

Alternate Systems Guidance



COMMONWEALTH OF PENNSYLVANIA

Department of Environmental Protection

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DEPARTMENT OF ENVIRONMENTAL PROTECTION
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POLICY: The Department of Environmental Protection (DEP) will develop, release for public comment and publish technical guidance for the siting, design and construction of alternate onlot sewage treatment systems.

PURPOSE: The purpose of this document is to provide current technical standards for alternate onlot systems and to update these standards periodically through amendments to this document.

APPLICABILITY: This guidance document applies to the siting, design and construction of alternate onlot sewage treatment systems proposed under the requirements of Chapter 73, Section 73.72.

DISCLAIMER: The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures should affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

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I. GENERAL

A. Introduction:

DEP has the authority and responsibility to classify onlot sewage systems. An onlot sewage system must be classified as either “conventional,” “alternate,” or “experimental.” A conventional sewage system is one that uses demonstrated technology recognized under Chapter 73 of the sewage facilities regulations. An alternate sewage system is one that uses demonstrated technology not recognized under Chapter 73. An experimental sewage system uses onlot technology that has not been demonstrated for use in Pennsylvania. The purpose of this Alternate Systems Guidance (ASG) is to provide relevant information about alternate technologies that have been pre-classified by DEP following successful demonstration and have not yet been placed in regulation.

This ASG is organized very differently from previous versions of the guidance. Previous versions were formatted to describe complete systems, from the building sewer to final treatment and absorption in the soil. “Systems” are actually collections of components that can be mixed and matched to achieve a desired result. The component-based format of this version recognizes and reflects that. The primary intent of this change in format is to provide maximum flexibility to system designers when designing systems. Final onlot sewage systems assembled using the components and configurations described in this ASG are considered to be pre-classified as alternate sewage systems under Section 73.72.

When using this new format, determine the minimum level of upfront treatment needed for the conditions found at the site, using the limiting zone (LZ) determined from examination of the soil profile. In general, the shallower the LZ, the higher the level of upfront treatment needed to

achieve the necessary overall treatment provided by the treatment technology and the renovative capabilities of the soil. The LZ information, plus the other site evaluations (slope, percolation rate, etc.), is used to determine what components and combinations may be suitable for that site. Limiting zone depth and absorption area installation depth are used to determine the necessary vertical isolation distance (defined as the distance between the bottom of the absorption area and the LZ). This vertical isolation distance is then used to determine the minimum treatment level required prior to the absorption area from the chart in Section II. The designer may achieve the required minimum treatment level by combining appropriate components from this guidance. Examples:

- A septic tank (Section III) achieves “primary treatment”, and, when combined with a steep slope elevated sand mound bed (Section VIII. B.) (to achieve the necessary vertical isolation distance of 48 inches), may be placed on sites with a minimum depth to LZ of 20 inches.
- A septic tank (Section III), when combined with a free access media filter with a loading rate of 5 gpd/ sqft (Section IV. C.) achieves “secondary treatment” and, combined with an at-grade absorption area (Section VIII. C.), may be placed on sites with a minimum depth to LZ of 20 inches.
- An aerobic treatment unit (Section IV. B) achieves secondary treatment, and, when combined with a free access media filter (Section V. C.) and an UV disinfection unit (Section VI), achieves “advanced treatment with disinfection” and when combined with a “shallow limiting zone at-grade absorption area” (Section VIII. D.), may be used on sites with a seasonal high water table (SHWT) LZ as shallow as 10 inches.

In changing to this component-based ASG format, except for the specialized systems and components included in Section X, DEP has eliminated proprietary technology names. In order for system designers, sewage enforcements officers or other users to know which specific manufacturers’ technologies have been pre-classified by DEP as an ASG component, DEP has created the “Proprietary Alternate Technology Components” listing. This listing is updated as additional technologies qualify and is available on the DEP web site at _____ .

This version of the ASG also establishes minimum maintenance standards (activities and intervals) for each component. In order to achieve “permanent infrastructure” status, onlot treatment systems must be regularly maintained. This new ASG format allows flexibility in component selection while realistically addressing the variety of minimum maintenance requirements necessary for the proper operation of each component of a system. Using the second example shown earlier, the normal three-year pumping/inspection cycle for septic tanks would not be adequate to satisfy the annual inspection requirement of both the free access media filter and the at-grade absorption area. However, annual pumping of a properly sized septic tank would probably be both unnecessary and expensive. The inspection and maintenance interval appropriate for this complete system would be yearly, with the septic tank being pumped approximately every third year.

B. Definitions.

Words and terms used in this guidance are defined in Chapter 73. The following additional words and terms have the following meanings, unless the context clearly indicates otherwise:

Advanced treatment—The use of biological and chemical processes designed to remove biochemical oxygen demand (BOD₅) and total suspended solids (TSS) to levels of less than or equal to 10 milligrams per liter (mg/L) based on the 95th percentile.

Aggregate Area—The square footage occupied by the aggregates in a soil absorption area, the square footage of the area extending directly under and 10 feet beyond the outer wetted perimeter of a spray distribution field, or the square footage directly under and extending two feet beyond the outermost installation of drip distribution tubing in a drip distribution area, from which horizontal isolation distances are measured.

Biochemical treatment—The use of biological and chemical unit processes in the treatment of sewage.

Biochemical oxygen demand (BOD₅)—The amount of dissolved oxygen, expressed in milligrams per liter (mg/L), required by bacteria while stabilizing, digesting or treating organic matter under aerobic conditions.

Borehole—A circular hole made by boring; esp. a deep vertical hole of small diameter, such as a shaft, a well (an exploratory oil well or a water well), or a hole made to ascertain the nature of the underlying formations, to obtain samples of the rocks penetrated, or to gather other kinds of geologic information.

Coarse Aggregate—Coarse material meeting the required size and grading criteria specified in this guidance and the following specifications:

- (1) The coarse aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate, including material finer than the No. 200 sieve, clay lumps and friable particles.
- (2) The coarse aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using ASTM C 142.

- (3) The coarse aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using ASTM C 117 or PMT No. 100.

Domestic wastewater—Raw sewage effluent with composition within the following ranges: 12 – 50 mg/L ammonia as nitrogen, 8 – 35 mg/L organic nitrogen (20 – 85 mg/L total Kjeldahl nitrogen), 350 – 1200 mg/L total solids, 100 – 350 mg/L total suspended solids and 110 – 400 mg/L BOD₅.

Filter units—A system of distribution piping, media, aggregate and collection piping used for the filtration and biochemical treatment of sewage. The term includes:

- (1) Buried media filter—A system of distribution piping, media, aggregate and collection piping contained in a buried liner used for the intermittent filtration and biochemical treatment of sewage.
- (2) Free access media filter—An accessible system of filter tanks containing distribution piping, media, aggregate and collection piping and used for the intermittent filtration and biochemical treatment of sewage.
- (3) Recirculating media filter—An accessible system of filter tanks, pressure dose distribution piping, media, aggregate and collection piping used for the recirculating filtration and biochemical treatment of sewage.

Fine Aggregate—Fine material meeting the required size and grading criteria specified in this guidance and the following specifications:

- (1) The fine aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
- (2) The fine aggregate must not contain more than 5 % by weight clay lumps and friable particles. Testing must be performed using ASTM C 142.
- (3) The fine aggregate must not contain more than 3% by weight material finer than the No. 200 sieve. Testing must be performed using ASTM C 117 or PMT No. 100.

Hydraulic linear loading rate— The quantity of effluent applied along the length of a lateral, typically expressed as volume per unit length per unit time, expressed in gal/ft_l/d.

Infiltration Loading Rate – The rate at which wastewater enters a given soil, expressed in gal/ft²/d.

Light weight equipment—Equipment with a total weight of 15,000 pounds or less and a maximum ground pressure of 6.5 pounds per square inch.

Mineral soil—Soil, excluding the natural organic layers of the surface, which consists of naturally occurring mineral matter with organic materials not exceeding 20 percent by weight. This does not include the organic layer, which consists of recognizable, decomposing materials such as grass, sticks, leaves etc.

NSF—NSF International, formerly known as the National Sanitation Foundation.

Primary treatment—The use of physical operations to remove floating and settleable solids found in wastewater.

Renovation—The act of improving the effluent quality prior to reaching the groundwater.

Rock outcrop—The part of a rock formation that appears above the surface of the surrounding land.

Secondary treatment—The use of physical, biological and chemical operations and processes designed to remove biochemical oxygen demand (BOD₅) and total suspended solids (TSS) to levels of less than or equal to 30 milligrams per liter (mg/L) based on the 95th percentile.

Seepage area—The aggregate area of an absorption area or the surface area of a media filter.

System designer—The person responsible for the design of the treatment system and ensuring all applicable standards are met.

Total suspended solids (TSS) —The total weight of solids that are visible and in suspension in a given volume of effluent.

Vertical isolation distance—The minimum distance from the lowest point in the absorption area to the highest point of the limiting zone.

Zero discharge system—A system which receives sewage or treated wastewater and is designed for ultimate disposal of the sewage at another site or through evapotranspiration. The term includes the following:

- (1) Evapotranspiration system—A system designed so the combined loss of water from the system due to evaporation from the enclosed soils and transpiration from the plants equals the volume of applied effluent, on a maximum daily basis.

C. Application

1. The alternate systems and technologies contained in this guidance have been determined to meet the criteria listed under Chapter 73, Section 73.72. In addition to the criteria in Section 73.72, the design and construction conditions in the following listings must be met. It should be noted that Section 73.3(b), Policy, allows for the use of these systems when correcting a malfunction or making a repair of an existing system.
2. Site suitability for these systems need not be considered as part of the suitability determinations performed under Chapter 71, Section 71.64(c)(1) (relating to site suitability for small flow treatment facilities).
3. Alternate systems may be used to serve residential development or other facilities producing sewage having chemical characteristics typical of domestic wastewater.
4. Alternate onlot systems require proper operation and maintenance to assure adequate sewage treatment over the life of the system. Municipalities are required to assure proper operation and maintenance of the systems proposed for use within their borders in accordance with the provisions of Chapter 71, Subchapter E, titled "Sewage Management Programs." All proposals submitted as alternate under Chapter 73, Section 73.72 of the regulations must document compliance with the appropriate regulatory requirements relating to sewage management. The operation and maintenance requirements for each technology are specified in the individual listings.
5. Under Chapter 72, Section 72.43(l), DEP may delegate the review of certain alternate sewage systems intended for single family residential use to Sewage Enforcement Officers (SEOs) determined to be qualified by DEP to review the systems. Each alternate component or technology listing describes the qualifications that must be met by an SEO to independently review an onlot system that includes that alternate component or technology and issue a permit. If DEP review is necessary for a given technology, this is indicated in the individual description. DEP may also require review of proposals for systems not intended to serve single-family residential homes. The final determination on the issuance of an individual alternate permit is the sole responsibility of the local agency.

D. Minimum horizontal isolation distances

Minimum horizontal isolation distances shown in Chapter 73, Section 73.13 must be met. If conditions warrant, greater isolation distances may be required. All distances from stormwater retention and detention basins must be measured from the toe of their berm.

E. Sewage flows.

Sewage flows shown in Chapter 73, Section 73.17 must be used in the design of alternate sewage systems.

II. SITE EVALUATION

A. Limiting zone.

Soil tests to determine the presence of a limiting zone and the capacity of the soil to permit the passage of water must be conducted prior to permit issuance. These tests must be performed in accordance with the requirements of Chapter 73, except as described in (B), below.

B. Morphological evaluation.

Where an absorption area is proposed for installation on sites with soils having limiting zones within 20 inches of the mineral soil surface or a drip distribution absorption area is proposed, a qualified soil scientist must conduct the necessary morphological evaluation. A report including soil profile descriptions for all soils evaluated, the soil drainage classification determination, and confirmation that the appropriate loading rate and horizontal linear load from the hydraulic linear loading rate table (Table A of this guidance) are met, must be signed by the qualified soil scientist. The following procedure must be followed:

1. At a minimum, the depth to any limiting zone must be:
 - a. Greater than or equal to 10 inches to a seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil redoximorphic features.
 - b. Greater than or equal to 16 inches to a rock formation with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.
 - c. Greater than or equal to 10 inches to a rock formation that is so slowly permeable that it effectively limits downward passage of effluent.
 - d. Greater than or equal to 10 inches to any stratum or soil condition that is so slowly permeable that it effectively limits downward passage of effluent.

2. Distribution of the effluent in the absorption area will be determined by the soil profile evaluations and vertical distance between the bottom of the aggregate and the top of the seasonal high water table or rock formation.
3. For sites that do not show evidence of seasonal high water tables, or a rock formation or other stratum or soil condition which effectively limits the downward passage of effluent, a minimum of two soil profile evaluations must be evaluated, on contour, bracketing the proposed absorption area.
 - a. The on-contour spacing of the soil profile evaluations must not exceed 100 feet in length.
 - b. In cases where the site conditions require an aggregate area that exceeds 100 feet in length, additional test pit evaluations are required to verify the soil morphology of the absorption area. No down gradient area test pits are required, unless the qualified soil scientist or Department soil scientist determines that site conditions warrant their evaluation.
 - c. Overall site suitability will be limited by the most restrictive depth to rock formation and the soil morphology from all of the test pits evaluated.
 - d. System sizing will be based on the infiltration loading rate (ILR) determined from the appropriate column of Table A of this guidance of the most restrictive horizon in all the soil test pits evaluated, or 670 square feet, whichever is greater.
 - e. Absorption areas with a vertical isolation distance of less than 20 inches must not be placed on concave topography
4. For sites that have seasonal high water tables or restrictive horizons, a minimum of four soil profile test pits must be evaluated to verify the morphology of the proposed absorption site.
 - a. At a minimum, two soil profile evaluations upslope and two soil profile evaluations down slope must be evaluated and must bracket the proposed absorption area.
 - b. The on-contour spacing of the soil profile evaluations must not exceed 100 feet in length.
 - c. The down slope spacing of the soil profile evaluations must be a minimum of 50 feet from the down slope edge of the proposed absorption area.
 - d. In cases where the calculated aggregate area length exceeds 100 feet, additional test pit evaluations must be required to verify the soil morphology of both the absorption area and the downgradient area.

