland treatment system may be proposed on a case by case basis. Systems determined by the Secretary to be capable of meeting the 30 mg/l BOD₅ and 30 mg/l TSS requirements for filtrate effluent disposal systems will be approved for discharge to a complying filtrate effluent disposal system.
- (b) Each constructed wetland system must be uniquely designed for the site on which it will be located. The design shall be prepared by a Class 1 designer. Prior to beginning such a design, the designer shall contact the Secretary and review the basic principles on which the design will be based. The review will include not only the ability of the system to produce the required level of treatment, but will also include review of the potential impact on its surroundings including issues related to invasive plant species or potential effects on existing wetlands and their buffers.

§1-917(c) Constructed Wetland Treatment Systems

- (c) Any designer proposing a constructed wetland treatment system should consult existing references such as:
 - 1. Reed, S.C.R. Crites, and E.J. Middlebrooks: Natural Systems for Waste Management and Treatment, McGraw-Hill Publishers, 2nd edition, 1995
 - 2. Natural Systems for Wastewater Treatment, Manual of Practice FD-16, Water Pollution Control Federation, 1990(d).
- (d) Any permit issued for use of a constructed wetland treatment system will include conditions related to the operation and maintenance of the system along with reporting conditions needed to ensure compliance with the operational and maintenance requirements.

§1-918 Disposal of Wastes from Pump Out Facilities for Marine Sewage Holding Tanks

- (a) Where direct hookup to a wastewater treatment plant is available or site conditions permit, disposal of wastes from pump-out facilities shall be in conformance with the normal operational requirements of this Subchapter.
- (b) Where it is not feasible to comply with subsection (a) above, a holding tank may be used.
- (c) Holding tank design shall be in accord with §1-919 of these Rules.

§1-919 Holding Tanks

- (a) The Secretary shall approve the use of sewage holding and pumpout tanks when it has been determined that :
 - (1) the existing or proposed building(s) or structure(s) to be served by the sewage holding tank are publicly owned;
 - (2) the plan for construction and operation of the sewage holding tank will not result in a public health hazard or environmental damage;
 - (3) a designer demonstrates that an economically feasible means of meeting current standards is significantly more costly than sewage holding and pumpout tanks, based on a projected twenty (20) year life of the project; and
 - (4) the design flows do not exceed 600 gallons per day.
- (b) A sewage holding tank may also be used for a project that is eligible for a variance under §1-806, whether or not the project is publicly owned, where the existing wastewater system has failed, or is expected to fail, and in either instance, where there is no other cost feasible alternative;

§1-919(c)**Holding Tanks**

- (c) When a sewage holding tank is proposed for use, a designer shall submit all information necessary to demonstrate that the holding tank will comply with the following requirements:
- (1) the holding tank shall be capable of holding at least 14 days of the expected flow from the building or structure or campground;
 - (2) the tank shall be constructed of durable materials that are appropriate for the site conditions and the nature of the sewage to be stored;
 - (3) the tank, any piping connected to the tank, and all access structures connected to the tank shall be watertight. The tank shall be leakage tested prior to being placed in service;
 - (4) the tank shall be designed to protect against floatation when the tank is empty, such as when it is pumped;
 - (5) the tank shall be equipped with audio and visual alarms that are triggered when the tank is filled to 75% of its design capacity;
 - (6) the tank shall be located so that it can be reached by tank pumping vehicles at all times when the building or structure or campground is occupied; and
 - (7) the analysis supports a claim under subdivision (a)(4) of this section.
- (d) The permit application shall specify the method and expected frequency of pumping.
- (e) Any building or structure or campground served by a sewage holding tank shall have a water meter, or meters, installed that measures all water that will be discharged as wastewater from the building or structure or campground.
- (f) Any permit issued for the use of a sewage holding tank will require a designer to periodically inspect the tank, visible piping, and alarms. The designer shall submit a written report to the Secretary detailing the results of the inspection and any repairs or changes in operation that are required. The report shall also detail the pumping history since the previous report, giving the dates of pumping and the volume of wastewater removed. The frequency of inspections and reports shall be stated in the permit issued for the use of the tank, but shall be no less frequent than once per year. The designer shall also inspect the water meter or meters and verify that they are installed, calibrated, and measuring all water that is discharged as wastewater. The designer shall read the meters and compare the metered flow to the pumping records. Any significant deviation shall be noted in the report and explained to the extent possible.
- (g) The owner of a sewage holding tank shall maintain a valid contract with a licensed wastewater hauler at all times. The contract shall require the licensed wastewater hauler to provide written notice of dates of pumping and volume of wastewater pumped. Copies of all such notices shall be submitted with the written inspection reports.

§1-919(h) Holding Tanks

- (h) Wastewater holding tanks used for process wastewater will be reviewed on a case by case basis. The decision will consider the nature of the wastewater, its ultimate point of disposal, and the risks associated with the failure of the system to operate, or to be operated, as permitted. Any permit that is issued will include conditions related to the operation and maintenance of the holding tank system along with reporting requirements needed to ensure compliance with the operational and maintenance requirements.

§1-920 Systems located within a Two-Year Time of Travel Management Zone

- (a) The separation distance normally required between the bottom of a wastewater disposal system and the seasonal high water table may be reduced or eliminated provided:
 - (1) the permittee owns or controls all of the property that is located within the two-year time of travel management zone (management zone);
 - (2) there are no sources of potable water within the management zone;
 - (3) the design flow for the wastewater system is 700 GPD or less; and
 - (4) a qualified hydrogeologist has delineated the management zone.
- (b) The management zone shall meet the following requirements:
 - (1) the soils throughout the management zone must be consistent and horizontally extensive, must be of silt or clay texture, and shall not be tills;
 - (2) site specific testing shall be done that demonstrates there will be at least a two-year time of travel from the bottom of the leachfield to the bedrock. The analysis must include any seasonal pathways such as drying cracks;
 - (3) the management zone must extend at least 50 feet uphill of the wastewater disposal system and at least 50 feet to the sides of the system with the downslope distance based on the two-year time of travel;
 - (4) the time of travel calculation must account for effluent movement in both shallow and more permeable layers and the deeper less permeable layers. The assumptions must include movement through the shallow layers when the mounded water table formed by the combination of the effluent and the seasonal high water table is present within the shallow layers; and
 - (5) the wastewater system must be designed to meet the performance based approach requirement that the mounded water table remain at least 6 inches below the surface of the naturally occurring soil throughout the management zone.

§1-920(c) Systems located within a Two-Year Time of Travel Management Zone

- (c) Conditions may be included in any permit to ensure that the management zone is not altered or used in a way that would result in non-compliance with the two-year time of travel concept.

§1-921 Storage and Dose Concept

- (a) Systems that store the effluent during periods when the groundwater level is near the surface and then dose the wastewater into a leachfield when the groundwater is low may be approved provided:
 - (1) the system shall be designed so that the effluent will, at all times, remain at least 6 inches below the surface of the ground;
 - (2) the design incorporates the two-year time of travel management zone; and
 - (3) the design flow for the wastewater system is 700 gallons per day or less.
- (b) The design must demonstrate that, on a yearly basis, the system can function in compliance with subsection (a) above while discharging the wastewater design flow in no more than 9 months per year.
- (c) The design may propose an initial storage tank capacity that reflects an average water usage, the expected occupancy of the building, and the expected duration of the storage period. For residential use, a minimum of 50 gallons per day per person, 3 person occupancy, and 30 day storage period shall be used. The design shall indicate how additional tankage can be added to accommodate the full design flow. The design shall incorporate a high water alarm system that provides 5 days of storage above the alarm level.
- (d) The system shall incorporate a control system that allows discharge of wastewater to the leachfield only when the effluent level is calculated to remain at least 6 inches below the surface of the naturally occurring ground.
- (e) Conditions may be included in the permit to ensure that the system is operated in accordance with the Rules and that additional storage tankage is added if the site conditions or use exceed the initial capacity.

§1-922 Composting or Incinerating Toilets and Greywater Disposal Systems

- (a) Composting or incinerating toilets may be approved in place of conventional water carried toilets. Use of these toilets in buildings other than single family residences on their own individual lots, is subject to review related to the adequacy of the particular unit for the proposed use.
- (b) All waste removed from a composting toilet shall be considered to be pathogenic. The waste material shall be disposed of at a certified landfill, or by shallow burial in a location approved by the Agency that meets the minimum site conditions given in section 1-805 of these Rules.

§1-922(c) Composting or Incinerating Toilets and Greywater Disposal Systems

- (c) Use of a composting or incinerating toilet does not change the requirements for a potable water supply and interior plumbing. If there will be any interior plumbing, a greywater disposal system must be installed.
- (d) A greywater disposal system shall comply with all of the design factors for wastewater disposal systems in these rules, except that a reduction in size of the system constructed may be approved. A 25% reduction in size will be approved for residential use. Reductions for use in non-residential situations will be determined on a case by case basis.

