Small Flow Treatment Facilities Manual

TECHNICAL GUIDANCE
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COMMONWEALTH OF PENNSYLVANIA
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DEPARTMENT OF ENVIRONMENTAL PROTECTION
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TITLE:	Small Flow Treatment Facilities Manual
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AUTHORITY:	The Clean Streams Law (35 P.S. §§ 691.1-691.1001) and Title 25 Pa. Code Chapter 91.
POLICY:	To improve and preserve the purity of the waters of the Commonwealth for the protection of public health, animal and aquatic life, and for recreation.
PURPOSE:	To provide guidance regarding the design, permitting, installation, operation and maintenance of domestic wastewater treatment facilities with maximum daily flows not greater than 2,000 gallons per day (gpd).
APPLICABILITY:	This guidance applies to the design and construction of small flow treatment facilities.
DISCLAIMER:	The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Pennsylvania Department of Environmental Protection (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.
PAGE LENGTH:	49 pages

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DIVISION 10: INTRODUCTION

10. Definitions

Building sewer - Piping carrying liquid wastes from a building to the treatment tank.

Domestic Wastewater - Wastewater that contains sewage from dwellings, commercial buildings, institutional facilities and the like. The generation of this wastewater is primarily from toilet flushing, bathing, food service preparation, and laundry facilities. It does not include industrial discharges and high strength wastewater.

Dosing pump - The pump housed in a dosing tank which provides a measured volume of sewage effluent to the pressurized distribution system.

Dosing tank - A tank in which sewage is collected and later discharged at the rate needed by subsequent treatment processes.

Foundation drain - A system of piping which serves to remove ground water from around the perimeter of a structure in order to prevent the seepage of the ground water into the structure. The term may also include sump pumps, if the purpose of the sump pump is to remove ground water, rather than domestic wastewater.

Free access sand filter - An accessible system of tanks, dose piping, sand media, aggregate and collection piping used for the intermittent filtration and biochemical treatment of sewage.

Geotextile - Material consisting of mesh polypropylene, polyester, nylon or similar material, used to prevent migration of fine aggregate into coarser aggregate.

Intermittent Stream - A reach of stream that flows only during wet periods of the year (30% - 90% of the time) and flows in a continuous well-defined channel. During dry periods, especially in summer months, the flow of an intermittent stream may be reduced to a trickle of water which makes it appear dry, when in fact there is water flowing through the stream bottom or "substrate." This is usually caused by the seasonal changes of the local soil water table or during periods of long-term drought.

Service provider - A person or company knowledgable in, and trained by, a manufacturer in the proper operation and maintenance procedures for the equipment that has been installed.

SFTF - Small Flow Treatment Facility - An individual or community sewerage system designed to adequately treat sewage flows not greater than 2,000 gpd for final disposal using a stream discharge or other methods approved by the Department. (25 Pa. Code 92a.2)

Solids retainer - A deflection device at the outlet tee or baffle of a treatment tank designed to deflect buoyed solids from escaping the tank.

Subsurface Sand Filter - A system of piping, sand media, aggregate and collection piping in a buried liner used for the intermittent filtration and biochemical treatment of sewage.

Treatment tank - A water-tight tank designed to retain sewage long enough for satisfactory bacterial decomposition of the solids to take place. The term includes the following:

(i) *Septic tank* - A treatment tank that provides for anaerobic decomposition of sewage prior to its discharge to a filter for further treatment.

(ii) *Aerobic sewage treatment tank* - A mechanically aerated treatment tank that provides aerobic biochemical stabilization of sewage prior to its discharge to a filter for further treatment.

11. Systems Covered by this Manual

11.1 System Design

This manual provides guidance for the design, permitting, installation, operation and maintenance of small flow treatment facilities which have met all the requirements of 25 Pa Code § 71.64. These facilities are intended to serve single-family residences, duplexes and small commercial establishments that generate a maximum daily domestic wastewater flow of no greater than 2,000 gpd and are not intended to receive industrial waste.

All plans and specifications must be prepared by a licensed professional engineer authorized to practice in this Commonwealth in accordance with 25 Pa. Code § 91.23.

11.2 Discharge Location

The treated sewage effluent from an SFTF may be discharged to a stream or dry stream channel once the proper authorization is acquired from the Department. The feasibility of discharge options is site-specific. The determination of which option is best in a specific case involves the evaluation by a Licensed professional engineer authorized to practice in this Commonwealth. Refer to DEP's *Policy and Procedure for Evaluating Wastewater Discharges to Intermittent and Ephemeral Streams, Drainage Channels and Swales, and Storm Sewers* (386-2000-013), available on DEP's eLibrary website at www.depgreenport.state.pa.us/elibrary/.