- e. Overall site suitability will be limited by the most restrictive depth to the seasonal high water table, depth to rock formation and soil morphology from all of the soil test pits evaluated.

C. Treatment requirements.

Minimum required treatment levels before distribution to the soil absorption area must conform to the following table. Additional levels of treatment may be used in excess of the minimum required.

Vertical Isolation Distance (inches)	Minimum Treatment Level
≥48	Primary
≥20-<48	Secondary
≥10-<20 to seasonal high water table	Advanced with disinfection
≥16-<20 to rock	Advanced with disinfection

III. PRIMARY TREATMENT

Standards for septic tanks.

Septic tank standards as set forth in Chapter 73, Section 73.31, must be adhered to for alternate system installations, with the following additional specifications:

A. Requirements

1. The septic tank capacity must be sized to have a minimum hydraulic retention time of 2.5 days, using estimated maximum daily sewage flows from Chapter 73.
2. Septic tanks must be rectangular or horizontally cylindrical in shape.
3. A septic tank consists of a dual compartment tank or 2 single compartment tanks connected in series. Two single compartment tanks connected in series are equivalent to one dual compartment tank.
4. Measures to control flotation of the tank must be implemented when the tank is installed in areas below any indication of a water table.
5. An effluent filter bearing the seal of NSF indicating testing and approval by that agency under Standard No. 46 must be installed on the outlet of the final tank or compartment.
6. Tanks having a capacity in excess of 5,000 gallons may be constructed onsite to meet the standards of the National Concrete Masonry Association for reinforcement and waterproofing. These standards are contained in Basement Manual, Design and Construction Using Concrete Masonry, TR 149, National

Concrete Masonry Association, 2001, Concrete Masonry Basement Wall Construction, TEK 3-11, National Concrete Masonry Association, 2001 and Preventing Water Penetration in Below-Grade Concrete Masonry Walls, TEK 19-3A, National Concrete Masonry Association, 2001.

7. Steel tanks must meet the requirements of Underwriters Laboratory (UL) standards 1746 or 70.
 8. The tanks must be watertight after installation. The installer must demonstrate and certify in writing that the tank is watertight using one of the following methods:
 - a. Water-Pressure Testing -The tank must be sealed. The tank must be filled with water to a minimum level of 2 inches above the highest joint on the risers and allowed to stand for 24 hours. After the 24 hours have elapsed, the tank must be refilled to the original level and allowed to stand for 1 hour. The tank meets the requirements of this section if the water level remains constant for a minimum of 1 hour.
 - b. Vacuum Testing- The vacuum test must be performed prior to backfilling around the tank. The tank must be sealed. A vacuum equal to 4 inches (100 mm) of mercury must be applied to the tank. The tank meets the requirements of this section if 90 % of the applied vacuum is held for a minimum of 5 minutes.
 9. All inlet and outlet pipes must be connected to tanks by means of a sealed flexible joint connector. Use of any grouting is not permitted.
 10. Treatment tank access should be extended to grade. The access cover must be airtight. Grade level access covers must be secured by bolts or locking mechanisms, or have sufficient weight to prevent unauthorized access.
 11. Covers, connections and piping must be designed and constructed so as to withstand an anticipated minimum AASHTO H-10 loading.
 12. The septic tank must be installed using a minimum of 4 inches of sand, pea gravel or other similar suitable aggregate to bed the tank.
- B. Minimum Maintenance Standards:
1. Maintenance:
 - a. Pumping of the septic tank every three years or whenever measurement reveals that the tank is filled with solids in excess of one third of the liquid depth of the tank or with scum in excess of one third of the liquid depth of the tank.
 - b. Provision by the manufacturer of an operation and maintenance manual for the effluent filter to the permittee.

- c. Cleaning or replacement of the effluent filter according to the manufacturer's recommended maintenance schedule.
2. Inspection:
 - a. Measurement of sludge and scum depth as adequate to determine need for and frequency of pumping, unless pumping every three years is determined to be appropriate as the pumping frequency.
 - b. Inspection of tank, inlet and outlet baffles, and solids retainer every 3 years for structural integrity.

IV. SECONDARY TREATMENT

A. Performance standards

1. Secondary treatment components must have demonstrated a treatment level of less than or equal to 30 milligrams per liter (mg/L) biochemical oxygen demand (BOD₅) and total suspended solids (TSS) based upon the 95th percentile.
2. The minimum maintenance standards for each component in a treatment system must be listed on the permit issued by the local agency for the sewage facilities under Chapter 72, § 72.25 (relating to issuance of permits).
3. The plans, specifications, reports and supporting documentation submitted as part of the permit application become part of the permit.

B. Aerobic treatment unit.

In addition to the requirements of Chapter 73, Section 73.32, aerobic treatment units proposed for use in alternate systems must meet the following requirements:

1. For all installations, the rated treatment capacity shall meet or exceed the daily sewage flow as determined from Chapter 73, Section 73.17.
2. An effluent filter bearing the seal of NSF indicating testing and approval by that agency under Standard No. 46 shall be installed on the outlet of the aerobic treatment unit.
3. The aerobic tank shall be installed using a minimum of 4 inches of pea gravel, sand or other suitable aggregate to bed the tank.
4. Covers, connections and piping shall be designed and constructed so as to withstand an anticipated minimum AASHTO H-10 loading.
5. Minimum Maintenance Standards:

- a. Maintenance:
 - (1) Pump out of the aerobic treatment unit annually
 - (2) Provision by the manufacturer of an operation and maintenance manual for the effluent filter to the permittee.
 - (3) Cleaning or replacement of the effluent filter according to the manufacturer's recommended maintenance schedule
- b. Sampling: Sample collection annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results shall be sent to the municipality or other approved management entity.

C. Free access media filters (for secondary treatment).

An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for alternate system designs approved under this listing. All other system proposals under this listing must be submitted to DEP's regional office for review and comment.

- 1. Filter. The filter must be constructed in a tank meeting the following specifications:
 - a. The filter has a maximum loading rate of 5 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using a septic tank for initial treatment.
 - b. The filter has a maximum loading rate of 10 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using an aerobic tank for initial treatment.
 - c. Filter tanks must be watertight and made of a sound, durable material that is not subject to excessive corrosion or decay.
 - d. The filter tank must be installed using a minimum of 4 inches of pea gravel, sand or other suitable aggregate to bed the tank.
 - e. Concrete filter tanks must have a minimum wall thickness of 2 1/2 inches and be adequately reinforced.

- f. If precast concrete slabs are used as filter tank tops to support the access covers, the slabs must have a thickness of at least 3 inches and be adequately reinforced.
- g. Filter tanks must be designed and constructed so that the depth from the cover to the top of the media layer provides sufficient freeboard to allow for maintenance of the media surface.
- h. If the filter tank access is provided by a minimum of two round or square access openings, these access openings must be a minimum of 1,600 square inches in size and provide access to the entire surface of the filter. The tank wall may be set a maximum of 12 inches below final grade.

A single rectangular access opening may be used if the following requirements are met:

- (1) The minimum dimension of any access opening is greater than or equal to 36 inches.
- (2) For access openings with a dimension less than 60 inches, the inside of the tank wall is no greater than 18 inches from the edge of the opening in the direction of that dimension.
- (3) For access openings with a dimension greater than or equal to 60 inches, the inside of the tank wall is no greater than 36 inches from the edge of the opening in the direction of that dimension.
- (4) If more than one access opening is used, the distance between the openings is no greater than 36 inches.

- i. The access openings must be extended a minimum of 6 inches above final grade.
 - j. Access covers must be insulated against severe weather, secured by bolts or locking mechanisms, prevent water infiltration and the entrance of debris, and be lightweight to facilitate routine maintenance.
 - k. All inlet and outlet pipes must be connected to the filter tank by means of a sealed flexible joint connector. Use of any grouting is not permitted.
2. Media. A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, the testing results, the testing date, the amount of material purchased under this certification and the delivery date. All testing must be conducted within 90

days of the delivery date. The media to be supplied must meet the following specifications:

- a. The media must have an effective size of between 0.3 to 0.6 mm, a uniformity coefficient of less than 3.5 and less than 4% of the media passing the #100 sieve. The sieve analysis is conducted in accordance with the most recent revision of ASTM C 136 or AASHTO No. T27.
 - b. The media may not contain more than 3% by weight materials finer than the #200 sieve as determined using the most recent revision of ASTM C 117 or AASHTO No. T11.
3. Construction. The media filter must be constructed according to the following standards:
- a. A minimum 3-inch diameter perforated underdrain pipe with a minimum 2,500 pound crush test specification or meeting the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent (DWV) pipe is placed on the bottom of the tank.
 - b. Two rows of perforations between 1/2 to 3/4 inch in diameter must be drilled in the underdrain pipe at 6-inch intervals and the pipe must be placed so the perforations face downward and the rows are approximately 22.5° from bottom dead center.
 - c. All coarse aggregate must meet the following specifications:
 - (1) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
 - (2) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
 - (3) The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
 - (4) All coarse aggregate testing must be conducted within 1 year of the delivery date.
 - (5) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of

the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.

- (6) Coarse aggregate must be placed around the underdrain to a total depth of 5 inches from the bottom of the tank. The coarse aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
 - (7) A minimum depth of 4 inches of aggregate meeting the uniform size and grading requirements of AASHTO No. 8 must be placed over the aggregate underdrain material.
 - (8) The coarse aggregate must be covered by a geotextile material prior to placing the filter media.
- d. Media must be placed over the coarse aggregate to a depth of at least 24 inches.
 - e. The media in the filter may not be greater than 36 inches deep.
 - f. A high water alarm must be installed in the filter tank that produces an audible and visual alarm when effluent backs up on the filter surface to 12 inches above the surface of the media.
 - g. When two filters or chambers are required to treat septic tank effluent, the duplicate units may, at the discretion of the designer, be flooded alternately, periodically by using valves, or simultaneously.
 - h. The central distribution piping may not be more than 2 inches in diameter when using pressure distribution and must be designed and installed to convey a minimum 2-inch flood dose of effluent to the surface of the media filter. When using gravity distribution, the central distribution piping must be a minimum of 3 inches in diameter and installed level.
 - i. The height of the central distribution system's effluent outlet above the media surface must be sufficient to allow for the installation of a splash plate. When using pressure distribution, the height of the central distribution system's effluent outlet above the media surface must also be sufficient to allow for the maximum flooding depth of the media filter.
 - j. A splash plate made of concrete or other suitable material must be located under each effluent outlet to prevent scouring of the media surface.

- k. The filter must be capable of being isolated from the system by valves to perform maintenance.
- l. The tanks must be watertight after installation. The installer must demonstrate and certify in writing that the tank is watertight using one of the following methods:
 - (1) Water-Pressure Testing-The tank must be sealed. The tank must be filled with water to a minimum level of 2 inches above the highest joint on the risers and allowed to stand for 24 hours. After the 24 hours have elapsed, the tank must be refilled to the original level and allowed to stand for 1 hour. The tank meets the requirements of this section if the water level remains constant for a minimum of 1 hour.
 - (2) Vacuum Testing- The vacuum test must be performed prior to backfilling around the tank. The tank must be sealed. A vacuum equal to 4 inches (100 mm) of mercury must be applied to the tank. The tank meets the requirements of this section if 90 % of the applied vacuum is held for a minimum of 5 minutes.

4. Minimum Maintenance Standards:

a. Inspection at least annually to ensure that:

- (1) solids are not accumulated on the surface of the media.
- (2) effluent is not ponded over the media in excess of 12 inches.
- (3) the high water alarm is functional.
- (4) the surface of the media is raked and that media is replaced sufficient to maintain the filter media depth at a minimum of 24 inches.
- (5) the plumbing in the free access media filter tank is functional and free of leaks, and that the splash plates are in place.
- (6) the filter tank and cover are structurally sound and secured to inhibit unauthorized access, and that any insulation is in place and in good condition.
- (7) the area around the outside of the filter tank is free of ponded effluent and downgradient seepage.

b. Sampling: sample collection from the filter effluent annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results must be sent to the municipality or other approved management entity.

D. Buried media filters (for secondary treatment).

A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The buried media filter must be designed as set forth below.

1. Location.

- a. When buried media filters are proposed to be installed in areas where bedrock is encountered above the proposed depth of the media filter, or where the seasonal high groundwater table rises above the proposed depth of the media filter, the designer should consider measures to prevent filter and liner damage and groundwater infiltration.
- b. A buried media filter must be constructed in excavated native soil or clean stabilized fill.