§1-923 Subsurface Drip Distribution

- (a) Subsurface Drip Distribution (SDD) means a pressurized wastewater distribution system that delivers small, precise doses of effluent to shallow subsurface disposal fields. SDD distribution piping is small diameter, flexible polyethylene tubing (dripline) with small in-line emitters (orifices that can discharge effluent at slow, controlled rates, usually specified in gallons per hour). Dripline can be trenched (by hand or with a trenching machine) into narrow, shallow trenches or plowed (with a vibratory plow or other insertion tool) directly into the soil and backfilled without gravel. Typical installation depth is between 6 and 18 inches.
- (b) Soil absorption systems using subsurface drip distribution may be permitted on any site meeting the requirements of §1-805 of these Rules. Subsurface drip distribution systems require highly treated effluent and are used with aerobic treatment units or packed media filters. The isolation distances required from the bottom of the subsurface drip distribution system to bedrock and the seasonal high water table may be reduced in accordance with §1-916 of these Rules, when effluent quality is equal to or better than filtrate effluent.
- (c) Subsurface drip distribution systems shall be designed, installed, operated and maintained in accordance with current design, installation and maintenance instruction of the manufacturer. All designs for subsurface drip distribution systems shall be completed and submitted by a Class 1 Designer, as described in §1-701(b) of these Rules.
- (d) All subsurface drip distribution systems shall be designed to ensure that the system will function in all weather conditions. This would include, at a minimum, that the system (transport and distribution piping) be designed to “drainback” between dosing events.
- (e) The linear loading rate for subsurface drip distribution systems shall be calculated using a site specific hydrogeologic analysis in accordance with §1-916(a)(3)(E) of these Rules. The loading rate for subsurface drip distribution systems shall be calculated based on the percolation rate of the receiving soil and the actual wetted area around the drip emitters.

§1-924 Disposal of Used Stone, Mound Sand and Soil from a Soil-based Disposal System

- (a) When reconstructing, repairing or replacing a soil-based disposal system, the stone, mound sand, and soil removed from the system shall be disposed of in the following manner:
 - (1) If the material is disposed on the same lot on which the soil-based disposal system is located, it shall be disposed in a location that meets the minimum site conditions set forth in §1-805 of these Rules and in accordance with any applicable procedure under the Vermont Solid Waste Management Rules; or
 - (2) If the material is not disposed of on the same lot on which the soil-based disposal system is located, it shall be disposed of in accordance with the Vermont Solid Waste Management Rules.

Subchapter 10 - Approval of Innovative/Alternative Systems and Products

§ 1-1001 Innovative/Alternative Systems and Products: General Use

- (a) The Secretary shall authorize an innovative/alternative system or product for general use when the Secretary determines that:
 - (1) the innovative/alternative system or product is designed to achieve the purposes and to satisfy the performance criteria of these Rules;
 - (2) the innovative/alternative system or product is of demonstrated reliability and performance based on its use elsewhere in sufficient numbers and ranges of applications to support its use in the manner proposed;
 - (3) all persons using or affected by the alternative system or product will be protected from health hazards and pollution associated with the use of the innovative/alternative system or product; and
 - (4) the innovative/alternative system or product will not place an unreasonable burden on persons using or affected by the innovative/alternative system or product through unreasonable increased costs or unreasonable long-term operation and maintenance obligations.
- (b) In authorizing the general use of an innovative/alternative system or product, the Secretary shall specify the conditions under which such a system or product may be used.

§ 1-1002 Innovative/Alternative Systems and Products: Pilot Projects

- (a) The Secretary shall authorize an innovative/alternative system or product for a limited number of specific applications, either individually or as part of a pilot project, when the Secretary determines that:
 - (1) the innovative/alternative system or product as designed is likely to achieve the purposes and to satisfy the performance criteria of these Rules;
 - (2) all persons using or affected by the innovative system or product are protected from health hazards and pollution in the event the innovative/alternative system or product does not meet the purposes or the performance criteria of these Rules;
 - (3) the innovative/alternative system or product is not likely to place an unreasonable burden on persons using or affected by the innovative/alternative system or product through unreasonable increased costs or unreasonable long-term operation and maintenance obligations; and
 - (4) the proposal is designed to measure and report on criteria related to reliability, performance and cost necessary to determine its suitability for general use under section 1-1001.

§ 1-1002(a)(5) Innovative/Alternative Systems and Products: Pilot Projects

- (5) Up to twenty-five (25) installations or uses of each specific innovative/alternative system or product may be authorized under this subsection.

- (c) The Secretary may require demonstration of any innovative/alternative system or product under this subsection before considering an application for general use under § 1-1001. Once the Secretary determines through individual project applications or through a pilot project that the innovative system or product performs as intended under this section, the Secretary may, on his or her own motion or upon application, consider the innovative/alternative system or product for general use in accordance with § 1-1001 of these Rules.

§ 1-1003 Innovative/Alternative Systems and Products: Experimental Designs

- (a) The Secretary may authorize an experimental system or product intended to try a new technology or application, provided such experimental system or product meets the following criteria:
 - (1) the proposal as designed has the potential to achieve the purposes of these Rules and to satisfy all applicable performance criteria;
 - (2) the proposal is based on scientific and engineering principles;
 - (3) all persons using or affected by the proposal are protected from health hazards, pollution and increased costs in the event the experimental system or product does not meet the purposes or the performance criteria of these Rules;
 - (4) in the case of an experimental system, the site(s) at which the experimental system is to be located is capable of accommodating a fully complying system under these Rules, or the Secretary has determined that, as a replacement system, the experimental system is equal to or better than any other option available, considering the cost of the incremental increase in environmental and human health protection;
 - (5) in the case of an experimental product, the criteria in (a)(4) above are met, or the Secretary determines that sufficient safeguards exist in the rest of the system design to satisfy (a)(3) above; and
 - (6) adequate monitoring of the experimental system or product is provided to ensure protection of public health and the environment as well as to assess the performance of the experimental system or product.

- (b) Up to five (5) installations or uses of each specific experimental system or product may be authorized under this subsection.

- (c) The Secretary may require bonding or other surety of an appropriate amount to ensure performance or replacement of an experimental system or product in the event that it fails to meet the purposes of these Rules. Surety or bonding shall be established for a specified time period in each case.

§ 1-1004 Application Process for Innovative/Alternative Systems and Products

An application for use of an innovative/alternative technology shall be submitted on a form prepared by the Secretary. The application form shall require the following information:

(a) General Information

- (1) Company or vendor name.
- (2) Address.
- (3) Specific contact name, address, phone number, fax number, and E-mail address.

(b) System or Product Information

- (1) System trade name and model/s number(s), if any.
- (2) Description of theory of operation.

(c) Statement of Claim

- (1) Advantages related to prevention of health hazards, surface and ground water pollution, environmental protection or other advantages.
- (2) Treatment performance claims, if any, expressed in mg/l or in appropriate units for biologic constituents.
- (3) Type of authorization (general, pilot, or experimental) requested and justification why the system or product belongs in the requested class.
- (4) Possible modes of failure and an assessment of the risks to public health, owners/operators of the system or product, and the environment.

(d) Authorization/Denial History

- (1) Authorizations from (include copies of all authorizations and the contact person):
 - (A) Other states.
 - (B) Other jurisdictions.
- (2) Denials from (include copies of all denials and the contact person):
 - (A) Other states.
 - (B) Other jurisdictions.

§ 1-1004(e) Application Process for Innovative/Alternative Systems and Products

(e) Information Related to the System or Product

- (1) Copies of all operational reports, patent information, technical reports, and laboratory reports published on the proposed system or product even if the information might in whole or part reflect negatively on the system or product.
- (2) The number of systems or products installed and their jurisdictional location
- (3) Reports of any failures, with the cause if determined, and any corrections or modifications to the system or product that have been made to correct and/or prevent failures.

(f) Design Criteria

- (1) Design and material requirements.
- (2) Plans and cross sections.
- (3) Design limitations or restriction.
- (4) Leachfield sizing and justification.
- (5) Construction requirements and limitations.
- (6) Aesthetic (noise, odor, and appearance) issues.

(g) Operation Requirements

- (1) Technical qualifications for operators.
- (2) Specific actions required to operate the system or product.

(h) Maintenance Requirements

- (1) Technical qualifications for maintenance personnel.
- (2) Specific actions required to maintain the system or product.

(i) Monitoring Requirements

- (1) Proposed schedule for monitoring, including frequency and constituents, if any is proposed.
- (2) All treatment systems or products shall include suitable sample collection locations for routine or verification monitoring.

§ 1-1004(j) Application Process for Innovative/Alternative Systems and Products

(j) Cost

- (1) Design cost estimates.
- (2) Construction or installation costs.
- (3) Operation and maintenance costs.
- (4) Energy costs.