12. Advantage of Using the Systems in this Manual

The systems described in this manual may be eligible for coverage under NPDES General Permit PAG-04 and Water Quality Management (WQM) General Permit WQG-01. These general permits are issued on a statewide basis. Coverage under the general permits may be obtained by documenting compliance with the provisions of these general permits which are reflected in this manual and a commitment to meet any conditions contained in the statewide permit.

The design standards in this manual are based on accepted engineering practices and ensure that the resulting systems are adequate to protect public health and the environment.

Proponents of proposals for systems not described in this manual are more appropriately regulated under an individual permit pursuant to 25 Pa. Code §§ 92a.54 and 91.27. Proponents of such a project should consult with the appropriate DEP office to better understand the individual NPDES permit process.

DIVISION 20: DESIGN PROVISIONS

20. General

20.1 Effluent Standards

The general permits require the achievement of the below listed effluent standards and require that the systems do not otherwise cause public health hazards or pollute the waters of the commonwealth in accordance with The Clean Stream Law.

Parameter	Concentration Limitations, mg/L	
	Monthly Average	Instantaneous Max
BOD_5 (mg/L)	10	20
TSS (mg/L)	10	20
Total Residual Chlorine (mg/L)	Report	Report
pH (Standard Units)	Between 6.0 and 9.0 at all times	
Fecal Coliform (No/100 mL)	200 geo mean	XXX

The technology in this manual, if properly installed, operated and maintained, will meet these permit conditions.

20.2 Hydraulic and Organic Design

20.21 Hydraulic Design

a. It is standard practice for an SFTF proposed to serve a single-family residence with three bedrooms or less to be designed based on a minimum daily flow of 400 gpd. The flow is increased by 100 gpd for each additional bedroom over three. These flow figures allow for the use of household garbage grinders, automatic washing machines, dishwashers and water softeners.

b. SFTFs proposed to serve sources of domestic sewage other than a single-family residence are designed based on the flows in Appendix A based on the type of facility to be served.

1. Actual water meter or sewer meter flow data indicating maximum daily flows different than those shown in this section over a 1-year period for a similar non-residential establishment may be used in place of the estimated sewage flows listed in Appendix A.

2. If average daily flows are used, the maximum daily flow is calculated by multiplying the average daily flow by two.

3. For non-residential establishments, a maximum daily volume of 200 gpd is the minimum volume used for design.

20.22 Organic Design

a. It is standard design practice for an SFTF proposed to serve a single-family residence with three bedrooms or less to be designed based on a minimum peak daily organic load of 1.02 lbs BOD_5 per day. The load is increased by 0.34 lbs BOD_5 per day for each additional bedroom over three. These load figures allow for the use of household garbage grinders, automatic washing machines, dishwashers and water softeners.

b. SFTFs proposed to serve any other source of domestic sewage are designed based on the loads in Appendix A for the type of facility to be served.

1. If available, actual loading data obtained by daily recordkeeping or monitoring for any establishment, indicating peak daily loads over a 1-year period, may be used in place of the estimated sewage loading listed in Appendix A.

2. If average daily loads are used, it is standard design practice for the peak daily load to be calculated by multiplying the average daily load by two.

3. For non-residential establishments, 0.51 lb BOD_5 per day is the minimum peak daily load used in calculating the size of the SFTF.

20.3 System Definition

An SFTF consists of a grease trap (if necessary), a treatment tank, a filtration system, effluent disinfection and an outfall sewer, unless the system is approved under the provisions of Section 27 (Systems classified as advanced alternate).

20.4 Piping

All piping for an SFTF, except perforated underdrain piping in Sections 25.16, 25.26, and 25.35 should be marked NSF-Drain-Waste-Vent (DWV).

20.5 Restrictions

a. Liquid wastes, including kitchen and laundry wastes and water softener backwash should be discharged to a treatment tank.

b. Discharge from Roof gutters, foundation drainage, floor drains not from sewage generating connections and surface runoff should not be discharged to the SFTF, nor should the discharges be permitted to flow over any underground treatment units.

20.6 Pretreatment

a. It is standard design practice for establishments with food preparation facilities to install adequately designed pretreatment units and traps to reduce greases and biological oxygen demand (BOD) prior to discharge to the remainder of the treatment system.

b. Grease traps should be designed in accordance with the local plumbing codes.

20.7 Water Conservation

a. Water conservation practices should be considered in the overall project design.

b. Water conservation practices reduce the volume of wastewater requiring treatment. Along with the reduction in energy cost, benefits include prolonging the life of the treatment system. Examples of water conservation fixtures include but are not limited to 1.6-gallon flush toilets, faucet and shower flow restrictor, and high efficiency washing machines.

20.8 Accessibility

It is necessary for all components of the SFTF to be accessible for inspection, sampling and maintenance.