2. Size.

- a. The filter must have a maximum loading rate of 0.8 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using a septic tank for initial treatment.
- b. The filter must have a maximum loading rate of 1.2 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using an aerobic tank for initial treatment.

3. Construction.

- a. All coarse aggregate must meet the following specifications:
 - (1) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.

- (2) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
- (3) The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
- (4) All coarse aggregate testing must be conducted within 1 year of the delivery date.
- (5) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
- (6) At least 2 inches of clean coarse aggregate must be placed surrounding underdrains and distribution pipes. The coarse aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
- (7) A minimum depth of 4 inches of aggregate must be placed over the aggregate underdrain material. Coarse aggregate used in the transition layer must meet the uniform size and grading requirements of AASHTO No. 8. A layer of porous geotextile material may be placed on top of both layers of aggregate to prevent migration of soil or media into the aggregate.
- (8) The coarse aggregate must be covered by a geotextile material prior to placing the filter media.

- b. At least 24 inches of media must be used. All media must meet the following specifications:
 - (1) All media testing must be conducted within 90 days of the delivery date.
 - (2) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.

- (3) The media must consist of fine aggregate meeting the uniform size and grading requirements for fine aggregate in the most recent revision of ASTM C 33.
 - (4) The media may not contain more than 3% by weight materials finer than the #200 sieve as determined using the most recent revision of ASTM C 117 or AASHTO No. T11.
- c. The minimum depth of earth cover over the coarse aggregate in all installations must be 12 inches. When the top of the aggregate is less than 12 inches from the undisturbed soil surface, the soil cover must extend beyond the filter area by at least 3 feet on all sides. The soil over the media filter must be so graded that surface water will run off, consist of soil suitable for the growth of vegetation and be seeded to control erosion.
- d. Underdrain piping.
- (1) A minimum 3-inch diameter perforated underdrain pipe with a minimum 2,500 pound crush test specification or meeting the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent pipe must be placed on the bottom of the tank.
 - (2) Underdrain piping must be laid on a grade of 3 to 6 inches per 100 feet sloped to the outfall pipe.
 - (3) Underdrain piping must be positioned between the distribution laterals to maximize effluent travel through the filter media.
 - (4) Underdrain piping holes must be equal or greater in number and size to the distribution piping holes.
 - (5) Underdrain piping must have two rows of holes placed at approximately 22.5° angle from bottom dead center along the bottom half of the pipe.
 - (6) The outfall pipe from the underdrain header must have an antiseep collar and bentonite clay plug or a leak proof boot sealed as per manufacturer's instructions to the subsurface media filter liner.
- e. The base of the filter must be sloped to the underdrain pipe a maximum of 1%. An impervious liner of hyplon, polyvinyl chloride or polyethylene sheeting of 20 mil thickness or equal must be installed on a tamped earth base to prevent seepage to the groundwater. A concrete bottom and sides may also be used at the discretion of the designer. A 2-inch layer of sand or a layer of 10-ounce porous geotextile material must be provided on

each side of the liner to prevent punctures and tears. Seams must be made according to manufacturer's specifications.

- f. Distribution of effluent. The effluent must be distributed to the buried media filter using pressure distribution.

4. Minimum Maintenance Standards:

- a. Inspection: inspection annually of the area around the outside of the media filter to ensure that there is no ponding of effluent or downgradient seepage.
- b. Sampling: sample collection from the filter effluent annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results must be sent to the municipality or other approved management entity.

V. ADVANCED TREATMENT

A. Performance standards.

- 1. Advanced treatment components must have demonstrated a treatment level of less than or equal to 10 milligrams per liter (mg/L) biochemical oxygen demand (BOD₅) and total suspended solids (TSS) based upon the 95th percentile.
- 2. The minimum maintenance standards for each component in a treatment system must be listed on the permit issued by the local agency for the sewage facilities under §72.25 (relating to issuance of permits). Any treatment system for which a permit was issued prior to the effective date of this guidance must be operated and maintained, at a minimum, in accordance with the minimum maintenance standards applicable to the components of that system as detailed in this guidance.
- 3. The plans, specifications, reports and supporting documentation submitted as part of the permit application must become part of the permit.

B. Recirculating subsurface media filter

A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The recirculating subsurface filter (RSF) must be designed as set forth below.

- 1. Location:

An RSF must not be installed in areas where bedrock is found at a depth less than the proposed depth of the media filter. However, an RSF can be installed when the seasonal high groundwater table rises above the bottom of the media filter if a suitable synthetic liner which will prevent sewage exfiltration or groundwater infiltration is included in the design.

2. Size:

- a. The filter must have a maximum loading rate of 1.3 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73 when using a septic tank for initial treatment.
- b. The filter must have a maximum loading rate of 2 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73 when using an aerobic tank for initial treatment.

3. Construction:

- a. Coarse aggregate: All coarse aggregate must meet the following specifications:

- (1) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
- (2) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
- (3) The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
- (4) All coarse aggregate testing must be conducted within 1 year of the delivery date.
- (5) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.

- (6) At least 2 inches of clean coarse aggregate must surround underdrains and distribution pipes. The aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
 - (7) A 3-inch layer of clean coarse aggregate must be placed on the top of the underdrain aggregate to help prevent migration of the media into the aggregate. The aggregate must meet AASHTO No. 8 size and grading requirements.
 - (8) The coarse aggregate must be covered with geotextile material prior to placing the filter media.
- b. Media: At least 24 inches of media must be used. All media must meet the following specifications:
- (1) All media testing must be conducted within 90 days of the delivery date.
 - (2) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - (3) The media must consist of fine aggregate meeting the uniform size and grading requirements for fine aggregate in ASTM C 33.
 - (4) The media may not contain more than 3% by weight materials finer than the #200 sieve as determined using the most recent revision of ASTM C 117 or AASHTO No. T11.
- c. Cover Soil: A layer of geotextile material must be placed over the coarse aggregate followed by a minimum of 12 inches of cover soil material in all installations. Ponding observation ports must be installed to the top of the coarse aggregate through the cover soil material. The cover soil over the media filter must consist of soil suitable for growth of vegetation, be seeded to control erosion, and be graded so that surface water will run off.
- d. Underdrain Piping:
- (1) A minimum 3-inch diameter perforated underdrain pipe with a minimum 2,500 pound crush test specification or meeting the requirements of the most recent revision of ASTM D 2665 for

polyvinyl chloride (PVC) drain, waste and vent pipe must be placed on the bottom of the tank.

- (2) Underdrain piping must be laid on a grade of 3 to 6 inches per 100 feet, sloped to the outfall pipe. Piping must be placed between the distribution laterals to optimize effluent travel through the filter media.
 - (3) Underdrain piping holes must be equal to or greater in number and size to the distribution piping holes. The underdrain piping must have two rows of holes placed at approximately 22.5° angles from bottom dead center along the bottom half of the pipe.
 - (4) The required effluent recirculation to outfall drain ratio is 3:1. This ratio can be achieved by one of the following methods or equivalent:
 - (i) The underdrain is divided by an 8-inch high baffle placed under the liner and perpendicular to the long sidewall of the filter. Seventy-five percent of the effluent collected by the underdrain must be recirculated back to the RSF dose tank through a T-configured underdrain pipe and gravity discharge pipe. The remaining 25% of the effluent must be collected by an underdrain pipe set parallel to the baffle with gravity discharge to the disinfection unit (if required) or to the absorption area.
 - (ii) A typical flow splitter may be installed so that 75% of the effluent collected by the underdrain is recirculated back to the RSF dose tank. The remaining 25% must be conveyed by gravity to the disinfection unit (if required) or to the absorption area.
 - (5) Underdrain piping must have a cleanout extended to grade at a minimum of 1 foot from the sidewall and baffle.
- e. Filter Base and Liner: The base of the filter must be sloped at a 1% minimum slope to the underdrain pipe. An impervious liner of hyplon, polyvinyl chloride (PVC) or polyethylene sheeting of a minimum of 20 mil thickness or equal must be installed on a tamped earth base to prevent seepage to the groundwater. A 2-inch layer of sand or a layer of 10-ounce porous geotextile material must be placed on each side of the liner to prevent punctures and tears. Seams must be made according to the liner manufacturer's specifications.
 - f. The RSF dose tank must be installed using a minimum of 4 inches of pea gravel, sand or other suitable aggregate to bed the tank.

- g. All inlet and outlet pipes must be connected to tanks by means of a sealed flexible joint connector. Use of any grouting is not permitted.
- h. The tanks must be watertight after installation. The installer must demonstrate and certify in writing that the tank is watertight using one of the following methods:
 - (1) Water-Pressure Testing -The tank must be sealed. The tank must be filled with water to a minimum level of 2 inches above the highest joint on the risers and allowed to stand for 24 hours. After the 24 hours have elapsed, the tank must be refilled to the original level and allowed to stand for 1 hour. The tank meets the requirements of this section if the water level remains constant for a minimum of 1 hour.
 - (2) Vacuum Testing- The vacuum test must be performed prior to backfilling around the tank. The tank must be sealed. A vacuum equal to 4 inches (100 mm) of mercury must be applied to the tank. The tank meets the requirements of this section if 90 % of the applied vacuum is held for a minimum of 5 minutes.

4. Minimum Maintenance Standards.

- a. Inspection: inspection annually of the area around the outside of the media filter to ensure that there is no ponding of effluent or downgradient seepage.
- b. Sampling: sample collection from the filter effluent annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results must be sent to the municipality or other approved management entity.

C. Free access media filters (for advanced treatment).

A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The free access media filter must be designed as set forth below.

- 1. Filter. The filter must be constructed in a tank meeting the following specifications:

- a. The filter must have a maximum loading rate of 1.25 gallons per day per square foot of filter surface area, based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using a septic tank for initial treatment.
- b. The filter must have a maximum loading rate of 2 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using an aerobic tank for initial treatment.
- c. Filter tanks must be watertight and made of a sound, durable material that is not subject to excessive corrosion or decay.
- d. The tank must be installed using a minimum of 4 inches of pea gravel, sand or other suitable aggregate to bed the tank.
- e. Concrete filter tanks must have a minimum wall thickness of 2 1/2 inches and be adequately reinforced.
- f. If precast concrete slabs are used as filter tank tops to support the access covers, the slabs must have a thickness of at least 3 inches and be adequately reinforced.
- g. Filter tanks must be designed and constructed so that the depth from the cover to the top of the media layer provides sufficient freeboard to allow for maintenance of the media surface.
- h. If the filter tank access is provided by a minimum of two round or square access openings, these access openings must be a minimum of 1,600 square inches in size and provide access to the entire surface of the filter. The tank wall must be set at a maximum of 12 inches below final grade.

A single rectangular access opening may be used if the following requirements are met:

- (1) The minimum dimension of any access opening is greater than or equal to 36 inches.
- (2) For access openings with a dimension less than 60 inches, the inside of the tank wall is no greater than 18 inches from the edge of the opening in the direction of that dimension.
- (3) For access openings with a dimension greater than or equal to 60 inches, the inside of the tank wall is no greater than 36 inches from the edge of the opening in the direction of that dimension.

- i. If more than one access opening is used, the distance between the openings is no greater than 36 inches.
 - j. The access openings must be extended a minimum of 6 inches above final grade.
 - k. Access covers must be insulated against severe weather, secured by bolts or locking mechanisms, prevent water infiltration and the entrance of debris, and be lightweight to facilitate routine maintenance.
 - l. All inlet and outlet pipes must be connected to tanks by means of a sealed flexible joint connector. Use of any grouting is not permitted.
2. Media. A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date. All testing must be conducted within 90 days of the delivery date. The media supplied must meet the following specifications:
- a.. The media must have an effective size of between 0.3 to 0.6 mm, a uniformity coefficient of less than 3.5 and less than 4% of the aggregate passing the #100 sieve. The sieve analysis must be conducted in accordance with the most recent revision of ASTM C 136 or AASHTO No. T27.
 - b.. The media may not contain more than 3% by weight materials finer than the #200 sieve as determined using the most recent revision of ASTM C 117 or AASHTO No. T11.
3. Construction. The media filter must be constructed according to the following standards:
- a. A minimum 3-inch diameter perforated underdrain pipe with a minimum 2,500 pound crush test specification or meeting the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent (DWV) pipe must be placed on the bottom of the tank.
 - b. Two rows of perforations between 1/2 to 3/4 inch in diameter must be drilled in the underdrain pipe at 6-inch intervals and the pipe must be placed so the perforations face downward and the rows are approximately 22.5° from bottom dead center.
 - c. All coarse aggregate must meet the following specifications:

- i. The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
 - ii. The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
 - iii. The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
 - iv. All coarse aggregate testing must be conducted within 1 year of the delivery date.
 - v. A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - vi. Coarse aggregate must be placed around the underdrain to a total depth of 5 inches from the bottom of the tank. The coarse aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
 - vii. A minimum depth of 4 inches of aggregate meeting the uniform size and grading requirements of AASHTO No. 8 must be placed over the aggregate underdrain material.
 - viii. The coarse aggregate must be covered by a geotextile material prior to placing the filter media.
- d. Media must be placed over the coarse aggregate to a depth of at least 24 inches.
 - e. The media in the filter may not be greater than 36 inches deep.
 - f. A high water alarm that produces an audible and visual alarm when effluent backs up on the filter surface to 12 inches above the surface of the media must be installed in the filter tank.