(k) Approval or Denial of Applications

- (1) The Secretary shall make a determination for each of the factors related to the specific class (general, pilot, or experimental) for which authorization is requested.
- (2) The Secretary shall consider all of the information available and its reliability as follows:
 - (A) an advisory opinion of the Technical Review Committee for the New England Interstate Regulatory Cooperation Project that verifies one or more performance claims shall satisfy the requirements related to that performance claim.
 - (B) information from third party testing at certified laboratories and test facilities that represent a significant number of systems or products that have been installed in a variety of situations representative of Vermont's soils and climate shall be given great weight in determining whether performance claims are met. Such testing will normally be required for any treatment system or product seeking general use authorization.
 - (C) recommendations from other states based on use of a particular system or product that has been installed in a variety of situations representative of Vermont's soils and climate will be important. Reports related to systems or products that have been installed in large numbers for more than 5 years and that the state has monitored to determine successful operation will be given significant weight.
 - (D) limited third party testing at certified laboratories.
 - (E) extensive testing by the company or vendor based on accepted testing protocols.
 - (F) a combination of favorable results from (C), and (D) or (E), will normally be sufficient for pilot approval.
 - (G) bench testing and other information collected by the company or vendor. Limited information and a proposed process based on

§ 1-1004(k)(2)G Application Process for Innovative/Alternative Systems and Products

established scientific principles, when coupled with appropriate site limitations will normally be sufficient for experimental authorization.

- (3) Decisions
 - (A) All decisions shall be in writing and shall be made available for public review.
 - (B) Authorizations shall include conditions related to the conditions under which the wastewater system or product may be used, the obligations of the system or product owner to operate and maintain the system or product, and any requirements to submit records.
 - (C) Any denial shall state the basis of the denial. Denials may be issued when it has been determined that the wastewater system or product does not meet the performance requirements of the Rules or when the company or vendor has failed to provide information that demonstrates compliance with the Rules.
- (4) Revocation of authorization: A system or product authorization may be revoked if the Secretary determines:
 - (A) the authorization was granted on the basis of incorrect, false, or misleading information; or
 - (B) the system or product fails to perform in compliance with any performance standard established for the system; or
 - (C) the system or product does not function with the expectations for reliability and protection of health and the environment upon which the authorization was based on; or
 - (D) the company or vendor fails to comply with conditions in the authorization, including but not limited to:
 - (i) filing required reports;
 - (ii) maintaining a required supply of repair or replacement parts; or
 - (iii) ensuring an adequate supply of trained individuals to operate and maintain the system or product, if required.
 - (E) Any revocation proceeding under this subdivision shall be done in accordance with the process, as applicable, in section 1-404 of these Rules.

APPENDIX 1-A DESIGN GUIDELINES

1-A-01 Introduction

Following are guidelines for use in the design of systems subject to the Environmental Protection Rules, Chapter 1. Designers are encouraged to use equally or more effective technologies or practices in the design of systems under these guidelines. The Agency may approve different designs that are based on current technology and that have been demonstrated as effective. The Agency may approve a demonstration project designed to test a different design. The designer must support any request for a different approach. Depending on the degree of difference from the guidelines, approval may be conditioned upon periodic inspections to determine that the project is functioning as designed. Any design for a project where a municipality will ultimately be responsible for the operation and maintenance of the project shall include municipal acceptance of the system. While there are no specific technical requirements for any particular design detail, the Secretary will not approve any design that is not based on accepted scientific and engineering principles, except for a demonstration project.

Note: Although these guidelines have been subject to review and comment in a rulemaking process, they remain merely guidelines, not binding rules, in order to allow for flexibility in the design of those aspects of sewers, sewage collection systems and lift stations that are addressed in this appendix.

1-A-02 Building Sewers

The building sewer is that part of the drainage system extending from a building drain to a public sewer, private sewer, septic tank system, or other treatment system. A sewer serving one building will be considered a building sewer. All other sewers will be considered a collection sewer.

- (a) **Materials:** The building sewer shall be constructed in a manner that will prevent leaking, breaking or clogging. Acceptable materials for the sewer are rubber ring jointed, PVC, or cast iron (CI) sewer service pipe. Other materials may be proposed for acceptance by the Secretary.
- (b) **Sizing & Slope:** Building sewers shall be sized based on procedures outlined under 1-A-02. Minimum building sewer size is 4 inches and minimum slope is 1/4 inch per foot.
- (c) **Connection to a collection sewer:** Building sewers discharging to a collection sewer shall be connected through a manhole constructed in accordance with 1-A-03(1) or with a wye fitting so as to direct flow and minimize in line turbulence.
- (d) **Cleanouts:** Cleanouts shall be provided at each horizontal change in direction of the building sewer greater than 45 degrees and at intervals of not more than 100 feet. Building sewer changes in direction that exceed 45 degrees should be made with two 45 degree ells or long sweep fittings. Manholes are acceptable in lieu of cleanouts. Where building sewers to be installed at a depth of less than 3 feet under driveways are anticipated, extra heavy cast iron or other high strength pipe acceptable to the Secretary shall be required.

1-A-02(e) Building Sewers

- (e) Leakage: Building sewers shall meet the leakage standards prescribed in Section 1-A-03(k).

1-A-03 Sewer Collection Systems

- (a) A sewer collection system is that system of sewers that transport wastewater from building sewers to the wastewater treatment/disposal system.
- (b) No connections of roof drains, area drains, foundation drains, cellar drains or other clean water sources or any storm drains will be allowed to building or collection sewers.
- (c) Building and collection sewers carrying raw or untreated wastewater shall be sized as follows:
 - (1) Collection sewers shall be a minimum of 6" diameter.
 - (2) The flow rate to be used in sizing the sewer shall be based on the full occupancy design flows for the facilities connected as derived from §1-808
 - (3) times the following factors.
 - (A) For design flows less than 10,000 gpd, a factor of 5.
 - (B) For design flows over 10,000 gpd, a factor derived from Table 1-A-1

TABLE 1-A-1
Peaking Factors

Design Flow	Peaking Factor
10,000 gpd	4.2
100,000 gpd	3.8
500,000 gpd	3.2
1, 000, 000 gpd	3.0

- (4) Sewers shall be sized for the above derived flow rate to provide a minimum velocity of 2 feet per second when flowing full using the Kutter formula or other acceptable formulae and friction coefficients appropriate for the pipe materials proposed, considering surface deterioration over the expected useful life of the pipe.
- (d) Depth: In general, sewers should be sufficiently deep to receive sewage from basements and to prevent freezing. A bury depth of at least four feet should be maintained. This depth should be increased to at least five feet in areas to be plowed during winter months. When these depths cannot be maintained without significant expense, the designer may propose less depths with mitigating measures to protect the sewer.

1-A-03(e) Sewer Collection Systems

- (e) Slope, Velocity: All sewers shall be designed and constructed to provide mean velocities, when flowing full, of not less than 2.0 feet per second. Regardless of the formula used or friction factors used in the design of the sewers, all sewers shall be installed with at least the slopes shown in Table 1-A-2

TABLE 1-A-2
Minimum Slopes

<u>Pipe Size (inches)</u>	<u>Slope (feet/100 feet)</u>
6"	0.60
8"	0.40
10"	0.28
12"	0.22
15"	0.15

Sewers shall be laid with uniform slope and straight alignment between manholes. Where velocities greater than 15 feet per second are attained, special provisions shall be made to protect against displacement by erosion and shock.

Sewers on 20 percent slopes or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

- (1) not over 36 feet center to center on grades 20 percent and up to 35 percent;
 - (2) not over 24 feet center to center on grades 35 percent and up to 50 percent; and
 - (3) not over 16 feet center to center on grades 50 percent and over.
- (f) When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.
 - (g) Sewer extensions should be designed for projected design flows even when the diameter of the receiving sewer is less than the diameter of the proposed extension. The Agency may require a schedule for future downstream sewer relief.
 - (h) Materials: Generally, rubber ring jointed PVC, AC or ductile iron (DI) gravity sewer pipe of the proper class is acceptable. Other materials may be approved by the Secretary .
 - (1) Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots throughout the life of the system.
 - (2) All sewers shall be designed to prevent damage from superimposed loads. Proper allowance loads on the sewer shall be made because of the width and depth of trench. Where necessary to withstand extraordinary superimposed loading, special bedding, concrete cradle or special construction may be used.

1-A-03(i) Sewer Collection Systems

- (i) Trenching: Ledge, rock, boulders, and large stones shall be removed to provide a minimum clearance of four inches below and on each side of all pipe(s).
- (j) Bedding:
 - (1) Bedding classes A, B, or C, as described in American Society for Testing and Materials (ASTM) C12 77 or Water Pollution Control Federation Manual of Practice (WPCF MOP) No. 9* shall be used for all rigid pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load.