20.9 Alarms

a. Visual and audible alarms at a location frequented by the homeowner or responsible individual are necessary for mechanical equipment, such as aerobic treatment units and pumps, to alert the responsible individual in the event of a malfunction.

b. These alarms, when electrically operated, should be connected to a separate circuit from the circuit and breaker serving the mechanical equipment or device.

20.10 Isolation Distances

With the exception of the effluent discharge piping, minimum horizontal isolation distances shown in subsections (a)-(e) should be maintained between the sewerage system and the features itemized. If conditions warrant, greater isolation distances may be needed.

a. Property line, easement or right-of-way – 10 feet.

b. Occupied buildings, swimming pools and driveways – 10 feet.

c. An Individual water supply or water supply system suction line – 50 feet.

d. Water supply line under pressure – 10 feet.

e. Streams, watercourses, lakes, ponds or other surface waters – 25 feet.

20.11 Other Necessary Permits

a. If the SFTF is proposed to be located in an area identified as a floodway, flood plain, or flood fringe by FEMA, an encroachment permit may be required.

b. Additional permitting may be required for SFTF construction within a wetland.

c. Consult with the DEP regional office to determine whether a Waterways and Wetlands permit may be required.

d. All necessary permits should be obtained prior to construction.

21. Building Sewer

21.1 General

a. Building sewers should be constructed of a durable material acceptable to DEP and in accordance with local plumbing or building codes.

b. When the average daily flow of sewage from an establishment is 1,000 gpd or less, building sewers should be at least three inches in diameter unless otherwise specified by local plumbing or building codes. When the average daily flow exceeds 1,000 gpd, all building sewers should be at least six inches in diameter unless otherwise specified by local plumbing or building codes.

c. Cleanouts should be placed at the junction of the building drain and building sewer.

d. Cleanouts should be provided at intervals of not more than 100 feet.

e. It is standard design practice for cleanouts to be provided at each change of direction in solids-carrying lines.

f. House or building sewers should be installed with as straight an alignment as possible. Bends ahead of the treatment tank should be limited to 45 degrees or less where possible. If 90-degree bends cannot be avoided, they should be made with two 45-degree bends.

g. The grade of the building sewer should be at least ⅛ inch per foot; however, the grade of the 10 feet of building sewer immediately preceding the treatment tank should not exceed 0.25 inches per foot.

h. Building sewers should be constructed with watertight joints, should be of sufficient strength to withstand imposed loads, and installed on material suitable for preventing damage from settling.

i. The building sewer should be installed to allow continuous venting of the treatment tank through the main building stack, unless otherwise specified by local plumbing or building codes.

j. Building sewers should be connected to treatment tanks using watertight mechanical seals or hydraulic grouting.

21.2 Trenching

a. To reduce the risk of injury, trenching should comply with appropriate Occupational Safety and Health Administration (OSHA) regulations.

b. It is necessary for the width of the trench to be sufficient to allow the pipe to be laid and joined properly and to allow the bedding and haunching to be placed and compacted to adequately support the pipe.

c. When wider trenches are needed, it is standard design practice for appropriate bedding class and pipe strength to be used.

d. In unsupported, unstable soil, it is standard design practice to consider the size and stiffness of the pipe, stiffness of the embedment and in-situ soil and depth of cover in determining the minimum trench width necessary to adequately support the pipe.

e. It is standard practice for the trench sides to be kept as nearly vertical as possible.

f. It is standard practice to remove ledge rock, boulders and large stones to provide a minimum clearance of four inches below and on each side of all pipes.

21.3 Bedding, Haunching, and Initial Backfill

a. It is standard design practice to use and carefully compact bedding Classes B or C or crushed stone encasement as described in ASTM C-12 for all rigid pipe, provided the proper strength pipe is used with the specified bedding to support the anticipated load.

1. It is standard design practice to base the anticipated load on the type of soil encountered and potential ground water conditions.

2. It is standard practice to use the same bedding material or other stone aggregate in the haunching and initial backfill zones such that a minimum cover of six inches above the pipe is provided.

b. It is standard design practice to use bedding Classes I, II or III as described in ASTM D-2321 for all flexible pipes, provided the proper strength pipe is used with the specified bedding to support the anticipated load.

1. It is standard design practice to base the anticipated load on the type soil encountered and potential groundwater conditions.

2. It is standard practice to carefully compact the embedment materials for all flexible pipe.

3. It is standard practice to use the same bedding material or other stone aggregate in the haunching and initial backfill zones such that a minimum cover of six inches above the pipe is provided.

c. It is standard practice to remove all water entering the excavations or other parts of the work and to handle it in accordance with approved erosion and sedimentation control specifications and permits.

d. No sanitary sewer should be used for the disposal of trench water.