- g. When two filters or chambers are required to treat septic tank effluent, the duplicate units may, at the discretion of the designer, be flooded alternately, periodically by using valves, or simultaneously.
- h. The central distribution piping may not be more than 2 inches in diameter when using pressure distribution and must be designed and installed to convey a minimum 2-inch flood dose of effluent to the surface of the media filter. When using gravity distribution, the central distribution piping must be a minimum of 3 inches in diameter and installed level.
- i. The height of the central distribution system's effluent outlet above the media surface must be sufficient to allow for the installation of a splash plate. When using pressure distribution, the height of the central distribution system's effluent outlet above the media surface must also be sufficient to allow for the maximum flooding depth of the media filter.
- j. A splash plate made of concrete or other suitable material must be located under each effluent outlet to prevent scouring of the media surface.
- k. The filter must be able to be isolated from the system to perform maintenance.
- l. The tanks must be watertight after installation. The installer must demonstrate and certify in writing that the tank is watertight using one of the following methods:
 - i. Water-Pressure Testing- The tank must be sealed. The tank must be filled with water to a minimum level of 2 inches above the highest joint on the risers and allowed to stand for 24 hours. After the 24 hours have elapsed, the tank must be refilled to the original level and allowed to stand for 1 hour. The tank meets the requirements of this section if the water level remains constant for a minimum of 1 hour.
 - ii. Vacuum Testing- The vacuum test must be performed prior to backfilling around the tank. The tank must be sealed. A vacuum equal to 4 inches (100 mm) of mercury must be applied to the tank. The tank meets the requirements of this section if 90 % of the applied vacuum is held for a minimum of 5 minutes.

4. Minimum Maintenance Standards:

- a. Inspection: at least annually to ensure that:
 - i. solids are not accumulated on the surface of the media.

- ii. effluent is not ponded over the media in excess of 12 inches.
 - iii. the high water alarm is functional.
 - iv. the surface of the media is raked and that media is replaced sufficient to maintain the filter media depth at a minimum of 24 inches.
 - v. the plumbing in the free access media filter tank is functional and free of leaks, and that splash plates are in place.
 - vi. the filter tank and cover are structurally sound and secured to inhibit unauthorized access, and that any insulation is in place and in good condition.
 - vii. the area around the outside of the filter tank is free of ponded effluent and downgradient seepage.
- b. Sampling: sample collection from the filter effluent annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results must be sent to the municipality or other approved management entity.

D. Buried media filters (for advanced treatment)

A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The buried media filter must be designed as set forth below.

1. Location.
 - a. When buried media filters are proposed to be installed in areas where bedrock is encountered above the proposed depth of the media filter, or where the seasonal high groundwater table rises above the proposed depth of the media filter, the designer should consider measures to prevent filter and liner damage and groundwater infiltration.
 - b. A buried media filter must be constructed in excavated native soil or clean stabilized fill.

2. Size.
 - a. The filter must have a maximum loading rate of 0.67 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using a septic tank for initial treatment.
 - b. The filter must have a maximum loading rate of 1.0 gallons per day per square foot of filter surface area based on the maximum daily sewage flows as determined from Chapter 73, Section 73.17 when using an aerobic tank for initial treatment.
3. Construction.
 - a. All coarse aggregate must meet the following specifications:
 - (1) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
 - (2) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
 - (3) The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
 - (4) All coarse aggregate testing must be conducted within 1 year of the delivery date.
 - (5) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - (6) At least 2 inches of clean coarse aggregate must be placed surrounding underdrains and distribution pipes. The coarse aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.

- (7) A minimum depth of 4 inches of aggregate must be placed over the aggregate underdrain material. Coarse aggregate used in the transition layer must meet the uniform size and grading requirements of AASHTO No. 8. A layer of porous geotextile material may be placed on top of the upper layer of aggregate to prevent migration of soil or media into the aggregate.
 - (8) The coarse aggregate must be covered by a geotextile material prior to placing the filter media.
- b. At least 24 inches of media must be used. All media must meet the following specifications:
- (1) All media testing must be conducted within 90 days of the delivery date.
 - (2) A written certification from the supplier must be provided to the sewage enforcement officer and permittee that includes the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - (3) The media must consist of fine aggregate meeting the uniform size and grading requirements for fine aggregate in the most recent revision of ASTM C 33.
 - (4) The media may not contain more than 3% by weight materials finer than the #200 sieve as determined using the most recent revision of ASTM C 117 or AASHTO No. T11.
- c. The minimum depth of earth cover over the coarse aggregate in all installations must be 12 inches. When the top of the aggregate is less than 12 inches from the undisturbed soil surface, the soil cover must extend beyond the filter area by at least 3 feet on all sides. The soil over the media filter must be so graded that surface water will run off, consist of soil suitable for the growth of vegetation and be seeded to control erosion.
- d. Underdrain piping.
- (1) A minimum 3-inch diameter perforated underdrain pipe with a minimum 2,500 pound crush test specification or meeting the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent pipe must be placed on the bottom of the tank.
 - (2) Underdrain piping must be laid on a grade of 3 to 6 inches per 100 feet sloped to the outfall pipe.

- (3) Underdrain piping must be positioned between the distribution laterals to maximize effluent travel through the filter media.
 - (4) Underdrain piping holes must be equal or greater in number and size to the distribution piping holes.
 - (5) Underdrain piping must have two rows of holes placed at approximately 22.5° angle from bottom dead center along the bottom half of the pipe.
 - (6) The outfall pipe from the underdrain header must have an antiseep collar and bentonite clay plug or a leak proof boot sealed as per manufacturer's instructions to the subsurface media filter liner.
- e. The base of the filter must be sloped to the underdrain pipe a maximum of 1%. An impervious liner of hypalon, polyvinyl chloride or polyethylene sheeting of 20 mil thickness or equal must be installed on a tamped earth base to prevent seepage to the groundwater. A concrete bottom and sides may also be used at the discretion of the designer. A 2-inch layer of sand or a layer of 10-ounce porous geotextile material must be provided on each side of the liner to prevent punctures and tears. Seams must be made according to manufacturer's specifications.
- f. Distribution of effluent. The effluent must be distributed to the buried media filter using pressure distribution.

4. Minimum Maintenance Standards:

- a. Inspection: inspection annually of the area around the outside of the media filter to ensure that the area is free of ponded effluent and downgradient seepage.
- b. Sampling: sample collection from the filter effluent annually by the maintenance provider and analysis by a certified laboratory for BOD₅ and TSS. A copy of the sample results must be sent to the municipality or other approved management entity.

F. Peat Filter

An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for alternate system designs approved under this listing. All other system proposals under this listing must be submitted to DEP's regional office for review and comment.

Peat filter configurations consist of an aerobic or septic tank followed by a peat filter as described in this listing.

1. General Requirements

a. System Requirements

Peat filters produced by different manufacturers vary in unit sizing, loading rate, installation methods and maintenance requirements. The peat filter components chosen for use must be installed and sized in accordance with the specific manufacturer's written installation specifications and recommended loading rates. A copy of the manufacturer's sizing, installation and operation and maintenance information must be attached to the permit application and provided to the end user.

b. Distribution of effluent from the septic tank or aerobic tank to the peat filter may be by gravity flow or pressure distribution. If a pump is required to lift effluent to the peat filter, a timed dose is required.

c. The peat filter must be watertight and all outlets properly sealed. Where a liner is used, the liner must be 20 mil thick hyplon, polyvinyl chloride or polyethylene sheeting placed on 2 inches of sand or a layer of 10 ounce porous textile material to prevent punctures and tears. The liner must be extended to the surface and any inlets or outlets at or below the water table or at or below the water level in the unit must have an anti-seep collar, bentonite clay plug or leak-proof boot sealed to the liner material.

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d. Minimum Maintenance Standards

(1) Maintenance:

- (i) Provision by the manufacturer or company of an operation and maintenance manual for the peat filter components to the permittee.
- (ii) Provision of the specific company's warranty for the peat filter attached to the permit application, permit and purchase agreement. This warranty must clearly notify the property owner of the need to replace the peat within the life expectancy period established by the company and to provide access to the filter for the annual inspection.
- (iii) Periodic replacement of peat in accordance with the manufacturer's approved schedule.

(2) Inspection: conducted annually in accordance with the manufacturer's and NSF requirements of septic tanks, aerobic tanks, dosing tanks, and lift pump tanks for structural integrity of the tank, inlet and outlet baffles, solids retainer, pumps, siphons and electrical connections.

(3) Sampling: collected annually by the maintenance provider following the disinfection unit and analyzed by a certified laboratory for BOD and TSS to determine compliance with the performance standard. Provision of results, plus documentation of the most recent inspection of the system by the maintenance entity established under Chapter 72, Section 72.25(h), at least annually to the municipality or other approved maintenance entity.

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2. Absorption areas

- a. Where the percolation rate is in the range of 3 to 120 minutes per inch (min/in), inclusive, up to a 1/3 reduction in the size of the absorption area is allowed. However, where the percolation rate is in the range of 121 to 180 min/in, inclusive, no reduction in absorption area sizing is permitted.
- b. Where sizing reductions are proposed, they are not cumulative. No additional sizing reduction is allowed for use of either an aerobic tank or infiltration chambers.
- c. If sizing reductions are proposed, where the system is used to serve a new dwelling, the site evaluations must document that sufficient area is

available for installation of a full-sized absorption area (prior to the calculation of the 1/3 reduction).

- d. For repairs, system sizing must be maximized up to the square footage of a full-sized system.
- e. An equivalent number of self-contained peat filters to treat the proposed flows may be used in place of an intermittent sand filter (Chapter 73, Section 73.162) for individual residential spray irrigation systems permitted by the local agency.
- f. A self-contained, sealed bottom peat filter, with final treatment and disposal using a separate subsurface sand filter designed in accordance with Section 73.54 and the regulations referenced in that section, may be used, except that 12 inches of the sand in the filter may be eliminated. No reduction in absorption area sizing is allowed.

VI. UV DISINFECTION

A. Performance standards.

1. Disinfection components must have demonstrated a treatment level of less than 200 fecal coliform organisms per 100 milliliters in a single sample based upon the 95th percentile.
2. Disinfection components must be constructed in accordance with this section unless one of the following conditions is met:
 - a. The component design has been submitted for review and classification under Chapter 73, § 73.72 (relating to alternate sewage systems) or § 73.71 (relating to experimental sewage systems).
 - b. The component is permitted under the technology verification process.
3. The minimum maintenance standards for each component in a treatment system must be listed on the permit issued by the local agency for the sewage facilities under Chapter 72, §72.25 (relating to issuance of permits). Any treatment system for which a permit was issued prior to the effective date of this guidance must be operated and maintained, at a minimum, in accordance with the minimum maintenance standards applicable to the individual components of that system as detailed in this guidance.
4. The plans, specifications, reports and supporting documentation submitted as part of the permit application must become part of the permit.

B. Ultraviolet Radiation Equipment Specifications.

1. Ultraviolet radiation at a level of 254 nanometers must be applied at a minimum dosage of 25,000 microwatt-seconds per square centimeter at all points throughout the water disinfection chamber. However, a higher dosage may be required based on the specific transmittance of the wastewater. In lieu of determining the specific transmittance level of the wastewater, a dosage of 30,000 to 35,000 microwatt-seconds per square centimeter should be provided.
2. The maximum water depth in the chamber, measured from the tube surface to the chamber wall, must not exceed 3 inches.
3. The ultraviolet tubes must be jacketed so that a proper operating tube temperature of approximately 104°F is maintained. The jacket must be made of quartz or high-silica glass with similar optical characteristics.
4. The units must be designed to permit frequent mechanical cleaning of the water contact surface of the jacket without disassembly of the unit.
5. An automatic flow control valve, accurate within the expected pressure range, must be installed to restrict flow to the maximum design flow of the treatment unit.
6. Minimum Maintenance Standards:
 - a. Maintenance:
 - (ii) Monthly mechanical cleaning of the water contact surface.
 - (iii) Replacement of UV tubes at least annually.
 - (iv) Availability of a spare UV tube and other necessary equipment to allow prompt repair of the ultraviolet unit by qualified personnel instructed in the operation and maintenance of the equipment.
 - b. Sampling: collection annually of a sample for fecal coliforms from the dosing tank by the maintenance provider and sent to a certified laboratory for analysis. A copy of the sample results must be sent to the municipality or other approved maintenance entity.

VII. DOSING AND DISTRIBUTION REQUIREMENTS

A. General.

1. Effluent from the treatment unit must be discharged to a dosing tank, to a distribution box or directly to an absorption area in accordance with the requirements of the appropriate sections of Chapter 73.
- 2.. Connections of lines to tanks and distribution boxes must be made using watertight mechanical seals. Use of any grouting material is not permitted.
- 3.. All distribution piping must meet a minimum 2,500 pound crush test specification or meet the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent pipe.
- 4.. The minimum maintenance standards for each component in a treatment system must be listed on the permit issued by the local agency for the sewage facilities under Chapter 72, § 72.25 (relating to issuance of permits).
6. The plans, specifications, reports and supporting documentation submitted as part of the permit application must become part of the permit.

B. Dosing tanks.

1. Dosing tanks must be constructed to the requirements of Chapter 73, Section 73.45, and the requirements listed in Section III.A of this guidance.

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e. For all systems other than individual residential spray irrigation systems, the dosing tank must be designed so that the estimated daily flow must be discharged to the absorption area in two or more doses. The dose volume must be five times the internal liquid capacity of the manifold and laterals plus the internal liquid capacity of the delivery line. When a siphon is used in a pressure distribution system, the minimum dose volume must be large enough to keep the entire distribution system full for at least 3 to 5 minutes.