*Note: WPCF MOP No. 9 is a joint publication with the American Society of Civil Engineers (ASCE) which lists it as "Manuals and Reports on ENGINEERING PRACTICE No. 39. " See Appendix 5-A for the address of the ASCE.
 - (2) Bedding classes I, II, or III, as described in ASTM 0232174(80) shall be used for all flexible pipe provided the proper strength is used with the specified bedding to support the anticipated load.
 - (3) Backfill shall be of a suitable material removed from excavation except where other material is specified. Debris, frozen material, large clods or stones, organic matter, or other unstable materials shall not be used for backfill within two feet of the top of the pipe.
- (k) Leakage Tests: When tested, the leakage inward and outward of a gravity sewer including manholes shall not exceed 200 gallons per inch of pipe diameter per mile per day. Upon completion of construction, a sewer line shall be tested in accordance with one of the following procedures:
 - (1) Water testing
 - (A) Plug or cap all service laterals, stubs, and fittings. Place adequate bracing to withstand thrust forces.
 - (B) A tapped plumber's plug should be inserted in the downstream manhole inlet sewer. The water supply connection is made at this point, but never directly from a public water supply system or hydrant unless a backflow preventer is used.
 - (C) A stand pipe is tightly connected at the upstream end of the sewer. The height of the stand pipe shall be at least two feet higher than any point in the sewer or two feet higher than the highest known ground water table, whichever is higher. A manhole may be used as a stand pipe .
 - (D) Water is added at the downstream connection in order to avoid trapping air bubbles or pockets. The line shall be filled to the elevation designated in the stand pipe.

1-A-03(k)(1)(E) Sewer Collection Systems

- (E) Allow the line to stand with water for at least a two hour stabilization period or such shorter period as may be required to achieve stabilized readings of water loss over three consecutive 15 minute periods. This allows air to escape and absorption to take place.
 - (F) Fill the sewer line to the reference mark and continue the test for at least one hour. Maintain the minimum head throughout the test, adding any volume of water required and including that volume in the leakage.
 - (G) Convert the leakage to the units specified.
- (2) Air testing
- (A) Procedures
 - (i) Determine the test time for the section of line to be tested using Table 1-A-3 or 1-A-4 or the formulas in Chart 1-A-1.
 - (ii) Plug all openings in the test section.
 - (iii) Add air until the internal pressure of the line is raised to approximately 4.0 pounds/square inch (psi) greater than the average pressure of any ground water. After this pressure is reached, allow the pressure to stabilize. The pressure will normally drop as the air temperature stabilizes. This usually takes 2 to 5 minutes depending on the pipe size. The pressure may be reduced to 3.5 psi before starting the test.
 - (iv) When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi above the pipe, start the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test. If a 1.0 psi drop does not occur within the test time, the line has passed the test.
 - (B) Test time
 - (i) Table 1-A-3 shows the required test time, T, in minutes/100 feet of pipe for each nominal pipe size. Test times are for a 1.0 psi pressure drop from 3.5 to 2.5 psi. Table 1-A-3 has been established using the formulas contained in Chart 1-A-1.
 - (ii) If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.
 - (iii) It is not necessary to hold the test for the whole period when it is clearly evident that the rate of air loss is less than the allowable.

1-A-03 Sewer Collection Systems

TABLE 1-A-3 MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size in inches	T (time) min/100 ft.	Nominal Pipe Size in inches	T (time) min/100 ft.
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

1-A-03 Sewer Collection Systems

CHART 1-A-1

FORMULAS AND ALLOWABLE AIR LOSS STANDARDS

Calculate the required test time at a given allowable air loss as follows:

$$T = (K) \times \frac{(D)^2(L)}{(Q)}$$

Calculate air loss with a timed pressure drop as follows:

$$Q = (K) \times \frac{(D)^2(L)}{(T)}$$

Symbols:

D = nominal size, in.

L = length of line of one pipe size, ft.

K = 0.534 x 10⁻⁶ for S.I. units

Q = air loss, ft³/min.

K = 0.371 x 10⁻³ for inch pound units

T = time for pressure to drop 1.0 psi, min

- (C) An appropriate allowable air loss, Q, in cubic feet per minute, has been established for each nominal pipe size. Based on field experience, the Q value that has been selected will enable detection of any significant leak. Table 1-A-4 lists the Q established for each pipe size.

TABLE 1-A-4 ALLOWABLE AIR LOSS FOR VARIOUS PIPE SIZES

Nominal Pipe Size in Inches	Q, ft ³ /min	Nominal Pipe Size in Inches	Q, ft ³ /min
3	2	21	5.5
4	2	24	6
6	2	27	6.5
8	2	30	7
10	2.5	33	7.5
12	3	36	8
15	4	39	8.5
18	5	42	9

For further information regarding the Air Testing procedures, refer to ASTM F1417-92 (2005) "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air", ASTM International. For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary Page on the ASTM website.

1-A-03(I) Sewer Collection Systems

(I) Manholes

- (1) Location: Manholes shall be installed at the end of each line, at all changes in grade, size or alignment, at all intersections, and at distances not greater than 300 feet unless the designer justifies a greater spacing.
- (2) Drop Type: A drop pipe should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted to prevent deposition of solids.

Drop manholes should be constructed with an outside drop connection. Inside drop connections (when necessary) shall be secured to the interior wall of the manhole and provide access for cleaning. Where inside drops are used, the manhole diameter shall be increased to allow adequate access.

Due to the unequal earth pressures that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete and supported by the manhole base.

- (3) Diameter: The minimum diameter of manholes shall be 48 inches; large diameters are preferred for connection to large diameter sewers. A minimum access diameter of 22 inches shall be provided.
- (4) Flow Channel: Flow channels shall be provided in the base of all manholes and the flow channel through manholes should be made to conform in shape and slope to that of the sewers.
- (5) Manholes shall be of the precast concrete or poured in place concrete type. Manholes shall be waterproofed on the exterior.
- (6) Inlet and outlet pipes shall be joined to the manhole with a rubber gasketed flexible watertight connection that allows differential settlement of the pipe and manhole wall to take place.

Grouting is not an acceptable connection. All manhole connections, including building sewers, shall be constructed to this standard.

- (7) Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. Locked manhole covers may be desirable in isolated easement locations where vandalism may be a problem.

1-A-03(1)(8) Sewer Collection Systems

- (8) All manholes shall be tested for leakage. Leakage testing of gravity sewers utilizing the water testing procedures takes into account the leakage from one manhole in the test section. Otherwise, manholes shall be tested for leakage in accordance with the following procedure:

After the manhole has been assembled in place, all lifting holes and exterior joints shall be filled and pointed with non shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs placed to prevent blowout.

Each manhole shall be checked for exfiltration by filling with water to the top of the cone section. A stabilization period of one hour shall be provided to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least six hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone measuring the volume of water added.

This amount shall be converted to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24 hour period for exfiltration and there shall be no visible infiltration.

Alternatively, the manhole may be tested for leakage using the following procedure:

All lifting hole and exterior joints shall be filled and pointed with an approved non-shrinking mortar. The completed manhole shall not be backfilled prior to testing. Manholes that have been backfilled shall be excavated to expose the entire exterior prior to vacuum testing or the manhole shall be tested for leakage by means of a hydrostatic test.

All pipes and other openings in the manhole shall be suitably plugged in a manner to prevent displacement.

A plate with an inflatable rubber ring the size of the top of the manhole shall be installed by inflating the ring with air to a pressure adequate to prevent leakage of air between the rubber ring and the manhole wall.

Air shall then be pumped out of the manhole through an opening in the plate until a vacuum is created inside of the manhole equal to 10 inches of mercury on an approved vacuum gauge. The removal of the air shall then be stopped and the test time begun.

The vacuum must not drop below 9 inches of mercury within a 2 minute test period. If more than 1 inch of drop in vacuum occurs within the 2 minute test period the manhole has failed the test and shall be repaired or reconstructed and retested.

Following satisfactory test results, the manhole may be backfilled.

1-A-03(I)(9) Sewer Collection Systems

- (9) Location of Sewers on Streams
- (A) Cover Depth: The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, the following cover requirements must be met:
- (i) One foot of cover is required where the sewer is located in rock;
 - (ii) Three feet of cover is required in other material. In major streams, more than three feet of cover may be required; and
 - (iii) In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.
- (B) Horizontal Location: Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to provide for future possible stream widening, minimize pollution by siltation during construction, and allow future access for repair and maintenance of sewers.
- (C) Structures: The sewer, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flood flows of the stream. No manholes or other access structures shall be located within the normal flow channel of the stream.
- (D) Alignment: Sewer crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.
- (E) Construction Materials: Sewers entering or crossing streams shall be constructed of cast or ductile iron pipe with mechanical joints and they shall be constructed so they will remain watertight and free from changes in alignment or grade. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials that will not cause siltation.

1-A-03(I)(10) Sewer Collection Systems

- (10) Aerial Crossings: Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent frost heave, overturning and settlement.

Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above ground and below ground sewers.

For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of pipe should be placed no lower than the elevation of the fifty (50) year flood.

- (11) Water Line Separation

- (A) Horizontal Separation: Sewers shall be laid at least ten feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge.

Where impossible or impracticable, due to ledge, boulders or other unusual conditions, to maintain the ten foot sewer--water pipe horizontal separation between sewer and water lines, the water line may be in a separate trench or on an undisturbed earth shelf in the sewer trench provided that the bottom of the water line is at least 18 inches above the top of the sewer. Wherever impossible or impractical to maintain the 18 inch vertical separation, the sewer line shall be constructed to normal water line standards and pressure tested to 50 psi for 15 minutes prior to backfilling. No leakage shall be allowed for this test.