21.4 Final Backfill

a. Suitable material removed from trench excavation, except where other material is specified, may be used in backfilling the remainder of the trench.

b. It is standard practice not to use debris, frozen material, large clods or stones, organic matter or other unsuitable materials as backfill within two feet of the top of the pipe.

c. It is standard practice for final backfill to be placed in such a manner as not to disturb the alignment of the pipe.

21.5 Deflection Test

a. It is standard design practice for deflection tests to be performed on all flexible pipe, and for deflection tests for composite pipes, such as truss pipe, to be performed if the design engineer deems it necessary.

b. It is standard practice for the deflection test to be run not less than 30 days after final backfill has been placed.

c. It is standard practice for the rigid ball or mandrel used for the deflection test to have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe, depending on which is specified in the ASTM Specification, including the appendix, applicable to the pipe manufactured.

d. It is standard design practice for the pipe to be measured in compliance with ASTM D-2122 Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings.

e. It is standard practice for the test to be performed without mechanical pulling devices.

f. It is standard design practice that no pipe exceed a deflection of five percent of the inside diameter. If deflection exceeds five percent, it is standard practice for

the pipe to be excavated, and for the replacement or correction to be accomplished in accordance with the provisions in the approved specifications.

21.6 Joints

a. It is standard design practice for the installation of joints and the materials used to be included in the specifications.

b. It is standard design practice for sewer joints to be designed to minimize infiltration and to prevent the entrance of roots throughout the life of the system.

22. Raw Sewage Pumping

22.1 Type of Unit

Where a pump is necessary to convey raw sewage from a building to the treatment tank, the pump used should be specifically designed for pumping of raw sewage. Grinder pumps may be necessary.

22.2 Location

If the pump unit is installed outside the structure served, it should be accessible and protected from weather and vandalism. Inside installations should be quiet, free from electrical and health hazards, and should be certified by nationally-recognized independent testing laboratories, such as the Underwriter's Laboratories, Inc. (UL) or NSF International.

22.3 Capacity

The pump should have a discharge capacity of at least two times the estimated maximum daily flow of the facility served when operating at designed level of head, but at least five gallons per minute (gpm) and should be rated by the manufacturer for handling sewage effluent.

22.4 Wet Well

a. The wet well should have a minimum storage capacity of 50 gallons, in order to accommodate normal peak flows and emergency storage during a short power outage.

b. The pump should be able to be serviced without dewatering the wet well.

c. The maximum water elevation in the wet well should be no less than six inches below the invert of the influent pipe.

22.5 Valves

a. Check and shutoff valves should be used to isolate the pump from the wet well and force main.

b. The check valve should be located between the shutoff valve and the pump.

c. The maximum water elevation in the wet well should be no less than six inches below the invert of the influent pipe.

22.6 Alarm Feature

It is standard design practice for an alarm system to be provided that warns of a sewage level in excess of the maximum water elevation in the wet well. Refer to Sections 20.9 and 22.4.

22.7 Ventilation

The wet well should be properly vented to the outside. Inside installations should be completely airtight and vented to avoid buildup of hazardous and odorous gases. The completed installation should be vacuum tested prior to operation.

22.8 Force Main

The force main piping associated with the pump unit(s) should have watertight joints and meet or exceed DWV specifications and be sufficient for three times the typical operating pressure of the pumping system.

23. Treatment Tanks

23.1 Septic Tanks

23.11 Capacity

a. The minimum liquid septic tank capacity for any installation should be 1,000 gallons.

b. The septic tank capacity should have a minimum hydraulic retention time of 2.5 days using estimated maximum daily sewage flows from Appendix A.

c. Septic tanks may be connected in series to attain the necessary capacity.

23.12 Construction

a. Because round septic tanks have been shown to be less effective than rectangular tanks, all septic tanks should be rectangular in shape.

b. Tanks should be watertight and constructed of sound and durable material not subject to excessive corrosion or decay.

1. Precast concrete tanks should have a minimum wall thickness of 2.5 inches and be adequately reinforced.

2. Precast slabs used as covers should have a thickness of at least three inches and be adequately reinforced.

c. The depth of liquid in any tank or its compartments should be:

1. Not less than 2.5 feet nor more than five feet for tanks having a liquid capacity of 600 gallons or less.

2. Not less than three feet nor more than seven feet for tanks having a liquid capacity of more than 600 gallons.

d. No tank or compartment should have an inside horizontal dimension less than 36 inches

e. Septic tank installations should consist of rectangular tanks with multiple compartments or multiple tanks.

1. The first compartment or tank should have at least the same capacity as the second but should not exceed twice the capacity of the second.