2. Minimum Maintenance Standards:
 - a. Maintenance: Pumping of the dosing tank whenever the septic tank or aerobic tank is pumped.
 - b. Inspection: Annual inspection of the dosing tank for structural integrity.

C. Dosing pumps, siphons and lift pumps.

1. All dosing pumps, siphons and lift pumps used for all onlot sewage treatment systems must meet the specifications set forth in Chapter 73, Section 73.46

2. Unless a pitless adapter is used, a disconnect must be incorporated into the piping within the tank for ease of pump removal. The disconnect must be located no lower than 18 inches below the top of the tank cover.
3. Minimum maintenance standards:
 - a. Maintenance: Testing annually by the maintenance provider of all operation level switches and all alarms associated with the distribution system.
 - b. Inspection: Annual inspection by the maintenance provider of all pumps and siphons installed in the system.

D. Flow Equalization

Non-residential facilities with regular, predictable, fluctuating flows (alternating high and low flows) may benefit from this design. Tanks, controls and dosing equipment are used to equalize the maximum flows. The following conditions apply:

1. Flow equalization tanks must be constructed in accordance with the requirements for septic tanks set forth in Chapter 73, Section 73.31. In addition:
 - a. Tanks having a capacity in excess of 5,000 gallons may be constructed onsite to meet the standards of the National Concrete Masonry Association for reinforcement and waterproofing. These standards are contained in Basement Manual, Design and Construction Using Concrete Masonry, TR 149, National Concrete Masonry Association, 2001, Concrete Masonry Basement Wall Construction, TEK 3-11, National Concrete Masonry Association, 2001 and Preventing Water Penetration in Below-Grade Concrete Masonry Walls, TEK 19-3A, National Concrete Masonry Association, 2001.
 - b. Steel tanks must meet the requirements of Underwriters Laboratory (UL) standards 1746 or 70.
2. The tanks must be watertight after installation. The installer must demonstrate and certify in writing that the tank is watertight using one of the following methods:
 - a. Water-Pressure Testing-The tank must be sealed. The tank must be filled with water to a minimum level of 2 inches above the highest joint on the risers and allowed to stand for 24 hours. After the 24 hours have elapsed, the tank must be refilled to the original level and allowed to stand for 1 hour. The tank meets the requirements of this section if the water level remains constant for a minimum of 1 hour.

- b. Vacuum Testing- The vacuum test must be performed prior to backfilling around the tank. The tank must be sealed. A vacuum equal to 4 inches (100 mm) of mercury must be applied to the tank. The tank meets the requirements of this section if 90 % of the applied vacuum is held for a minimum of 5 minutes.
3. The tank must be installed using a minimum of 4 inches of pea gravel, sand or other suitable aggregate to bed the tank.
4. The system designer has flexibility regarding where in the treatment process the flow equalization will occur (preceding or following the treatment tank). If flow equalization occurs before the treatment tank, the treatment tank capacity may be reduced appropriately. If equalization is to occur following the treatment tank, all flows must be treated in a septic or aerobic tank system that is designed for maximum flow (no size reduction) and must be discharged to an equalization tank specifically designed to meet the needs of the proposed facility.
5. The effluent is discharged from the tank in a timed, controlled volume that is lower than the maximum flow for the facility but sufficient to balance inflow and outflow over an extended period.
6. The equalization tank and discharge rate must be designed and established based upon the flow pattern of the facility; discharging a stabilized daily rate to the absorption area allows for reduction of the absorption area.
7. Since the effects of sustained maximum usage of an absorption area are unknown, the absorption area must be sized for the controlled daily volume plus 15-20%.
8. If flow equalization is proposed for an existing facility, proposals must include maximum daily water consumption volumes collected over a 1-year period with the highest consecutive 7-day period highlighted. If the proposal is for a new facility, flow data from an equivalent facility is also acceptable. If flow data from an equivalent facility are not available for a new facility, flows are calculated using Chapter 73. Where Chapter 73 does not list flow figures for the specific facility type, flows may be calculated using normally accepted engineering practices.
9. All inlet and outlet pipes must be connected to tanks by means of a sealed flexible joint connector. Use of any grouting is not permitted.
10. Covers, connections and piping must be designed and constructed so as to withstand an anticipated minimum AASHTO H-10 loading.

11. Minimum Maintenance Standards:

Annual inspection of the flow equalization tank for structural integrity.

VIII. ABSORPTION AREAS

A. General.

The absorption area selected for use must be designed in accordance with the applicable provisions of Chapter 73 and with the following requirements:

1. All distribution piping in the system must be marked with utility tape or other similar material detectable using a metal detector as a means of identifying the exact location of the distribution piping after the final cover is placed over the area.
2. All piping used in the absorption area must meet a minimum 2,500 pound crush test specification or meet the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain, waste and vent pipe.
3. Leaching chambers must be constructed of plastic and may be installed in trenches or beds as a substitute for aggregate. If a site is otherwise suitable for installation of an onlot system using an absorption area for final treatment and disposal of sewage effluent (including elevated sand mounds), leaching chambers may be installed with an up to 1/3 reduction in the size of the absorption areas when all of the following standards are met. In conformance with Chapter 73, Section 73.16(d), only the bottom area of the bed or trench may be used in calculating absorption area requirements. No additional size reduction is allowed for leaching chamber designs when these chambers are used in conjunction with secondary treatment units, advanced treatment units, composting toilets or other system components that would otherwise allow for sizing reductions.
 - a. Soil profile evaluation and percolation tests must document that there is sufficient area for installation of a full-sized absorption area (prior to the calculation of the up to 1/3 reduction).
 - b. The property owner must be provided with a 5-year warranty from the manufacturer of the chamber.
 - c. The leaching chamber system must be installed in accordance with all applicable specifications and appropriate general installation requirements listed in the individual manufacturer's chamber design guidelines.
 - d. The dimension of each chamber product is fixed. Designs incorporating chambers must be in length increments of the selected chamber. No

cutting, drilling or otherwise damaging a chamber is allowed. Endplates may be drilled according to manufacturer's installation guidelines to accept pressurized distribution pipe.

- e. All chambers in absorption areas must be marked with utility tape or other similar material detectable using a metal detector as a means of identifying the exact location of the chamber after the final cover is placed over the area.
 - f. All chambers should be certified to withstand the AASHTO H-10-44 highway structural rating or ASTM C-857 Design Load A-8 without damage or permanent deformation.
4. Separate Greywater Treatment: Onlot sewage treatment designs that include "blackwater" components such as composting, chemical, recycling and incinerating toilets or privies (proposed in conjunction with water under pressure), must meet the following conditions for the additional treatment of greywater:
- a. An onlot system meeting Chapter 73 standards or other approved method of sewage disposal must be installed to treat greywater flow from the structure. Septic tank installations must consist of either a two-compartment rectangular tank or two rectangular tanks in series and must be in conformance with Chapter 73, Section 73.31. Aerobic tanks used must be in compliance with Chapter 73, Section 73.32.
 - b. Only the absorption area may be reduced by up to 40 percent as a compensation for the use of a non-flush toilet alternative. No reduction of septic tank sizing is allowed.
 - c. If planning is required, general soil and site suitability must be conducted in accordance with Chapter 71, Section 71.62.
 - d. When a blackwater treatment system is proposed for use in conjunction with a greywater system in a subdivision, the provisions of Chapter 71, Section 71.63(f)(1) apply. The site and soil suitability testing must be sufficient to document the availability of an area for a full-sized system.
 - e. An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for systems approved under this listing.

5. Alternate Aggregates

Alternate aggregate materials may be substituted for the aggregates specified in Chapter 73, as described below.

a. Round Natural Aggregate and Tire Chip Derived Aggregate

Round, "Type C" coarse aggregate or tire chip derived aggregate may be used as an alternate material in the construction of absorption areas when all of the following criteria are met:

- (i) Third party certification is provided by an AASHTO/ASTM certified commercial soil testing laboratory demonstrating that the supplied material conforms to the specified aggregate requirements. The aggregate must meet AASHTO No. 3, 467, 5 or 57 size and grading requirements, or fall within the outer boundaries of sieve testing for each sieve size category.
- (ii) The supplier provides written certification with the bill of lading for each first load delivered to the site, and for each aggregate type, that the aggregate meets the minimum requirements. A copy of each certification must be attached to the permit.
- (iii) The permit application must be checked "alternate" and the words "coarse aggregate" must be placed in the space following the word "alternate."
- (iv) No DEP review is required.

b. Glass Cullet Aggregate

DEP has determined that coarse aggregate composed of cullet glass may be used as an alternate material in the construction of free-access intermittent sand filters (Chapter 73, Section 73.162(b)) as a replacement for the aggregate specified in Section 73.162(b)(4)(iv), as a replacement for the coarse aggregate or as a replacement for the pea gravel when all of the following criteria are met:

- (i) Third party certification is provided by an AASHTO/ASTM certified commercial soil testing laboratory demonstrating that the supplied material conforms to the specified aggregate requirements. The aggregate must meet AASHTO No. 8 size and grading requirements.
- (ii) The supplier provides written certification with the bill of lading for each first load delivered to the site that the aggregate meets the

minimum requirements. A copy of the certification must be attached to the permit.

(iii) The permit application must be checked “alternate” and the words “coarse aggregate” must be placed in the space following the word “alternate.”

(iv) No DEP review is required.

c. Alternate Fine Aggregate (Sand)

Recycled glass fine aggregate prepared to meet the regulatory size and grading specifications for fine aggregate has been found to be an acceptable alternate material for use in place of conventional fine aggregate in onlot sewage treatment facilities.

In system designs that do not have a regulatory requirement for the material to be obtained from a Pennsylvania Department of Transportation (PADOT) certified stockpile (intermittent sand filter - §73.162(b)(2)(i) and (ii); free access gravity sand filter and recirculating sand filter), ground recycled glass that meets the referenced size and grading specifications may be used as a direct replacement for fine aggregate.

In system designs that have a regulatory requirement for the material to be obtained from a PADOT certified stockpile (ESMs and buried sand filters - §73.55(c)), recycled glass fine aggregate may be used without being obtained from a PADOT certified stockpile when:

- (i) Third party certification is provided by an AASHTO/ASTM certified commercial soil testing laboratory demonstrating that the supplied material conforms to the specified aggregate requirements. The aggregate must meet the size and grading requirements of one of the following fine aggregate categories: Cement Concrete Sand Type A, Bituminous Concrete Sand Type B #1, Bituminous Concrete Sand Type B #3, or ASTM C 33.
- (ii) The supplier provides written certification with the bill of lading for each first load delivered to the site, and for each different aggregate type for which crushed recycled glass is used. A copy of each certification must be attached to the permit.
- (iii) The permit application must be checked “alternate” and the words “Fine aggregate” must be placed in the space following the word “alternate.”
- (iv) Suppliers of crushed glass must maintain third party certification records indicating that their stockpile(s) conforms to each aggregate/type

requirements for which their crushed recycled glass is being supplied. In some cases, this may require that the suppliers take measures to prevent loss of fines, or the segregation of aggregates by natural forces, or to protect against other deleterious changes to the stockpile. At a minimum, random triplicate samples must be collected and tested from each stockpile on a quarterly basis. The records must be maintained for a minimum of 5 years.

- (v) No DEP review prior to issuance of the alternate system permit is required.

B. Steep Slope Elevated Sand Mound (ESM) Beds

An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for alternate system designs approved under this listing. All other system proposals under this listing must be submitted to DEP's regional office for review and comment.

1. These absorption areas must be sited in accordance with the following:
 - a. Evaluation of the soil profile must show that there is greater than or equal to 20 inches of suitable soil under the entire absorption area as described in Chapter 73, Section 73.14. The installation of the system must not violate the 48-inch vertical separation requirement.
 - b. Slopes must be greater than or equal to 12 percent and less than or equal to 15 percent at the site of the proposed installation.
 - c. The percolation tests must be conducted in accordance with Chapter 73, Section 73.15(3)(ii) or (iii). The absorption area must be sized in accordance with the requirements of Chapter 73, Section 73.16(c), Table A, "Subsurface Sand Filters and Elevated Sand Mounds." No size reductions are permitted for use of aerobic tanks or other system components. The percolation rate must range between 3 and 90 minutes per inch, inclusive.
2. In addition to the requirements of Chapter 73, Section 73.55, the following standards are required:
 - a. Systems should be designed and permitted to serve single-family residential proposals that do not exceed 600 gpd or commercial facilities with residential flow characteristics that do not exceed 600 gpd.
 - b. Sand should meet the requirements of Chapter 73, Section 73.55(c). The downslope sand should be extended to a 2:1 ratio.

- c. Width must not exceed 10 feet. Overall bed dimensions, length to width, must be 6:1 or greater.
- d. The downslope berm should be extended to a 4:1 ratio to improve stability.
- e. Lateral end cleanouts are required.
- f. The surface should be chisel plowed across the slope (including the area under the berm) as described in Chapter 73, Section 73.55(b)(2).

3. Minimum Maintenance Standards:

Annual inspection of the absorption area to ensure that there is no ponding of effluent over the absorption area, downgradient seepage, or evidence of structural failure of the mound.

C. At-grade absorption area

An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for alternate system designs approved under this listing. All other system proposals under this listing must be submitted to DEP's regional office for review and comment.