- (B) Crossings: Sewers crossing water mains shall be laid beneath the water main with at least 18 inches vertical clearance between the outside of the sewer and the outside of the water main. When it is impossible to maintain the 18" vertical separation; 1) the crossing shall be arranged so that one full length of sewer is centered above or below the water line with sewer joints as far as possible from water joints; 2) the sewer pipe must be constructed to water main standards for a minimum distance of 20 feet either side of the crossing or a total of three pipe lengths, whichever is greater; 3) the section constructed to water main standards must be pressure tested to maintain 50 psi for 15 minutes without leakage prior to backfilling beyond one foot above the pipe to assure water tightness; 4) where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

1-A-04 Sewage Lift Stations

- (a) Flooding: Sewage pumping station structures and electrical and mechanical equipment shall be protected from physical damage from the one hundred (100) year flood. Sewage pumping stations should remain fully operational and accessible during the twenty five (25) year flood.
- (b) Equipment Removal: Provision shall be made to facilitate removal of pumps, motors, and other mechanical and electrical equipment.
- (c) Pump Removal: Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.
- (d) Construction: Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle.
- (e) Pumping Units: Lift stations receiving an average daily flow of less than 2,000 gal/day may be equipped with a single pumping unit, provided that replacement pumps are readily available, and one day's emergency storage is provided above the alarm level in the wet well. All other lift stations shall contain alternating duplex pumping units with each unit capable of pumping the maximum flow the station is expected to receive.
- (f) Pump Openings: For pumps handling raw sewage, except where grinder pumps are used, pumps shall be capable of passing spheres of at least three inches in diameter, and pump suction and discharge piping should normally be at least four inches in diameter. Pumps handling only settled wastewater shall be capable of passing 1½" spheres. However, the Agency will entertain proposals for smaller pumps where the engineer can demonstrate that such pumps are satisfactory for the particular wastewater to be pumped, based on actual operating experience.
- (g) Priming: Generally, the pump shall be so placed that, under normal operating conditions, it will operate under a positive suction head.
- (h) Electrical Equipment: Electrical systems and components (e.g., motors, lights, cables, conduits, switchboxes, control circuits; etc.) in raw sewage wet wells, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present shall comply with the National Electrical Code®, 2005 Edition, requirements for Class I, Group D, Division 1 locations. In addition, equipment located in the wet well shall be suitable for use under corrosive conditions. Each flexible cable shall be provided with watertight seal and separate strain relief. A fused disconnect switch located above ground shall be provided for all pumping stations. When such equipment is exposed to weather, it shall meet or exceed the requirements of weatherproof equipment as specified by the National Electrical Manufacturers Association (NEMA). Standard 3R shall be used as a minimum and is specified in Publication #250-1997, "Enclosures for Electrical Equipment (1,000 Volt Maximum.)" See Appendix 5-A for the address.

1-A-04(i) Sewage Lift Stations

- (i) Intake: Each pump should have an individual intake. Wet well design should be such as to avoid turbulence near the intake. Intake piping should be as straight and short as possible. Where turned down bellmouth inlets or submersible pumps are used the bottom of the inlets should be placed a sufficient distance above the wet well floor to minimize inlet head losses, but close enough to the wet well floor to assure inlet velocities sufficient to prevent solids deposition.
- (j) Pumping Rates: The pumps selected shall be capable of providing the following pumping rates:
 - (1) The minimum pumping rate shall not be less than 5 gallons per minute
 - (2) For average daily flows less than 10,000 gallons per day, the maximum rate shall be 5 times the average design flow.
 - (3) For average design flows greater than 10,000 gallons per day, the maximum flow rate shall be determined by multiplying the average design flow by the appropriate peaking factor from Table 1-A-1 Peaking Factors (page 133) .
- (k) Pump controls
 - (1) Location: The pump control system shall be located away from the turbulence of incoming flow and pump suction.
 - (2) Setting: The '2nd pump on' level and 'alarm on' level shall be at the same elevation.
- (l) Valves
 - (1) Suction Line: Suitable shutoff valves shall be placed on the suction line of each pump except on submersible pumps.
 - (2) Discharge Line: Suitable shutoff and check valves shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump. Check valves shall be suitable for the material being handled. Valves shall be capable of withstanding normal pressure and water hammer.
 - (3) Location: Valves may be located in wet wells only where single pump units are allowed. On all duplex unit pumping stations, the valves shall be in a separate valve pit adjacent to the wet well. This valve pit shall also contain a valved connection to allow the use of a portable pump for lift station bypassing during emergency conditions. The valve pit shall be provided with a drain to the wet well. An effective method of preventing sewage from entering the pit during surcharged wet well conditions shall be provided.

(m) Wet Wells

- (1) Size: For lift stations handling raw sewage and receiving more than 20,000 gallons per day average design flow, the size of the wet well shall be such that with any combination of inflow and pumping the cycle of operation of each pump will not be less than 5 minutes and the retention time in the wet well should not be more than 30 minutes at average design flow. For raw sewage lift stations receiving less than 20,000 gallons per day, the retention time in the wet well will not be more than 30 minutes at average design flow. These requirements do not apply for lift stations handling only settled wastewater.

Emergency storage or emergency power must be provided at all lift stations for power outage. Storage should be provided above the high water alarm level of the wet well, in the wet well or in an adjacent tank. The volume of storage should equal the design wastewater flow for a period in excess of the longest power outage in the last five years that would have affected the proposed site, or four hours, based on a 16 hour delivery rate, whichever is greater.

The emergency storage volume may overflow into the connecting sewer lines providing that the sewage does not back up into building basements or fixtures, back up into septic tanks or over top manholes or the wet well.

Emergency storage will be a minimum of one day of wastewater design flow for all lift stations with a single pump.

- (2) Floor slope: For all raw wastewater pump stations except submersible pump types, the wet well floor shall have a minimum slope of one to one to the hopper bottom. The horizontal area of the hopper bottom shall be not greater than necessary for proper installation and function of the inlet.

- (3) Ventilation

- (A) Dry Wells: Ventilation may be either continuous or intermittent. Ventilation, if continuous, shall provide at least six complete air changes per hour, if intermittent, at least 30 complete air changes per hour.

- (B) Wet Wells: For lift stations receiving less than 20,000 gallons per day design flow gravity ventilation is acceptable. For flows greater than 20,000 gallons per day design flow, forced ventilation shall be used. Forced ventilation may be either intermittent or continuous. Ventilation, if continuous, shall be capable of providing at least 12 complete air changes per hour, if intermittent, at least 30 complete air changes per hour. Air changes shall be forced into the wet well rather than exhausted from the wet well. Portable ventilation equipment may be approved when pumps, controls, screens, and other mechanical equipment can be serviced or replaced without entering the wetwell provided that the designer submits information demonstrating that the

proposed portable equipment will be suitable for the purpose, and operation and maintenance plan for the equipment, and a statement that the portable equipment will be equally or more effective than permanently installed equipment.

- (n) Alarm Systems: Alarm systems shall be provided for pumping stations. The alarm shall be activated in cases of pump failure, use of the lag pump, high water in wet well, or other evidence of pump station malfunction. Audio and visual alarms shall be provided. Alarms shall be located in a normally frequented area.

1-A-05 Force Mains

- (a) Velocity: The force main shall be sized to maintain a minimum hydraulic velocity of 2 feet per second with one pump on. The minimum force main size shall be 1 ½ inch diameter.
- (b) Air Relief Valve: An automatic air relief valve shall be placed at high points in the force main to prevent air locking.
- (c) Termination: Force mains should enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole
- (d) Design Pressure: Force mains and fittings, including reaction blocking, shall be designed to withstand normal pressure and pressure surges (water hammer).
- (e) Design Friction Losses: Friction losses in force mains shall be based on the Hazen Williams formula or other acceptable method. Selected friction factors shall be representative of pipe materials selected, considering surface deterioration over the expected useful life of the pipe.

Hazen Williams Formula

$$V = 1.32 C R^{0.63} S^{0.54}$$

R is the hydraulic radius

S is the slope of the energy grade line

C is the coefficient of roughness

- (f) Separation from Water Mains: There shall be a minimum 10-foot horizontal separation between water mains and force mains. A minimum 18 inch vertical separation between the outside pipe surfaces shall be maintained where force mains cross water mains. Force mains shall cross water mains at or near right angles with one full length of water pipe centered on the force main so both end joints are at maximum separation from the force main. Special structural support for the water main and the force main may be required.

1-A-05(g) Force Mains

(g) Pressure Test: Upon completion of construction of a force main the line shall be pressure and leakage tested. All newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 x the highest working pressure in the section in accordance with the following procedure:

- (1) Test pressures shall:
 - (A) not be less than 50 psi at the highest point along the test section.
 - (B) not exceed pipe or thrust restraint design pressures.
 - (C) be of at least 2 hour duration.
 - (D) not vary by more than 5 psi.
 - (E) not exceed twice the rated pressure of the valves when the pressure boundary of the test section includes closed gate valves.
- (2) Pressurization. Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to test gauge, shall be applied by means of a pump connected to the pipe.
- (3) Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe and valves.
- (4) Examination. All exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, or valves, that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated.