2. Tanks or compartments should be connected in series and should not exceed four in number in any one installation.

23.13 Inlet and Outlet Connections

a. The bottom of the inlet should be a minimum of three inches above the bottom of the outlet.

b. Inlet baffles or vented tees should extend below the liquid level at least six inches. Penetration of the inlet device should not exceed that of the outlet device.

c. The outlet baffles or vented tees of each tank or compartment should extend below the liquid surface to a distance equal to 40 percent of the liquid depth.

d. The inlet and outlet baffles or vented tees should extend above the liquid depth to approximately one inch from the top of the tank. Venting should be provided between compartments and each tank.

e. The outlet baffles or vented tees of the last compartment or tank should be equipped with a solids retainer, preferably an effluent filter bearing the seal of an ANSI accredited testing organization indicating approval by that organization under ANSI/NSF Standard No. 46.

23.14 Treatment Tank Access

a. Access to Each tank or compartment of the tank should be provided by a manhole with an inside dimension of at least 24 inches, with a removable cover. The top of the tank containing the manhole or the top of the manhole extension should not be more than 12 inches below grade level.

b. Access should be extended to grade.

1. The access cover should be airtight. Grade level access covers should be secured by bolts or locking mechanisms or have sufficient weight to prevent unauthorized access.

2. The ground should slope away from any access extended to grade level.

3. An access port directly above the filter is necessary so the filter can be removed for inspection and cleaning.

23.15 Inspection Port

A maximum 4-inch diameter inspection port with sealed cover should be installed to grade level above the inlet tee.

23.2 Aerobic Treatment Tanks

23.21 Capacity

Capacity should comply with the following:

a. The rated treatment capacity of an aerobic treatment tank should be specified by the manufacturer. The manufacturer's data should be in conformance with the approved test sequence and protocol in Section 23.23, Testing and Approval.

b. The minimum manufacturer's rated treatment capacity of an aerobic treatment tank approved under this section is 400 gpd.

c. The rated treatment capacity should meet or exceed the estimated maximum daily sewage flow as determined using Appendix A.

23.22 Limits of Usage

Local conditions may limit the use of an aerobic treatment unit under the following circumstances:

a. Where intermittent use will adversely affect the functioning of the aerobic treatment unit.

b. Where dependable maintenance service is not available.

c. Where electrical service is unreliable.

d. Where the waste characteristics are stronger than normal domestic sewage (e.g. restaurants, bakeries, etc.).

23.23 Testing and Approval

a. Aerobic treatment tanks with flows of 1500 gpd or less should bear a seal indicating testing and approval under ANSI/NSF Standard 40 by an ANSI-certified testing organization.

b. Units tested and awarded a seal under other than the current standard should be approved for use until the expiration of the seal. Units initially submitted for testing or resubmitted for testing should be approved under the version of NSF International Standard No. 40 in effect at that time.

c. Manufacturers, retailers or other persons seeking approval of aerobic treatment units should submit a copy of the certification report including complete test procedures and results conducted by the testing agency certifying that such units proposed for installation meet or exceed the standards as established in NSF Standard No. 40. For example, if a company receives NSF approval in 2015, and the approval is good for seven years, but the criteria for Standard 40 changes in 2020, the existing approval is acceptable until the expiration of the approval (i.e. 2022). After that date, the treatment tank should be recertified.

23.24 Design Features

a. Multiple aerobic treatment tanks connected for the purpose of achieving the needed hydraulic capacity should only be permitted where the tanks are connected in parallel.

b. All tanks should have equal capacity and receive equal loading.

c. Every aerobic sewage treatment tank should be equipped with a visual and audible alarm system which should be designed to respond to any electrical or mechanical failure or malfunction of the tank or any component thereof. Refer to Section 20.10.

24. Filter Distribution System

24.1 General

a. Effluent from the treatment tank should be discharged to the dosing tank through a watertight line a minimum of three inches in diameter unless otherwise specified by local plumbing or building codes.

b. All lines should be placed on a minimum grade of at least 0.25 inch per foot, sloping away from the treatment tank.

c. The lines from the treatment tank to the pump station and the filter tank to a lift station or chlorine contact tank should meet the standards of this section.

d. Connections of lines to tanks and distribution boxes should be made using water-tight mechanical seals or hydraulic grouting. Portland cement is not an appropriate grouting material in this application.

24.2 Dosing Tanks

a. Dosing tanks should be constructed of materials to the specifications outlined in Section 23.12 (relating to standards for septic tanks).

b. The dosing tank should have a minimum liquid capacity equal to or greater than two times the designed dose volume.

c. Sufficient space should be provided for electrical connections and proper pump control operation.

d. Unless otherwise regulated by local electrical codes, all electrical connections should be moisture resistant and at a point higher than the inlet pipe or mounted above grade outside of the dosing tank or manhole extension within a tamper resistant, lockable control box.

e. A watertight manhole, at least 20 inches square (20 X 20) or 24 inches in diameter, extended to grade, should be provided for access to the dosing tank. Manhole covers should meet the specifications in Section 23.14, “Treatment Tank Access.”