1. Siting.
 - a. The minimum depth of suitable soil to limiting zone is 20 inches, as determined using the site investigation methods in Chapter 73, Section 73.14.
 - b. The slope of the installation site must be less than or equal to 15%.
 - c. The percolation rate must be greater than or equal to 3 and less than 181 min/in on 0 to 12% slopes. The percolation rate must be greater than or equal to 3 and less than or equal to 90 min/in on greater than 12 to 15% slopes.
2. Design.
 - a. Pressure dosing is required.
 - b. The absorption area must have a minimum length to width ratio of 4 to 1 on sites with 0 to 12% slopes. On sites with greater than 12 to 15% slopes the minimum length to width ratio must be 6 to 1.

- c. All laterals must have end cleanouts extended to the soil surface and be constructed using two 45 degree bends.
- d. Laterals must be fitted with end caps.
- e. All coarse aggregate used must meet the following specifications:
 - (i) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than No. 200 sieve, clay lumps and friable particles.
 - (ii) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
 - (iii) The aggregate must not contain more than 5% by weight material finer than No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
 - (iv) All coarse aggregate testing must be conducted within 1 year of the delivery date.
 - (v) A written certification from the supplier must be provided to the sewage enforcement officer and permittee including the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - (vi) A minimum of a total of 10 inches of coarse aggregate meeting AASHTO No. 3, 467, 5 or 57 size and grading requirements must be used. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
- f. The absorption area must be constructed in accordance with one of the two following options, at the discretion of the designer.
 - (i) Coarse aggregate must be placed over the laterals to a uniform depth of 2 inches. The aggregate must be placed beneath the laterals on contour to a uniform depth throughout the absorption area. The laterals must be designed in accordance with the pressurized distribution section. The upslope laterals must be placed 1 foot from the upper edge of the aggregate. The downslope laterals must be placed a minimum of 6 feet from the downslope edge of the

aggregate. Laterals must be placed a maximum of 6 feet on center. There is no minimum distance between the upslope and downslope laterals. All laterals must terminate 2 to 5 feet from the ends of the aggregate. The design must include a 3-foot subsoil berm around the ends and downslope side of the aggregate area in addition to the berm described in subsection 3.e. A 2:1 slope must be maintained on the subsoil berm.

- OR -

(ii) The laterals must be installed on contour, level and spaced evenly over the absorption area. Coarse aggregate must be placed over the laterals to a uniform depth of 2 inches. Sufficient coarse aggregate must be placed beneath the laterals so that they are level.

- g. A 2:1 coarse aggregate slope must be maintained on all sides of the aggregate.
- h. Designing the location of multiple absorption areas so that one absorption area is placed hydraulically upgradient or downgradient from the other may cause the lower absorption area to fail because of excessive hydraulic loading from the upper absorption area. Unless the applicant shows the potential for such an impact is nonexistent through the experimental system process, this type of absorption area placement is prohibited.

3. Construction.

- a. The proposed absorption area must not be obstructed by stumps or other obstacles and must be roughed or plowed parallel with the contour to a maximum depth of 6 inches, using a multiple share chisel plow or similar implement attached to light-weight equipment to scarify the soil surface without smearing the soil or breaking down the soil structure. Rotary tilling is prohibited.
- b. Immediately after plowing, aggregate must be placed over the exposed plowed surface. The aggregate must be placed from the upslope side of the bed using only lightweight equipment. Under no circumstances may equipment travel on the plowed soil surface until the aggregate is in place.
- c. The top of the coarse aggregate material must be covered with geotextile material to prevent backfill material from settling into the aggregate.
- d. The at-grade must be surrounded by a berm consisting of mineral soil containing less than 20% coarse fragments with no coarse fragments greater than 4 inches in diameter, more stable and less permeable than the fine aggregate, and lightly compacted during construction to contain and

protect the absorption area interior. The width of this berm must be a minimum of 3 feet at the top of the aggregate.

- e. Upon completion, the outside slope of the berm may be no greater than 33.3% (3:1) for sites with 0 to 12% slopes. On sites with greater than 12 to 15% slopes the outside slope of the berm may be no greater than 25% (4:1) down slope and no greater than 33.3% (3:1) upslope. The minimum berm should remain within the property. If a berm extends on to a adjoining property, a formal easement, recorded in both deeds and filed at the County Courthouse, must be established to the satisfaction of the local agency before the permit can be issued.
- f. The cover over the aggregate must be 8 inches of soil suitable for the growth of vegetation and must be seeded to assure the stability of the berm.

3. Minimum Maintenance Standards:

Annual inspection of the absorption area to ensure that there is no ponding of effluent over the absorption area or downgradient seepage.

D. Shallow limiting zone at-grade absorption area

An SEO who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The shallow limiting zone at-grade absorption area must be designed as set forth below.

- 1. Siting.
 - a. The minimum vertical isolation distances for this option are greater than or equal to 10 inches to the seasonal high water table, or greater than or equal to 16 inches to rock formation.
 - b. These absorption areas must not be placed on concave topography.
 - c. The slope of the site must be less than or equal to 15%.
- 2. Design.

- a. The treatment and disposal distribution configuration is based on the horizontal linear loading rate derived from the soil morphological evaluation conducted in accordance with Section II.B. and the Hydraulic Linear Loading Rate (HLLR) from Table A.

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TABLE A
Hydraulic Linear Loading Rate Table

Soil Characteristics			Hydraulic Linear Loading Rate (HLLR), gal/ft/d								
			Slope								
Texture		Structure	Infiltration Loading Rate (ILR), gal/ft ² /d	0 - <5%		≥5 - ≤10%		>10%			
				Infiltration Distance, Inch		Infiltration Distance, Inch		Infiltration Distance, Inch			
		Shape	Grade	≥10 - ≤12	>12 - ≤20	≥10 - ≤12	>12 - ≤20	≥10 - ≤12	>12 - ≤20		
COS, S, LCOS, LS		--	0SG	1.6	4.0	5.0	5.0	6.0	6.0	7.0	
FS, VFS, LFS, LVFS		--	0SG	1.0	3.5	4.5	4.0	5.0	5.0	6.0	
CSL, SL		--	0M	0.6	3.0	3.5	3.6	4.1	5.0	6.0	
		PL	1	0.5	3.0	3.5	3.6	4.1	4.0	5.0	
			2, 3	May not be used.							
		PR/BK /GR	1	0.7	3.5	4.5	4.0	5.0	5.0	6.0	
2, 3	1.0		3.5	4.5	4.0	5.0	5.0	6.0			
FSL, VFSL		--	0M	0.5	2.0	2.3	2.4	2.7	2.7	3.2	
		PL	1, 2, 3	May not be used.							
			1	0.6	3.0	3.5	3.3	3.8	3.6	4.1	
		PR/BK /GR	2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4	
L			--	0M	0.5	2.0	2.3	2.4	2.7	2.7	3.2
		PL	1, 2, 3	May not be used.							
			1	0.6	3.0	3.5	3.3	3.8	3.6	4.1	
		PR/BK /GR	2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4	
SIL			--	0M	0.2	2.0	2.5	2.2	2.7	2.4	2.9
		PL	1, 2, 3	May not be used.							
			1	0.6	2.4	2.7	2.7	3.0	3.0	3.5	
		PR/BK /GR	2, 3	0.8	2.7	3.0	3.0	3.5	3.3	3.8	
SCL, CL, SICL			--	0M	May not be used.						
		PL	1, 2, 3	May not be used.							
			1	0.3	2.0	2.5	2.2	2.7	2.4	2.9	
		PR/BK /GR	2, 3	0.6	2.4	2.9	2.7	3.0	3.0	3.5	
SC, C, SIC			--	0M	May not be used.						
		PL	1, 2, 3	May not be used.							
			1	May not be used.							
		PR/BK /GR	2, 3	0.3	2.0	2.5	2.2	2.7	2.4	2.9	

Adapted from Tyler, 2000.

Width of Infiltration Field = Hydraulic Linear Loading Rate divided by Infiltration Loading Rate
Length of Infiltration Field = Wastewater Volume divided by Hydraulic Linear Loading Rate

- b. Pressure dosing is required.
- c. For sites that do not have seasonal high water tables, or a rock formation or other stratum or soil condition that effectively limits the downward passage of effluent, the at-grade absorption areas may be constructed in a bed configuration. These absorption areas must have a minimum length to width ratio of 4 to 1 on sites with less than or equal to 12% slopes. On sites with greater than 12% slopes, the minimum length to width ratio must be 6 to 1.
- d. For sites that have seasonal high water tables or restrictive horizons, the at-grade absorption areas must be constructed in an at-grade trench configuration. Trench design must be determined by the figures in the Hydraulic Linear Loading in Table D using the following calculations:

Width of Infiltration Field = $HLLR \div ILR$
(HLLR)=Hydraulic Linear Loading Rate
(ILR)=Infiltration Loading Rate

Length of Infiltration Field = $\text{Peak daily sewage flow} \div HLLR$
(HLLR)=Hydraulic Linear Loading Rate

- e. All laterals must have end cleanouts extended to the soil surface and be constructed using two 45-degree bends.
- f. Laterals must be fitted with end caps.
- g. All coarse aggregate must meet the following specifications:
 - (i) The aggregate must not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the aggregate including material finer than the No. 200 sieve, clay lumps and friable particles.
 - (ii) The aggregate must not contain more than 5% by weight clay lumps and friable particles. Testing must be performed using the most recent revision of ASTM C 142.
 - (iii) The aggregate must not contain more than 5% by weight material finer than the No. 200 sieve. Testing must be performed using the most recent revision of ASTM C 117 or PMT No. 100.
 - (iv) All coarse aggregate testing must be conducted by the supplier within 1 year of the delivery date.

- (v) A written certification from the supplier must be provided to the sewage enforcement officer and the permittee including the name of the supplier, testing results, testing date, amount of material purchased under this certification and the delivery date.
 - (vi) A minimum of a total of 10 inches of coarse aggregate meeting AASHTO No. 3, 467, 5 or 57 size and grading requirements must be used. The aggregate may meet the characteristics of an individual category (3, 467, 5 or 57) or fall within the outer boundaries of sieve testing for each sieve category.
- h. At-grade bed absorption areas must be constructed in accordance with one of the following two options, at the discretion of the designer.
- (i) Coarse aggregate must be placed over the laterals to a uniform depth of 2 inches. The aggregate must be placed beneath the laterals on contour to a uniform depth throughout the absorption area. The laterals must be designed in accordance with section VII.B. The upslope laterals must be placed 1 foot from the upper edge of the aggregate. The downslope laterals must be placed a minimum of 6 feet from the downslope edge of the aggregate. Laterals must be placed a maximum of 6 feet on center. There is no minimum distance between the upslope and downslope laterals. All laterals must terminate 2 to 5 feet from the ends of the aggregate. The design must include a 3-foot subsoil berm around the ends and downslope side of the aggregate area in addition to the berm described in Subsection 3.e. A 2:1 slope must be maintained on the subsoil berm.
- DRAFT - OR - DRAFT
- (ii) The laterals must be installed level and spaced evenly over the absorption area. Coarse aggregate must be placed over the laterals to a uniform depth of 2 inches. Sufficient coarse aggregate must be placed beneath the laterals so that they are level.
- i. A 2:1 coarse aggregate slope must be maintained on all sides of the aggregate.
 - j. The at-grade absorption area must be surrounded by a berm consisting of mineral soil containing less than 20% coarse fragments with no coarse fragments greater than 4 inches in diameter, more stable and less permeable than the fine aggregate, and lightly compacted during construction to contain and protect the absorption area interior. The width of this berm must be a minimum of 3 feet at the top of the aggregate.

3. Construction.

- a. The proposed absorption area must not be obstructed by stumps or other obstacles and must be roughed or plowed parallel with the contour to a maximum depth of 6 inches, using a multiple share chisel plow or similar implement attached to light-weight equipment to scarify the soil surface without smearing the soil or breaking down the soil structure. Rotary tilling is prohibited.
- b. Immediately after plowing, aggregate must be placed over the exposed plowed surface. The fine aggregate must be placed from the upslope side of the bed using only lightweight equipment. Under no circumstances may equipment travel on the plowed soil surface until the fine aggregate is in place.
- c. The top of the coarse aggregate material must be covered with geotextile fabric to prevent backfill material from settling into the aggregate.
- d. Upon completion, the outside slope of the berm may be no greater than 33.3 % (3:1) for sites with 0 to 12% slopes. On sites with greater than 12 to 15% slopes the outside slope of the berm may be no greater than 25% (4:1) down slope and no greater than 33.3% (3:1) upslope. The minimum berm should remain within the property. If a berm extends on to a neighbor's property, a formal easement, recorded in both deeds and filed at the County Courthouse, must be established to the satisfaction of the local agency before the permit can be issued.
- e. The cover over the aggregate must be 8 inches of soil suitable for the growth of vegetation and must be seeded to assure the stability of the berm.
- f. Designing the location of multiple absorption areas so that one absorption area is placed hydraulically upgradient or downgradient from the other may cause the lower absorption area to fail because of excessive hydraulic loading from the upper absorption area. Unless the applicant shows the potential for such an impact is nonexistent through the experimental system process, this type of absorption area placement is prohibited.

4. Minimum Maintenance Standards:

Annual inspection of the absorption area to ensure that there is no ponding of effluent over the absorption area or downgradient seepage.