(h) Leakage Test

- (1) A leakage test shall be conducted concurrently with the pressure test.
- (2) Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled.

1-A-05(h)(3)

Force Mains

- (3) Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{(N)(D) \times \sqrt{P}}{7400}$$

L is the allowable leakage, in gallons per hour
N is the number of joints in the length of pipeline tested
D is the nominal diameter of the pipe, in inches
P is the average test pressure during the leakage test, in pounds per square inch gage.

APPENDIX 2-A SOIL MOTTLING

2-A-01 **Soil Mottling**

- (a) Mottling indicates the average seasonal high water table over many years produced by the seasonal fluctuation of the water table. The presence of mottling is a definite indication of the seasonal high water table. However, mottling does not occur in all soils. The absence of mottling does not necessarily indicate that the seasonal high water table is not a problem.

- (b) The soil mottling should be described in abundance, size, contrast, and color of the mottles in the following manner:
 - (1) Abundance. Abundance shall be described as "few" if the mottled color occupies less than 2% of the exposed surface; "common," if the mottle color occupies from 2% to 20% of the exposed surface; or "many" if the mottled color occupies more than 20% of the exposed surface.

 - (2) Size. Size refers to the length of the mottle measured along the longest dimension and shall be described as "fine" if the mottle is less than 5mm; "medium" if the mottle is from 5mm to 15mm, or "coarse" if the mottle is greater than 15mm.

 - (3) Contrast. Contrast refers to the difference in color between the soil mottle and the background color of the soil and is described as "faint" if the mottle is evident but recognizable only with close examination; "distinct" if the mottle is readily seen but not striking; or "prominent" if the mottle is obvious and one of outstanding features in the soil horizon

 - (4) Color. The color(s) of the mottle(s) shall be given.

- (c) Observed Groundwater: Groundwater shall be observed and reported at the highest level the ground water rises in the soil excavation or at the highest level of sidewall seepage in the excavation. Measurements shall be made from the ground surface. Soil above the water level in the excavation shall be checked for the presence of mottles or color patterns indicative of soil saturation.

- (d) Color Patterns Not Indicative of Seasonal High Groundwater: One-foot exception. Soil profiles that have an abrupt textural change with finer textured soils overlying more than 4 feet of unmottled, or coarse sand can have a mottled zone in the finer textured material. If the mottled zone is less than one foot thick and is immediately above the textural change, then a soil-based system may be installed in the loamy sand or coarser material below the mottled layer.

- (e) Other Color Patterns: Soil mottles can occur that are not due to zones of seasonal or periodic soil saturation. Examples of such soil conditions not limited by enumeration are:
- (1) soil mottles formed from uneven weathering of glacially deposited material. Glacially deposited material may also be naturally gray in color. This may include concretionary materials in various stages of decomposition;
 - (2) deposits of lime in a profile derived from highly calcareous parent materials;
 - (3) soil mottles that are usually vertically oriented along old or decayed root channels with dark organic stain usually present in the center of the mottled area.

APPENDIX 3-A
SEPTIC TANK SPECIFICATIONS AND MAINTENANCE

3-A-01 Septic Tank Specifications and Maintenance

(a) Specifications

- (1) Materials: Septic tanks shall be watertight, structurally sound, and constructed of materials not subject to extensive corrosion or decay. Heavy gauge steel, reinforced concrete and fiberglass are considered the normal construction materials. Steel tanks shall be continuous and watertight. Precast concrete tanks shall have a minimum wall thickness of 3 inches and shall be adequately reinforced to facilitate handling. When precast slabs are used as covers, they shall be watertight, have a thickness of at least 3 inches, and be adequately reinforced. For fiberglass tanks, the manufacturer may be required to substantiate the structural soundness of the tank by submitting an approved laboratory report, that relates to structural testing of the tank.

- (2) Tank Properties: Adequate tank capacity is required above the liquid tank level to provide for that portion of the scum that floats above the liquid. Although some variation is to be expected, on the average, about 30 percent of the total scum will accumulate above the liquid line. In addition to the provision for scum storage, one inch is usually provided at the top of the tank to permit free passage of gas back to the inlet and house vent pipe.

For tanks having straight, vertical sides, the distance between the top of the tank and the liquid line should be equal to approximately 20% of the liquid depth. In horizontal, cylindrical tanks, an area equal to approximately 15 percent of the total circle should be provided above the liquid level.

- (3) Access to Tank: Adequate access must be provided to each compartment of the tank for inspection and cleaning. Both the inlet and outlet devices shall be accessible. Access shall be provided to each compartment by means of either a removable cover or a manhole of at least 16 inches in diameter. Each tank shall have one manhole access to grade of sufficient diameter to allow removal of any septic tank covers. If only one access to grade is provided it shall provide access to the outlet filter. Covers should be tight fitting and designed to prevent entry by children.

- (4) Inlet: The inlet invert shall enter the tank at least 3 inches above the liquid level in the tank to allow for momentary rises in liquid level during discharges to the tank. A vented inlet tee, or baffle, shall be provided to direct the incoming wastewater downward. It shall penetrate at least 6 inches below the liquid level, but in no case shall the penetration be greater than that allowed for the outlet device.

- (5) Outlet: It is important that the outlet device penetrate just far enough below the liquid level of the septic tank to provide a balance between sludge and scum storage volume. The outlet device retains scum in the tank, but at the same time, it limits the amount of sludge that can be accommodated without scouring, which results in sludge discharging in the effluent from the tank.

The outlet device should generally extend to a distance below the surface equal to 40 percent of the liquid depth. For horizontal, cylindrical tanks, this should be reduced to 35 percent. All septic tank installations shall include an effluent filter approved by the Secretary. The filter shall prevent the passage of solids larger in size than 1/8th inch.

(b) Maintenance

- (1) At least once a year, the depth of sludge and scum in the septic tank should be measured. The tank should be pumped if:
 - (A) the sludge is closer than twelve inches to the outlet baffle, or
 - (B) the scum layer is closer than three inches to the septic tank outlet baffle.
 - (C) Following septic tank cleaning in units over 5,000 gallons, all interior surfaces of the tank should be inspected for leaks and cracks.
- (2) At least once a year, dosing tanks and distribution boxes should be opened and settled solids removed as necessary and the dosing tank or distribution box checked for levelness.
- (3) Toxic or hazardous substances should in general not be disposed of in septic systems. These substances may pass through the system in an unaltered state and contaminate groundwater or remain in the septage and subsequently contaminate the soil or crops at the site of ultimate disposal.

**APPENDIX 4-A
PERCOLATION TEST PROCEDURES**

4-A-01 Percolation Test Procedures

The following procedure is to be used for determining the percolation value required by these rules.

- (a) **Depth of Test** Tests shall be taken entirely within the most dense, least permeable soil identified within one (1) to three (3) feet below the bottom of the infiltrative surface of the proposed leachfield.
- (b) **Type of Test Holes** The test hole will be unlined, shaped like a vertically oriented cylinder with a diameter of 6-8 inches and a depth of 10 inches.
- (c) **Preparation of Test Hole** Using a sharp instrument, carefully scrape the sidewalls of the hole to remove any smeared soil surface. This is particularly important in soils that have a significant silt or clay content. Place one (1) inch of clean crushed stone in the bottom of the hole to reduce scouring. When possible, instead of pouring water directly from a bucket into the hole, use a hose to siphon water out of a suitably located reservoir to provide a high degree of control over the rate of water entering the hole, to minimize scouring.
- (d) **Percolation Test Measurements** To begin the test, fill the hole with water up to a level six (6) inches above the stone and allow it to drop the distance specified in the table below for seven (7) consecutive runs. After each run, bring the water up to the six (6) inch level. The time of each run, the refill time between each run, and the total elapsed time must be accurately recorded.

WATER LEVEL DROPS FOR EACH TEST RUN OF THE PERCOLATION TEST PROCEDURE

Soil Texture:	Coarse to Medium Sand	Fine Sand to Silt Loam	Silts to Clay Loam
Anticipated Percolation Rate (min/in)	1 - 10	10 - 60	60 -120
Drop (inches)	2	1	1/2

- (e) **Determining the Percolation Rate** The rate of drop for each run is plotted, on graph paper with logarithmic scales on both axes (log/log graph paper), against the cumulative time of the seven runs, including the refill times. The best straight line is fitted to the seven data points and extrapolated out to one (1) day (1440 minutes) of cumulative time. The rate of drop after 1440 minutes is the percolation rate.