24.3 Dosing Pumps

a. The intake of the dosing pump should be at least six inches from the bottom of the tank.

b. The intake of any dosing pump should be at a lower elevation than the lowest lateral.

c. Pumps should not be suspended above the bottom of the tank by chains or similar equipment.

d. A disconnect should be incorporated into the piping within the dosing tank for ease of pump removal. This should be located so that entering the tank to remove the pump is not necessary.

e. An effective warning device to indicate when the tank is filled to within 75% of its capacity should be installed in the dosing tank to indicate failure of the pump. Refer to Section 20.10.

f. A copy of the performance curve of the pump to be used should be attached to the system design.

g. A copy of the manufacturer's specifications showing that the pump is designed to handle sewage or sewage effluent should also be attached to the system design.

h. When an aeration tank or other treatment process is used which results in a periodic pump discharge from the treatment tank, the discharge mechanism may be substituted for a dosing tank and pump if the periodic discharge rate meets the criteria in paragraph h(1) below and Section 24.1(b) (relating to dosing tanks).

i. The water level in the dosing tank should be maintained to keep the pump suction submerged at all times.

j. Pump Capacity

1. The pump should be designed to deliver a flow in gpm equal to or greater than the combined flows from all discharge holes in the laterals when operating at designed level of head and should be rated by the manufacturer for handling of sewage effluent.

2. Discharge rates from the individual holes of the lateral at design head should be calculated using the sharp-edged discharge hole equation:

$$q = 11.82d^2\sqrt{h}$$

Where:
q = discharge rate (gpm)
d = diameter of hole (inches)
h = head to be maintained at terminal ends of lateral (in feet)

3. Total pump head should be calculated by addition of all losses incurred due to elevation changes, pipe and fitting friction losses, and the head level to be maintained at the terminal end of the lateral of three feet.

4. Head loss due to friction in pipe and fittings used in construction of the pressure system should be calculated using a friction loss table for smooth-walled plastic pipe (C=150).

24.4 Pressure Dose Criteria

24.41 General Provisions

a. The piping used in a pressurized system should have watertight joints.

b. Delivery pipes from dosing pumps should be installed to facilitate drainage of the distribution piping back to the dosing tank between doses.

c. The use of check valves on delivery pipes is not appropriate.

d. Dosing Tank effluent delivery pipe should be sized to minimize friction loss. Where the system designer determines that water hammer may be a problem, thrust blocks should be installed on delivery pipes.

e. The head loss due to friction from the beginning of the distribution manifold to the terminal end of the last lateral should not exceed 15 percent of the head level to be maintained at the terminal end of the lateral.

f. The permittee should conduct a test pressurization of the completed distribution system in the presence of the design engineer prior to covering the piping system from view. During the test, the permittee should confirm that all joints are watertight and that a discharge is occurring from each hole.

24.42 Manifolds

a. Distribution to the individual laterals should be by a central manifold extending into the filter area from the delivery pipe or header. It is standard design practice for the manifold to have the following minimum diameter:

Sq. ft. of Filter Area	Minimum Manifold Diameter
<1,200	1.5"
≥1,200	2"

b. The manifold should be installed level to provide equal distribution of treatment tank effluent to each line.

c. Laterals should be extended from both sides of the manifold by opposing tees or a double sanitary tee.

24.43 Laterals

a. The filter should contain a minimum of two laterals or two opposing sets of laterals.

b. Laterals should consist of 1.5-inch diameter pipe, with holes placed along the bottom of the pipe; an end cap should be cemented on the terminal end of the lateral.

c. The maximum length of a lateral from the manifold to the end cap should be:

1. 51 feet and contain nine holes for filters less than 2,500 square feet; or

2. 100 feet for filters greater than 2,500 square feet.

d. Laterals should be level to a maximum tolerance of four inches of fall per 100 feet toward the terminal end of the lateral.

e. Distribution laterals should be placed from four to six feet on center.

f. Laterals should be placed no further than five feet nor less than two feet from the sidewalls of the bed.

g. Laterals should be placed in the bed so that the first and last discharge holes will be no more than five feet nor less than two feet from the ends of the bed.

h. All systems should be designed to maintain a minimum of three feet of head at the terminal end of each lateral.

i. Opposing laterals should not differ in length by more than six feet.

j. When less than the maximum length of lateral is used, as described in paragraph (c), the lateral should be shortened in 6-foot sections with hole spacing maintained as outlined in paragraph 24.44(b).

24.44 Discharge Holes

a. Minimum hole size should be 0.25-inch for systems using pumps.

b. The first hole in the lateral should be three feet from the manifold. Additional holes should be placed six feet on center with the last hole placed directly in the end cap.