E. Drip distribution system

A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

The drip distribution system must be designed as set forth below.

1. Siting.

- a. The soils must be classified morphologically as either well drained or moderately well drained as determined by a soil scientist. A report regarding the soil drainage classification determination and assigning of the appropriate loading rate and horizontal linear load consistent with (2)(e) below must be signed by the qualified soil scientist and must be attached to the permit application. The soil scientist who signs the soils report must determine the number and placement of soil profile descriptions required to conduct the morphological evaluation of soils in the proposed drip zones. The profiles may be supplemented with the use of a hand auger to confirm soil conditions between profiles. Excessive disturbance of soils within the proposed drip zone must be avoided.
- b. The slope in each drip distribution zone must be between 0 and 25%.
- c. The depth to seasonal high water table must be greater than or equal to 20 inches. Standard tubing installation depth (in (3), below) may be used on sites exhibiting seasonal high water table limiting zones. A minimum vertical isolation distance of 20 inches must be maintained between the depth of tubing installation and the shallowest indication of rock that is defined as a limiting zone.
- d. Isolation distances must be measured from a perimeter extending two feet beyond the outermost drip tubing in a drip distribution zone.

2. Design.

- a. Treatment: If an aerobic treatment unit is proposed, the specific aerobic tank proposed for use must be identified, and the application must include a letter from the drip system manufacturer stating that they have evaluated this specific unit for compatibility with their system and have accepted it for this use.

- b. Filtration:
- (i) Final filtration must be provided by a hydraulic unit fitted with in-line filters.
 - (ii) The in-line filters must have maximum size openings of 150 microns.
 - (iii) The filters must include a mechanism to automatically or continuously flush the filters. Filters that are automatically backwashed must backwash before each dose.
 - (iv) Backwash from the filters must be returned to the first compartment of the septic tank or to the inlet of the aerobic treatment tank.
 - (v) The hydraulic unit must be protected from temperatures below freezing in accordance with the manufacturer's specifications.
- c. Each zone must either be automatically flushed a minimum of each 50 cycles or be continuously flushed to clean the drip tubing, maintaining a scouring velocity of 1 foot per second at the distal end of each lateral connection.
- d. The system must be equipped with a dosing tank alarm to alert the operator of problems with the system.
- e. Drip Distribution Zone:
- (i) A minimum of two zones are required for each system, with adequate flow equalization provided to accommodate time dosing of the zones.
 - (ii) The drip tubing must follow the contour of the land.
 - (iii) The loading rate must be no more than 0.34 gallons per day per lineal foot of tubing. The total linear feet of drip tubing required is the maximum design flow in gpd divided by this loading rate.
 - (iv) The tubing must have pressure-compensating emitters every 2 feet with spacing between tubing ranging between 2 and 3 feet unless justification for different spacing is provided (such as trees, irregular topography, etc.). All emitters within the zone must provide equal distribution between plus or minus 10%.
 - (v) The horizontal linear load (the gallons per foot along the topographic contour) must not exceed 4.6 gallons per day as calculated on the

average daily flow of the onlot system. The average daily flow is 50% of the maximum design flow as listed in Chapter 73. Where the vertical isolation distance is greater than 20 inches, the horizontal linear load may be increased based on the evaluation of a combination of factors including, but not limited to, increased depth over limiting zone, permeability and slope.

- (vi) The horizontal linear load equals the average daily gallons per day divided by the length of the system.
- (vii) The minimum horizontal length required is the average daily flow divided by 4.6.
- (viii) The sewage enforcement officer may require the site plan for the drip distribution zones to be developed by or in consultation with the manufacturer or a representative of the manufacturer of the drip distribution system being installed. All drip distribution systems with less than 20 inches vertical isolation distance must be developed by or in consultation with the manufacturer or a representative of the manufacturer of the drip distribution system being installed.
- (ix) On slopes greater than 5%, top-feed supply and return manifolds must be used.

3. Construction.

- a. Drip lines must be installed below the soil surface using a vibratory plow, a standard trencher or by manual or hand installation to a maximum depth of 12 inches from the soil surface, with 6 inches being the optimum installation depth. Cable pullers must not be used. Where installation depths less than 6 inches from the soil surface are necessary due to stoniness, additional cover must be required to provide 6 to 12 inches of cover. Cover may be either clean mineral soil or native soil. Imported mulch is permissible in wooded areas of passive activity with established forest litter. For installation less than 6 inches, the tubing may not be installed on the ground surface unless adequate soil and tubing interface are created.
- b. The manufacturer's representative must be present to oversee the installation of the system. A current list of manufacturer's representatives is available from the manufacturer. As an alternative, contractors who have completed a training course provided by the manufacturer before installing drip tubing may install the system independently of oversight by the manufacturer.

- c. Installation of the drip distribution system must meet the specifications provided by the manufacturer.
- d. Drip tubing is susceptible to freezing when sufficient turf cover is not established in non-wooded areas prior to winter operation. When turf cover will not be established prior to winter operation, other measures, such as a temporary cover of mulch or straw, should be used to insulate the tubing.

4. Minimum Maintenance Standards:

- a. A meeting between the manufacturer's representative and the property owner within one month of system start-up and/or occupancy of the dwelling and with the local agency's SEO upon request, to explain the operation and maintenance of the system and provide written instructions to the property owner that include:
 - (i) Instructions on the operation and maintenance of the system.
 - (ii) The locations of all parts of the system.
 - (iii) A caution notice regarding disturbance of the drip zones that may cause system damage (i.e., excavation for trees, fencing, etc.).
 - (iv) An explanation of the automatic alarm system.
 - (v) A statement requiring that the manufacturer's representative be contacted if the alarm system is activated.
- b. Provision by the manufacturer of the drip distribution system of a minimum 2-year warranty on all defects due to materials or workmanship.
- c. Inspection
 - (i) Inspection of the absorption area by the owner at least annually for ponding of effluent over the absorption area or downgradient seepage.
 - (ii) Inspection by the maintenance provider annually to assure that:
 - (a). The flows in each drip zone are consistent with the design.
 - (b). The system is flushing properly.
 - (c). The disc filters are in good working order.
 - (d). The system is backwashing to remove debris as designed.

F. Modified Subsurface Sand Filter for Fast Percolation, Shallow Bedrock Sites with no Water Table Present

The following standards are required:

1. The site must have a percolation rate of less than 3.0 min/in as determined by a percolation test conducted between 12 and 36 inches from the soil surface. Limiting zones other than excessively permeable rock or gravel layers may not occur within 72 inches of the soil surface.
2. The soil analysis must indicate a lower horizon at least 20 inches thick with sufficient fines present to support an acceptable percolation rate. The top of this horizon must occur at a depth greater than or equal to 36 inches and less than or equal to 60 inches from the soil surface.
3. A percolation test conducted at a depth between 36 and 60 inches from the soil surface must result in an average percolation rate between 3.0 and 180 min/in. The material in the horizon with a percolation rate less than 3.0 min/in must be excavated and replaced with sand meeting the specifications outlined in Chapter 73, Section 73.55(c).
4. The maximum depth of excavation should be 5 feet.
5. The total depth of sand and the suitable soil horizon must be equal to or greater than 48 inches.
6. A minimum of 12 inches of sand should be used in every instance.
7. Sufficient sand must be provided so the bottom of the aggregate is within 36 inches of the soil surface.
8. The entire absorption area must be surrounded by a 4-foot perimeter of sand material not containing any part of the aggregate bed. The lateral system should not extend into the 4-foot perimeter.
9. The design of the bed should meet the specifications of Chapter 73, Sections 73.52 and 73.53, except for the addition of the width requirement in #8 above (where applicable).
10. Where the average percolation rate falls between 3.0 and 6.0 min/in 1.50 square feet per gallon should be used to determine total absorption area required for an in-ground system.. Sites with a percolation rate of over 6.0 min/in for the percolation test conducted between 36 and 60 inches from the soil surface should use ESM application rates.
11. Construction using trench configuration is not acceptable.

12. DEP's regional office must review the proposal prior to permitting by the SEO.

13. Minimum Maintenance Standards:

Annual inspection of the absorption area to ensure that there is no ponding of effluent over the absorption area or downgradient seepage.

G. Shallow Placement Pressure Dosed System

An SEO who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

This modification of the in-ground pressure dosed system is used on sites where a limiting zone is identified at depths greater than or equal to 58 inches. Conditions for using this system are:

1. The design and construction of these systems must comply with all of the requirements of Chapter 73 except for Section 73.52(b)(5), which relates to the depth to the bottom of the absorption area (12 to 36 inches).
2. Pressure distribution is required.
3. The minimum aggregate depth associated with a pressure distribution system of 10 inches allows a minimum installation depth of 10 inches. Percolation testing is performed at the depth of the installation in accordance with Chapter 73, Section 73.15. For systems designed at the minimum installation depth of 10 inches, the holes should be filled to the top with water and allowed to drain until a drop of 2 inches is measured during the initial presoak. The hole is then filled with water again to achieve the 12-inch minimum initial presoak required by Section 73.15(5)(i).
4. The system must be designed and installed parallel to the contours.
5. Due to the physical relationships between limiting zones, slopes and system widths, depths and configurations for the design of the system are critical to proper system performance and installation. Design standards are identical to those found in Appendix 1 for slopes of 20-25 percent.
6. To ensure that the minimum 48-inch vertical isolation distance between the limiting zone and the bottom of the absorption area is maintained, the following formula may be used to verify depth and maximum width of the system based on field conditions:

$$W = \frac{[LZ - (ID + 48)] \times 8.3}{\text{slope (percent)}}$$

Where:

LZ = shallowest depth to limiting zone (inches)

ID = depth to installation (inches)

W = maximum width of the system (feet) when the long axis is parallel to the contours

slope = maximum percent of slope in the area of the proposed system installation *Note: Do not use slope as a unit. The slope is expressed as an integer in this formula (e.g., 8 percent is expressed as 8).*

7. Minimum Maintenance Standards:

Annual inspection of the absorption area to ensure that there is no ponding of effluent over the absorption area or downgradient seepage.

IX. ZERO DISCHARGE COMPONENTS

A. General

Zero discharge sewage components require permits. They must only be used where the Department finds and gives written notice to the approving body that the requirements of Chapter 71 (relating to administration of sewage facilities planning program) have been met.

B. Evapotranspiration system.

This technology consists of low flow plumbing fixtures inside the home, a minimum of secondary treatment, and specially modified passive solar greenhouse beds where the wastewater is eliminated through the process of evapotranspiration. These systems are often used where site limitations, such as depth to seasonal high water table or excessive slope, make use of other soil based absorption systems difficult. The minimum requirements are as follows:

1. Design and installation must follow the manufacturer's specifications.
2. The bed must be contained in an enclosed, walled structure (usually cinder blocks) and insulated on the exterior to avoid contact with frozen ground. The

bed must be lined to retain all effluent and avoid infiltration with the underlying soil.

3. The bed must be sectionalized with a series of valves that control effluent flow to each section proportional to the evapotranspiration potential of the season.
4. Temperature controls and humidity exchangers must be used to maintain the proper internal environment necessary to reach optimal evapotranspiration potential.
5. Any application for the use of an evapotranspiration system must include the identity and contact information of the person responsible for the design.
6. Each application for an evapotranspiration system must be accompanied by a statement acknowledging the requirement that the sewage enforcement officer be notified of any malfunction or modification of the original system.
7. These systems require regularly scheduled maintenance and monitoring to insure the long-term reliability of their performance. The sewage enforcement officer should include all operation and maintenance requirements in the permit.
8. It is the responsibility of the sewage enforcement officer to ensure that all components of the systems have been installed in compliance with the above conditions.
9. DEP's regional office must review the proposal prior to permitting by the sewage enforcement officer. If requested by the regional office, central office will also provide comments.
10. Minimum maintenance standards:

Provision of the permit requirements for operation and maintenance to the permittee.

Operation and maintenance in accordance with permit requirements.

X. SPECIALIZED SYSTEMS OR COMPONENTS

A. Geomatrix SoilAir Air Injection for Absorption Area Renovation

An SEO who has successfully completed an appropriate Department sponsored training course that included this specific technology, or has received review delegation in writing from the Department, may independently review the design and issue the permit for systems including components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.

1. General:

The SoilAir system is a process by which an installed air blower moves air into the system absorption area and adjacent soil, in order to reestablish aerobic conditions and rejuvenate the absorption area. The process is used to enhance treatment efficiency and to improve hydraulic capacity, by displacing carbon dioxide, methane and hydrogen sulfide, and increasing oxygen levels in the absorption area. The process can enhance wastewater treatment by increasing the aerobic microbial population and helping to reverse diminished soil permeability caused by the effects of anaerobic bacterial metabolism. In this way, the use of the SoilAir technology may help correct a system that is determined to be failing or ponding due to an anaerobic condition. The process is not used in situations where the absorption area is determined to be failing due to improper siting or design, or hydraulic overload.

While this technology is generally employed in repair situations, it also may be considered for use as a component in new installations. In either case, it is considered to be a permanent part of the system, and a local agency permit is required for installation.