APPENDIX 5-A

ORGANIZATIONS THAT PUBLISH THE CODES AND MATERIAL STANDARDS REFERRED TO IN THE GUIDELINES CONTAINED IN APPENDIX 1-A

- ASCE American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191-4400
Telephone: 800-548-2723
www.asce.org
- ASTM ASTM International
100 Barr Harbor Drive
P.O. Box C700
West Conshohocken, PA 19428-2959
Telephone: 610-832-9585
www.astm.org
- CISPI Cast Iron Soil Pipe Institute
5959 Shallowford Road, Suite 419
Chattanooga, TN 37421
Telephone: 423-400-0784 (Northeast Regional Representative)
www.cispi.org

- NEIWPCC New England Interstate Water Pollution Control Commission
Boott Mills South
116 John Street
Lowell, MA 01852
Telephone: 978-323-7929
www.neiwpcc.org

For copies of:

“TR-16 Guide for the Design of Wastewater Treatment Works”

contact NEIWPCC at 978-323-7929 or by email at: mail@neiwpcc.org

- BOCA International Code Council
& 500 New Jersey Avenue, NW, 6th Floor
IPC Washington, DC 20001
Telephone: 888-422-7233
Email: webmaster@iccsafe.org

- NFPA National Fire Protection Association, Inc.
1 Batterymarch Park
Quincy, MA 22169-7471
Telephone: 800-344-3555
617-770-3000
www.nfpa.org

Note: The National Electrical Code is a registered trademark of the National Fire Protection Association, Inc. of Quincy, Massachusetts.

APPENDIX 5-A

NEMA National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
Telephone: 703-841-3200
www.nema.org

Publications available through Global Engineering Documents
Telephone: 800-854-7179
www.global.ihs.com

Health Education Services, Inc.
P.O. Box 7126
Albany, NY 12224
Telephone: 518-439-7286
www.hes.org

Source for: “Recommended Standards of Sewage Works”

APPENDIX 6-A
SPECIFIC INFORMATION FOR APPLICATIONS

6-A-01

An application for a water supply and wastewater permit shall contain the following information:

(a) **General Content:**

- (1) name and location of the proposed project;
- (2) design flow of the project's wastewater system(s) and potable water supply(ies);
- (3) name and address of the applicant;
- (4) signature of the applicant, and any co-applicants;
- (5) applicable fee as required by 3 V.S.A. section 2822;
- (6) name and address of the designer who designed the project;
- (7) a statement of the purpose of the project, including the intended use of land after subdivision or improvement, such as residential, single family, 2 family, multiple housing, commercial, industrial, recreational, or agricultural;
- (8) a statement of the type of potable water supply proposed for the project, such as individual systems on each lot, community system, or municipal system;
- (9) a statement of the type of wastewater system proposed for the project, such as individual soil-based system on each lot, community soil-based system, or municipal system;
- (10) The latitude and longitude of the "center of parcel" shall be reported on the application form using a global positioning system receiver using the NAD 83 coordinate system or a NAD 83 base map. The coordinates shall be reported in decimal degrees to five decimal places with an accuracy of +/- 50 feet. The "center of parcel" is the center of the parcel of land that is being built on or subdivided. Because many parcels are irregularly shaped, the center location is approximate.
- (11) a description of the existing use(s) of adjacent properties, including the locations of all existing and/or permitted water supplies (potable and non-potable) and wastewater systems that may be potentially affected by the project or that may potentially affect the project design;

6-A-01(a)(12)

- (12) if the potable water supply or wastewater system is located on a different lot of land than the lot on which the building or structure or campground that it will be serving is located, evidence of permanent legal access to the supply or system, if available at the time of application;

Note: If evidence of permanent legal access is not available at the time of application, it must be submitted to the Secretary prior to the initiation of construction or else the permit that was issued is null and void until the evidence is provided.

- (13) whether the potable water supply is located within one (1) mile of a site listed on the hazardous sites list maintained by the Waste Management Division of the Department; and
 - (14) such additional information as the Secretary deems necessary to determine compliance with these Rules.
- (b) **Plot Plan:** An application shall also include a detailed plot plan of the proposed project drawn to an accurate scale of 1" = 100' or larger showing:
- (1) the location and dimensions of the land involved, with North arrow showing orientation. When the lot is larger than 10 acres in size, the exterior boundary may be shown on a map or aerial photograph where 1" equals more than 100'. The portion of the lot that may be potentially affected by the potable water supplies and wastewater systems shall be shown at a scale where 1" equals not more than 100';
 - (2) the scale of the plan, preparer's signature and date of preparation and revision(s) clearly indicated;
 - (3) the permanent benchmark established on the land involved and shown on the plan;
 - (4) existing and proposed topographic contours, in the areas that may be potentially affected by the project or that may potentially affect the project design, using contour intervals that are no greater than five (5) feet. At least 90% of the contours shall be accurate within one half contour interval and no inaccuracies shall exceed one contour interval. This plan shall include the location of all outcroppings and existing and proposed embankments. The designer shall be responsible for the accuracy of the contour information on the plot plan in areas of the project where contours are of critical importance (wastewater system disposal areas, sewer lines, potable water supply source locations, etc.). Photogrammetric contour maps may be used to show the general contour of the land in less critical areas. Some types of wastewater systems may require different contours. See Subchapter 9 of these Rules;
 - (5) when lots are being subdivided, the location of all existing and proposed lots, their dimensions and area;

6-A-01(b)(6)

- (6) the location of all existing and proposed property lines, easements, rights-of-way, parking areas, streets, parks, playgrounds and open spaces that may be potentially affected by the project or that may potentially affect the project design;
 - (7) the location of all standing and flowing waters and wetlands on the lot on which the project is located that may be potentially affected by the project or that may potentially affect the project design, including but not limited to lakes, ponds, brooks, rivers, streams, swamps, bogs, sedge meadows, and marshes; and the location of all existing and/or permitted potable water supplies that may be potentially affected by the project or that may potentially affect the project design;
 - (8) the location of all drainage courses, natural or artificial, existing and proposed, within or immediately bordering the lot on which the project is located that may be potentially affected by the project or that may potentially affect the project design, including identification of surface drainage patterns; and
 - (9) the location and elevation of any mapped special flood hazard area (using any available base flood elevation data) and any floodway on the lot on which the project is located.
- (c) **Detail Sheets:** The application shall include detail sheets that include site plans, drawn to a scale of at least 1" = 100', and plans for potable water supplies and wastewater systems, drawn to a scale of at least 1" = 30', that include:
- (1) the location of all existing and proposed buildings and building remnants on the lot on which the project is located that may be potentially affected by the project or that may potentially affect the project design, including previous foundations and excavations;
 - (2) the location and detail of all existing and proposed wastewater system components on the lot on which the project is located such as septic tanks, treatment units, sewers, pump stations, siphons, disposal fields, and piping, including the location of replacement areas; and
 - (3) the location of all existing and proposed potable water supply sources on the lot on which the project is located, including any source protection areas, and the location and detail of the project's potable water supply components such as pipelines, pumphouses and reservoirs.
- (d) **Soil Data:** Soil data must be included in the application as follows:
- (1) If a project or any portion of a project is to be served by a publicly or privately owned wastewater treatment plant, no soil data is required for the project or the portion of a project served by the plant;

6-A-01(d)(2)

- (2) If the project or a portion of the project is not served by a wastewater treatment plant, the soil and site evaluation report required under section 1-902 of these Rules must be submitted; and
 - (3) The designer shall submit the results of all soils tests or investigations performed for the project, whether or not they were used to support the project design. If the designer prepared a map or diagram that shows the location of all soils tests or investigations, a copy of the map or diagram shall also be submitted.
- (e) **Basis of design calculations:** The designer shall include with the application, a copy of his or her basis of design for the complete potable water supply and/or wastewater system. The calculations shall include all values used and any assumptions made.
- (f) **Flow Metering:** For any application for which flow metering will be the basis of a request for increase in flow or for a new project, a designer shall verify the accuracy of the flow meters, ensure that all water related to the project is measured, and ensure that the system has been maintained and operated so that valid information is collected. Note: See section 1-808 of these Rules.
- (g) **Construction details:** Each application shall contain plans, material specifications and construction specifications sufficient for construction of the potable water supply and wastewater system and shall include, as applicable:
- (1) lists of all materials to be used and specifications for those materials;
 - (2) invert elevations;
 - (3) final grades;
 - (4) details of all building enclosures for potable water supplies or wastewater systems, including structural details where required;
 - (5) specifications for potable water supply and wastewater system components, such as treatment units, pipelines, sewer lines, pumps, etc.;
 - (6) the make, size and model numbers of all equipment to be used;
 - (7) specifications on methods of installation, performance standards, quality of workmanship; and
 - (8) any other information necessary for adequate construction of the potable water supply or wastewater system.

6-A-01(h)

(h) Waiver of Required Information:

- (1) For projects that present a negligible potential for adverse environmental impact, the Secretary may waive the submission of any of the specific information required by this Appendix as he or she deems appropriate provided that the project being permitted does not require an installation certification; or
 - (2) For persons who need a permit because their wastewater system and/or potable water supply has failed, the Secretary may waive the submission of some or all of the specific information required by this Appendix and section 1-305 of these Rules.
- (i) Format:** The Secretary may require information to be submitted in a standard format in order to expedite project review.