25. Filtration System

25.1 Subsurface Sand Filter

25.11 Location

a. A subsurface sand filter should not be installed in areas where bedrock is encountered unless a concrete bottom and sides are used.

b. Where the seasonal high-water table rises above the bottom of the sand filter, it is standard design practice for a suitable liner and padding as described in Section 25.13 to be used to prevent sewage exfiltration or groundwater infiltration. For these cases, the design should consider the buoyant force on the filter unit.

c. A subsurface sand filter should not be constructed in unstabilized fill.

25.12 Size

a. It is standard design practice for the sand filter area to be the largest of following:

1. The area based on hydraulic loading as calculated in b. below;

2. The area based on organic loading as calculated in c. below;

3. 300 square feet.

b. Hydraulic Loading

1. For a septic tank system, it is standard design practice for the area needed for the sand filter to be determined using an application rate of 0.67 gpd per square foot of filter area based on the design flow calculated in Section 20.2.

2. When aerobic treatment is used, it is standard design practice for the area needed for the sand filter to be determined using an application rate of 1.0 gpd per square foot of filter area based on the design flow calculated in Section 20.2.

c. Organic Loading

It is standard design practice for the area needed for the sand filter to be determined using an application rate of five lbs BOD_5 per day per 1,000 square feet of filter area based on the design loading calculated in Section 20.2.

25.13 Media

25.131 Coarse Aggregate

a. At least two inches of clean aggregate should surround underdrains and distribution pipes. The coarse aggregate should have the following characteristics:

1. Coarse aggregate used in the underdrains and distribution system should meet the Type B requirements posted in the Department of Transportation specifications Publication #408, section 703, Table B. See Appendix C.

2. The uniform size and grading of the aggregate should meet AASHTO No. 57 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

b. A minimum depth of four inches of aggregate should be placed over the aggregate underdrain material. Coarse aggregate used in the transition layer should meet the following specifications:

1. Type B requirements posted in the Department of Transportation specifications Publication #408, Section 703, Table B. See Appendix C**.**

2. The size and grading should meet AASHTO No. 8 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

c. A layer of porous geotextile or equivalent material may be placed on top of both layers of aggregate to prevent migration of soil or sand into the aggregate.

25.132 Sand

a. At least 24 inches of clean sand should be placed over the underdrain aggregate.

b. PennDOT Cement Concrete Sand Type A or ASTM C-33 sand may be used. The following sand specification includes the preferred characteristics of sand for wastewater filtration:

1. Effective Size: 0.3 – 0.6 mm.

2. Uniformity Coefficient: < 3.5.

3. Percent passing 200 mesh: < 3.

4. The sand should not contain more than five percent by weight deleterious material as determined by AASHTO-104 or ASTM-3-88.

5. It is standard practice for the sand to be washed prior to installation.

c. The design engineer should submit a sieve analysis for each sand considered in the design.

1. If the chosen sand does not meet the standard listed, a justification for the use of the chosen sand should be provided.

2. The justification should compare and contrast the standard material specifications to the chosen sand specifications.

3. The justification should show that the material will not have an adverse effect on the performance of the filtration system.

4. Material cost may be a consideration but not the sole consideration.

25.14 Cover Soil

a. The minimum depth of earth cover over the aggregate in all installations should be 12 inches. Additional cover should be considered in colder climates.

b. Ponding observation ports should be installed to the top of the coarse aggregate through the cover material.

c. Where the top of the aggregate is less than 12 inches from the undisturbed soil surface, the soil cover should extend beyond the filter area by at least three feet on all sides.

d. The soil over the sand filter should consist of soil suitable for the growth of vegetation and be seeded to control erosion.

e. The soil over the sand filter should be graded so that surface water will run off.

25.15 Dosing

a. Type – It is standard design practice for the filter system to be time-dosed.

b. Frequency – The estimated daily flow should be discharged to the filter area in 12 or more doses.

c. Dose Volume

1. Minimum dose volume should be five times the internal liquid capacity of the delivery pipe, manifold and laterals, or a volume sufficient to cover the filter to a depth of 3/16 inch, whichever is greater.

2. When an establishment produces more than 50 percent of its total daily flow during a peak flow period, the minimum dose volume should equal the anticipated flow during that peak period.

25.16 Underdrain Piping

a. A 3-inch diameter or greater DWV or equivalent underdrain piping should be laid on a grade of three to six inches per 100 feet sloped to the outfall pipe.

b. Underdrain piping should be located between the distribution laterals to maximize effluent travel through the filter sand.

c. Underdrain piping holes should be equal or greater in number and size to the distribution piping holes.

d. Underdrain piping should have two rows of holes placed at approximately 45-degree angles from each other along the bottom half of the pipe.

e. Underdrain piping should have a cleanout extended to grade at a minimum of one foot from the sidewall and baffle.

f. The outfall pipe from the underdrain header should have an anti-seep collar and bentonite clay plug, or a leakproof boot sealed as per manufacturer's instructions to the subsurface sand filter liner.