2. Evaluation Procedure:

In repair situations, in order to determine if addition of a SoilAir system may benefit a specific site, a complete evaluation of the existing system history and current condition must be completed by the site evaluator. The following information should be developed and made part of the permit for the site:

- a. The evaluator should complete the SoilAir Evaluation Form, available from SoilAir (contact information below). This includes an assessment of the history of the property, water usage, the condition of existing sewage system components and their locations, and the soil conditions present in the location of the existing absorption area. SoilAir will provide technical assistance with the site evaluation protocol.
- b. The completed SoilAir Evaluation Form and any accompanying documents are submitted to SoilAir for review, to determine the appropriateness of the technology for the specific location. If Soil Air determines from the information submitted that the technology may be effective in rehabilitating the existing absorption area, SoilAir will provide a letter stating this. This letter may include additional items to be incorporated into the design plan.
- c. A design is then prepared by the site evaluator/designer and submitted to SoilAir for review. SoilAir will evaluate the design for adequacy. If the design is deemed adequate, SoilAir will provide a letter to the site evaluator/designer stating this, as well as any operation and maintenance requirements that may be specific to the design proposed.

- d. The site evaluator/designer submits copies of all design and supplemental information, to the local agency SEO and to the Regional and Central Offices of DEP. The submission should include the following:
 - i. Design of the SoilAir system for the specific location;
 - ii. Copies of the SoilAir of PA review letters;
 - iii. A plot plan of the project, showing the locations of all lot features, including the existing system, any soil test pit locations, all isolation distances, contours, etc.;
 - iv. Completed Appendix A forms for any soil evaluation pits performed, signed by the SEO;
 - v. A copy of the completed SoilAir Evaluation Form, including any attachments;
 - vi. The original permitting documentation for the existing system.

Upon receipt of comments from DEP, the local agency SEO may issue a permit for the installation of this technology.

3. Installation Procedure:

Whenever possible, it is recommended that the SoilAir assembly be installed within the existing septic tank. The advantages of this installation method include facilitating accurately monitoring the tank level, ease of service, no need for additional man ways or valve boxes, and less intrusive installation.

The technology is installed in a similar manner to installing an effluent filter. The septic tank baffle is removed and is replaced with the SoilAir unit assembly. Tank baffles integral to the septic tank must not be removed or altered, as this will compromise the structural integrity of the tank. If an effluent filter is used, a filter with an integral level switch, such as a Zabel or PolyLock filter, is preferred. When a riser pipe is required, the riser is drilled so that the airline and level switch wire are run through it. It should not be necessary to modify the septic tank or compromise its structural integrity in any manner.

The following procedure is used to install the technology:

- a. Pump tank(s) and dewater leach field
- b. Install SoilAir components
- c. Seal D-box and other potential air leaks

- d. Place additional top soil/cover over absorption area where significant differences in cover thickness are present
- e. Start blower. If any gross air leaks are detected, seal any leaks
- f. Put smoke indicator into smoke canister
- g. Mark locations where smoke indicates leaks, and seal with caulk, grout, soil and/or bentonite
- h. Program blower for desired operation
- i. Check system operation in a few days, and then again in a few weeks; smoke test again if necessary

A representative of SoilAir must be present at the time of both installation and start-up of the system. The property owner's contractor will install the technology under the supervision of a representative of SoilAir. Within 30 days of the installation, a representative of SoilAir shall meet with the homeowner and SEO to review the operation of the system and operation and maintenance requirements.

4. Minimum maintenance standards:

Provision of the permit requirements for operation and maintenance to the permittee.

Operation and maintenance in accordance with permit requirements.

Distributor: SoilAir of PA, LLC at P O Box 853, Horsham, PA 19044, 215-443-9988.

Manufacturer: Geomatrix, LLC, 385 Roast Meat Hill Road, Killingworth, CT 06419, 860-663-3993

B. Alternate Individually Designed Composting Toilet

Classification as an alternate individually designed composting toilet is limited to those composting devices not approved by the National Sanitation Foundation (NSF) as a pre-manufactured container with a designated model number identification; which are designed or installed by an individual as a custom, integral part of a building or structure; which are designed and installed by an individual or corporation with existing installations in Pennsylvania preceding November 22, 1997; which have had Pennsylvania installations monitored and determined to be functional; which are warranted for a minimum of 2 years and which are in compliance with the standards listed below. The only composting toilet that currently meets the specifications of

this listing is the Bio-Sun toilet, produced by Bio-Sun Systems, RR 2, Box 134A, Millerton, PA 16936.

Permit applications for all other individually designed composting toilets must be submitted to the DEP regional and central offices with supporting documentation for consideration as an experimental individually designed composting toilet under Chapter 73, Section 73.71.

1. Design Review Certification

A statement signed by a representative of the company certifying that the following requirements have been met for the specific proposal (signed statement must contain each item below):

- a. Materials: All materials proposed for use in the construction of the composting device (containment used to compost organic matter) must be durable and watertight, preclude infiltration of groundwater and prevent the escape of any liquids.
- b. Structural soundness: Construction must be designed to withstand hydrostatic pressures when the composting device is full and withstand earth pressures when the composting chamber is either full or empty.
- c. The composting device is constructed to prevent the entry of insects into any component in which biological activity is intended to occur except for entry points where wastes are intended to be deposited under normal usage.
- d. The design distance between the upper surface of the seat and the untreated waste is not less than 12 inches unless a leveling device or a cleanable barrier is included in the design.
- e. Water inlets must be protected against back siphoning or backflow by an air gap or vacuum breaker.
- f. Component parts subject to malfunction, wear, or requiring maintenance must be accessible.
- g. Electrical work, equipment and materials must comply with the National Electrical Manufacturers Association standards and the National Electric Code.

- h. Complete, detailed design plans and specifications and instructions for the installation, initiation of service, operation and maintenance must be provided to the permittee including:
 - (i) Design, including projected volumes and ratios of input urine liquids and input fecal solids (including paper and carbon bulking material); the chemical and biological characteristics of those materials; the oxygen requirements for complete conversion and stabilization of those materials; the ratio of waste mass volume to waste mass exposed surface and retention time; the air to waste interface efficiency of any aeration equipment; the average monthly and annual ambient air temperature and relative humidity and the design calculations based on these factors used to design the individual composting unit.
 - (ii) Arrangement of plumbing and electrical components.
 - (iii) Parts lists for replacement parts.
 - (iv) An operation and maintenance manual must be provided to the permittee.

The above signed statement must be attached to the permit application and permit for the individually designed composting toilet. A copy of each approved permit application must be sent to the DEP regional and central offices by the SEO. This mailing is in addition to normal transmittal of permit applications.

2. Performance Monitoring

Individually designed systems must be monitored to determine if the composting unit is functioning within the performance specifications of the NSF. At a minimum, the monitoring should include:

- a. Five core samples of solid product collected from the composting chamber at the clean-out port prior to the first clean-out cycle or within 1 year of the start up of operation, whichever occurs first. Each core sample must weigh at least 10 grams and must be collected by a commercial laboratory that certifies the validity of the sample location.
- b. The 7-day objectionable odor test described in NSF Standard 41 Section 7.1.4, conducted by the laboratory that collected the samples.
- c. Tests for fecal coliform and moisture content. The sample must not contain fecal coliforms exceeding 200 most probable number (MPN) per gram as an

arithmetic mean of the five samples collected. Moisture content of the solid end product must not exceed 65 percent by weight.

The results of all sample analyses must be received by DEP's regional and central offices within 1 year of the start up of the system.

C. CO-OP RFS III

An SEO who has successfully completed the appropriate DEP-sponsored continuing education course that included this specific technology or has received review delegation in writing from DEP may independently review the design and issue the permit for alternate system designs approved under this listing. All other system proposals under this listing must be submitted to DEP's regional office for review and comment.

1. Description.

This option involves treatment of septic tank effluent using a proprietary free access recirculating filter and a manufacturer-required disinfection unit.

2. Specifications.

- a. Size: The effective surface area of the free access recirculating sand filter should be sized to maintain a hydraulic loading rate no greater than 5 gpd/sq. ft. (design influent flow). In no instance should the effective surface area be less than 120 sq. ft. with minimum sewage flow of greater than or equal to 200 gpd.
- b. Media: Filter media should conform to wastewater treatment media requirements to be hard, durable and free of organic matter. Filter media is crushed boiler slag (Black Beauty product grade #1040) or manufacturer approved equal with the following physical properties:

Effective size	1.00 mm to 1.7 mm
Uniformity coefficient	less than 1.9
Particle shape	Angular
Hardness	6 to 7 on Moh's scale
Bulk density	75 to 100 lbs. per cubic foot
Specific gravity	2.73
Moisture content	less than 0.5%
Free silica	less than 1.0%

A minimum of 24 inches of media is required.

The bottom layer consists of at least 16 inches of AASHTO #57 washed and crushed aggregate, followed by 8 inches of AASHTO #8 washed and crushed aggregate.

- c. Underdrain Piping: The underdrain system consists of Infiltrator Systems, Inc.'s, Equalizer 36 chambers or equivalent. The underdrain should be positioned on either side of the spray grid.
- d. Distribution and Recirculation (400 to 600 gpd/unit in parallel):

Grids per system, with flexibility to shut off flow to any grid	2
Orifices/spray grid	4
Total orifices	8
Laterals per spray grid	2
Length of laterals	10 ft.
Orifice spacing	52 inch centers
Orifice size	0.25 inch diameter
Design flow per orifice	4.1 gpm
Recirculation ratio	12:1
Cycles per day	72
Recirculation tank	1,120 gal.
Flushing orifice to underdrain with valve	1 per grid
Return to head of septic tank with recirculation valve	1 per system
Freeboard (top of tank to sand)	1 ft.
Submersible pump	33 gpm at required total design head

The pump wet well contains a high water level alarm.

The recirculation tank must be constructed to comply with the minimum requirements in Chapter 73, Section 73.31(b).

- e. Disinfection: Disinfection of the recirculating filter effluent prior to discharge to the absorption area is required. This disinfection must be achieved by means of UV light emitting equipment. No other means of disinfection, such as chlorination, may be used, as it is essential to prevent negative effects on soil bacteria in the absorption area that may be caused by residual effects of disinfection.
3. Minimum Operation and Maintenance Standards:
- a. Operation and Maintenance: Provision of an operation and maintenance manual by the manufacturer to the end user of the unit and attached to the

permit. Operation and maintenance in accordance with the manufacturer's written operation and maintenance requirements.

- b. Sampling: Collection of a sample taken following the disinfection unit by the maintenance provider to be analyzed by a certified laboratory for BOD₅ and TSS to determine compliance with the performance standard. At least annually, a copy of these test results, along with documentation of the most recent inspection of the system by the maintenance entity established under Chapter 72, Section 72.25(h), must be sent to the municipality or other approved maintenance entity.

D. The Floating Outlet (Flout) Siphon

The Floating Outlet (Flout) siphon is a proprietary alternative siphon design to the standard bell siphon. It is produced by Rissy Plastics and distributed by L.I.Z. Electric, 1189 Rt. 9 South, Keeseville, NY 12944..

The Flout consists of one or more lengths of PVC pipe (the Flout body) that are attached to the dosing tank discharge pipes by a flexible coupling. The PVC pipes are equipped with floats that cause the Flout body to rise off the dosing tank floor as the tank fills. The location of the discharge hole(s) in the Flout body allows the pipe(s) to rise rather than flood. When the effluent level rises high enough, the water overflows into the Flout body, causing the Flout to lose buoyancy and sink to the tank bottom. This action opens a direct path for the effluent to flow out of the tank and into the absorption area. When the effluent level falls below the discharge hole of the Flout body, the effluent remaining inside the body drains into the absorption area, and the cycle begins again.

The requirements for use of this technology are as follows:

1. Use of this technology is limited to single-family residential applications.
2. Design and installation must follow the manufacturer's specifications.
3. It is the responsibility of the SEO to ensure that all components of the systems have been installed in compliance with the above conditions.
4. Minimum maintenance standards:

Annual inspection of the Flout mechanism by the maintenance provider.

APPENDIX 1

Trenches on Slopes of 20 to 25 Percent

Precise placement of trenches, length of trenches and, in particular, the upslope and downslope depth of trenches must be evaluated to ensure that each trench has equal absorption area and that each trench's width and depth is in accordance with the following restrictions:

1. Minimum downslope excavation - 12 inches.
2. Maximum upslope excavation - 36 inches. The depth may not be within 48 inches of any limiting zone identified by the SEO. The effect of the slope on the limiting zone must be calculated.
3. Trench width may be no less than 1 foot, no more than 6 feet and must be determined based on depth to limiting zone.

PLOT PLAN AND DESIGN PREPARATION:

1. Include all features typically required on the sewage permit application form.
2. Show the location of all soil tests conducted (both suitable and unsuitable).
3. Identify the location of all design elements (septic tank, manifold, delivery line, friction loss calculation, pump requirements, etc.) from a fixed reference point.
4. Provide site contour lines at 1 foot intervals in the area of the disposal system.
5. Show the location of each trench including its dimensions. The diagram should show the trench configuration required by the site contours. The elevation from an established benchmark must be shown for the downslope and upslope excavation of each trench.
6. Include a typical trench cross section diagram.
7. Provide information on proper installation practices as found in Chapter 73. Detailed construction guidelines regarding type of construction equipment to be used, placement of backfill, sequence of trench construction and any other installation features specific to the needs of the site are to be included.

ON-SITE MARKINGS:

Mark the location of all design elements with stakes or flags. Two rows of stakes should outline each trench and should be close enough to show any changes of direction needed to follow the contours. At the beginning and end of each trench, the ground surface elevation in relation to the established benchmark should be marked, as well as precise trench downslope and upslope depths.