Appendix 7-A Simplified Method for Prescriptive Desktop Mounding Analysis

Background

The Wastewater System and Potable Water Supply Rules (Rules) effective August 16, 2002 require that all subsurface wastewater disposal systems maintain an unsaturated zone of soil beneath and immediately downgradient of the disposal system. This unsaturated zone provides treatment of the wastewater effluent, and groundwater protection. The bottom of the disposal system must be at least 36" above the seasonal high water table when applying septic tank effluent or at least 24" above the seasonal high water table when applying filtrate effluent. In addition, the systems must maintain at least 36" separation between the bottom of the disposal system and the mounded water table when applying septic tank effluent or at least 18" when applying filtrate effluent.

Scope of this Document

This document incorporates a simplified method for a prescriptive desktop mounding analysis for use with mound systems with design flows of less than 1,000 gallons per day and in-ground and at-grade systems with design flows of less than 2,000 gallons per day. For larger systems, which include mounds over 1,000 gallons per day and in-ground and at-grade systems greater than 2,000 gallons per day, the Rules require a site/system specific hydrogeologic evaluation by a qualified hydrogeologist, as defined in §1-201 (a) (47) of the Rules, to insure that the design unsaturated zone is maintained. This document does not preclude a more in-depth site-specific hydrogeologic analysis by a qualified hydrogeologist for these smaller systems.

This document is for use by all licensed designers. It is based on a simple model incorporating Darcy's Law and using soil texture and ground-surface slope. It is intended that this model will generally produce conservative results, but care should be taken to insure that the site conditions used for the calculations are present beneath and within 25 feet downgradient of the entire disposal area.

Design standards set forth in the Rules must be adhered to. This approach may produce values, based on hydraulic loading, that do not meet the minimum design standards set forth in the Rules. If the design standard is more restrictive, the system must be designed to that standard.

If the Agency agrees with the assumptions made for this equation, this approach can be used to satisfy the desktop hydrogeologic study required by the rules when designing performance based systems.

Method and Assumptions

Incorporated in the Rules in the filtrate disposal and the enhanced prescriptive standards sections, the concept of system Linear Loading Rate (LLR) is conservatively used to insure the design unsaturated zone is maintained. This method identifies a design Linear Loading Rate (LLR) based on specific site characteristics, including soil texture, natural (not modified) ground slope, and the soil thickness available for groundwater mounding. The LLR is defined as the loading rate in gallons per day applied to each linear foot of the overall system **along the ground contour**. This is different than the AR, or application rate, which is based on percolation rate and is used to determine the size of the system. The Application Rate is the rate in gallons per square foot of trench or bed per day. Using this approach the minimum system length is calculated first based on the hydraulic capacity of the site. The system size is then determined based on the Application Rate, site limitations, designer preference, and other restrictions in the Rules (i.e. length to width ratios for mound systems).

The soil texture is based on the NRCS soil triangle that classifies soil textures based on percentages of clay, silt and sand. **Note: This Method may not be used on soils whose consistence is "firm" or denser.** The soil descriptions must be representative of the soils beneath the disposal area and for 25 feet downgradient. Additionally, the ground slope must be representative of the disposal area and 25 feet downgradient. The available thickness for groundwater mounding (h) is the thickness of soil from above the highest limiting condition to within 6" of the surface of the naturally occurring soil. Limiting conditions include, but are not limited to: seasonal high water table predicted by soil indicators, seasonal high water table "critical levels" based on the monitoring method in Section 1-903(e) of the Rules, bedrock, soil with a consistence of "firm" or denser, or a maximum of 36 inches below the natural ground surface.

Appendix 7-A Simplified Method for Prescriptive Desktop Mounding Analysis

After the above site characteristics are identified, select the appropriate LLR Factor (f) from Table 1. Use the following formula to calculate the appropriate LLR for the disposal system:

$$LLR = (h) (f)$$

Where: LLR = linear loading rate, in gallons per day per linear foot of disposal system, measured parallel to the natural ground contours;

h = the soil thickness available for groundwater mounding, measured in feet;

f = the LLR Factor from Table 1, based on soil texture and ground slope.

Table 1. Linear Loading Rate Factors Based on Soil Texture and Natural Ground Slope

Soil Texture	LINEAR LOADING RATE FACTORS (f)						
	Natural Ground Slope						
	0 - 2%	2.1 - 4%	4.1 - 6%	6.1 - 8%	8.1 - 10%	10.1 - 15%	15.1 - 20%
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	7.5	22.4	37.4	52.4	52.4	52.4	52.4
Coarse Sandy Loam, Sandy Loam, Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	3.7	11.2	18.7	26.2	33.7	33.7	33.7
Fine Sandy Loam, Very Fine Sandy Loam	1.5	4.4	7.5	10.5	13.5	18.7	26.2
Loam	1.1	3.4	5.6	7.9	10.1	14.0	19.6
Silt Loam	0.7	2.2	3.7	5.2	6.7	9.4	13.1
Sandy Clay Loam, Silty Clay Loam, Clay Loam	0.4	1.1	1.9	2.6	3.4	4.7	6.5
Sandy Clay, Silty Clay, Clay	0.2	0.7	1.1	1.6	2.0	2.8	3.9

Limiting conditions include, but are not limited to:

- . • seasonal high water table predicted by soil indicators
- . • seasonal high water table “critical levels” based on the monitoring method in §1-507(e) of the Rules
- . • bedrock
- . • soil with a consistence of “firm” or denser
- . • 36 inches maximum below the natural ground surface.

Example #1

Three bedroom home with a design flow of 420 gpd with a fine sandy loam friable to 28 inches with the estimated seasonal high water table (SHWT) at 24 inches and a ground slope of 8%.

LLR = (h) (f)

h = 18 inches or 1.5 feet. (24 inches to SHWT minus the 6 inches of unsaturated soil needed to be maintain between the induced mounding and the ground surface) **f = 10.5** (From Table 1)

LLR = (1.5) (10.5) LLR = 15.75 gpd/lf

System length is design flow divided by LLR

System Length = 420 gpd / 15.75 gpd/lf

= **27 lf.** System size: The maximum application rate for a mound system is 1.0 gallons/day/square foot. Therefore, 420 square feet of trench or bed bottom is needed.

Appendix 7-A Simplified Method for Prescriptive Desktop Mounding Analysis

The minimum system length is 27 feet.

The system width is: 420 square feet/ 27 feet = 16 feet.

A system 27 feet long and 16 feet wide does not meet the 2:1 ratio required by the Rules. The length of the system has to be increased to meet the design standards of the Rules.

System design could include a mound with 2.5 feet of sand beneath the disposal area for septic tank effluent or 1 foot of sand for filtrate effluent.

Example #2

Four bedroom home with a design flow of 490 gpd with a silt loam with the estimated seasonal high water table at 8 inches and a ground slope of 3%. Note: silt loams that are firm or denser in place do not qualify for use of this simplified method.

$$\text{LLR} = (\text{h}) (\text{f})$$

$$\text{h} = 2 \text{ inches or } 0.17 \text{ f} = 2.2$$

$$\text{LLR} = (0.17) (2.2) \text{ LLR} = 0.37 \text{ gpd/lf}$$

$$\text{System length} = 490 \text{ gpd} / 0.37 = 1324 \text{ lf}$$

System design could include a mound with 2.5 feet of sand beneath the disposal area for septic tank effluent or 1 foot of sand for filtrate effluent.

Example #3

Determine the LLR of an at-grade filtrate disposal system maintaining an 18 inch design unsaturated zone for a three bedroom home with a design flow of 420 gpd with a silt loam with the estimated seasonal high water table at 40 inches and a ground slope of 12%. Note: silt loams that are firm or denser in place do not qualify for use of this simplified method.

$$\text{LLR} = (\text{h}) (\text{f})$$

$$\text{h} = 18 \text{ inches or } 1.5 \text{ feet (36 inch limiting factor minus 18 inches of unsaturated soil needed)} \text{ f} = 9.4$$

$$\text{LLR} = (1.5) (9.4) \text{ LLR} = 14.1 \text{ gpd/lf}$$

$$\text{System length} = 420 \text{ gpd} / 14.1 = 30 \text{ lf}$$

System size:

The maximum application rate for an at-grade system with filtrate is 2.0 gallons/day/square foot. Therefore, 210 square feet of effective infiltration bottom is needed.

The minimum system length is 30 feet.

The system width is: 210 square feet / 30 feet = 7 feet

Appendix 7-A Simplified Method for Prescriptive Desktop Mounding Analysis

Example #4

Determine the LLR of an at-grade disposal system maintaining an 18 inch design unsaturated zone for a four bedroom home with a design flow of 490 gpd with a granular loamy sand with water table at 31 inches and an average ground slope of 3%.

$$\text{LLR} = (\text{h}) (\text{f})$$

h = 13 inches or 1.08 feet (31 inches minus 18 inches of unsaturated soil) **f = 22.4**

$$\text{LLR} = (22.4) (1.08) \text{ LLR} = 24.2$$

Minimum system length, based on hydraulic calculations, = $490 \text{ gpd} / 24.2 = 20.3 \text{ ft}$. The actual length of the system is determined by the requirements for at-grade systems.