25.17 Filter Base and Liner

a. The base of the filter should be sloped to the underdrain pipe a maximum of one percent.

b. An impervious liner of hyplon, polyvinyl chloride (PVC), high density polyethylene (HDPE), or polyethylene sheeting of 30 mil thickness or equal should be installed on a tamped earth base to prevent seepage to groundwater unless a concrete bottom and sides are used.

c. A 2-inch layer of sand or a layer of 10-ounce porous geotextile material should be provided on each side of the liner to prevent punctures and tears.

d. Seams should be made according to the liner manufacturer's specifications.

25.2 Recirculating Subsurface Sand Filter (RSSF)

25.21 Location

a. A recirculating subsurface sand filter (RSSF) should not be installed in areas where bedrock is found at a depth less than the proposed depth of the sand filter. An RSSF can be installed when the seasonal high groundwater table rises above the bottom of the sand filter if a suitable synthetic liner that will prevent sewage exfiltration or groundwater infiltration is included in the design. For these cases, the design should consider the buoyance force on the filter unit.

b. An RSSF should not be constructed in unstabilized fill.

25.22 Size

a. It is standard design practice for the sand filter area to be the largest of the areas based on the following:

1. The hydraulic loading, as calculated in b. below;

2. The organic loading, as calculated in c. below;

3. 150 square feet.

b. Hydraulic Loading

1. For a septic tank system, it is standard design practice for the area needed for the sand filter to be determined using an application rate of 2.0 gpd per square foot of filter area based on the design flow calculated in Section 20.2.

2. When aerobic treatment is used, it is standard design practice for the area needed for the sand filter to be determined using an application rate of 3.0 gpd per square foot of filter area based on the design flow calculated in Section 20.2.

c. Organic Loading

It is standard design practice for the area needed for the sand filter to be determined using an application rate of five lbs BOD_5 per day per 1,000 square feet of filter area based on the design loading calculated in Section 20.2.

25.23 Media

25.231 Coarse Aggregate

a. At least two inches of coarse aggregate should surround underdrains and distribution pipes. The coarse aggregate should have the following characteristics:

1. Coarse aggregate used in the underdrains and distribution system should meet the Type B requirements posted in the Department of Transportation specifications Publication #408, Section 703, Table B. See Appendix C.

2. The uniform size and grading of the aggregate should meet AASHTO No. 57 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

b. A minimum depth of four inches of aggregate should be placed over the aggregate underdrain material. Coarse aggregate used in the transition layer should meet the following charachteristics:

1. Type B requirements posted in the Department of Transportation specifications Publication #408, Section 703, Table B. See Appendix C.

2. The size and grading should meet AASHTO No. 8 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

c. A layer of porous geotextile or equivalent material may be placed on top of both layers of aggregate to prevent migration of soil or sand into the aggregate.

25.232 Sand

a. In order to allow for adequate treatment, a depth of at least 24 inches of clean sand is necessary

b. The following sand should be used:

1. Effective Size: 1.0 – 3.0 mm.

2. Uniformity Coefficient: < 2.5.

3. Percent passing 200 mesh: < 3.

4. The sand should not contain more than five percent by weight deleterious material as determined by AASHTO-104 or ASTM-3-88.

5. It is standard practice for the sand to be washed prior to installation.

c. The design engineer should submit a sieve analysis for each sand considered in the design.

1. If the chosen sand does not meet the standard listed, a justification for the use of the chosen sand should be provided.

2. The justification should compare and contrast the standard material specifications to the chosen sand specifications.

3. The justification should show that the material will not have an adverse effect on the performance of the filtration system.

25.24 Cover Soil

a. The minimum depth of earth cover over the coarse aggregate in all installations should be 12 inches. Additional cover should be considered in colder climates.

b. Ponding observation ports should be installed to the top of the coarse aggregate through the cover material.

c. When the top of the aggregate is less than 12 inches from the undisturbed soil surface, the soil cover should extend beyond the filter area by at least three feet on all sides.

d. The soil over the sand filter should consist of soil suitable for the growth of vegetation and be seeded to control erosion.

e. The soil over the sand filter should be graded so that surface water will run off.

25.25 Dosing

a. Type – It is standard design practice for the filter system to be time-dosed.

b. Frequency – The estimated daily flow should be discharged to the filter area in 48 doses.

c. Dose Volume

1. Minimum dose volume should be five times the internal liquid capacity of the delivery pipe, manifold and laterals, or a volume sufficient to cover the filter to a depth of 3/16 inch, whichever is greater.

2. When an establishment produces more than 50 percent of its total daily flow during a peak flow period, the minimum dose volume should equal the anticipated flow during that peak period.

25.26 Underdrain Piping

a. A 3-inch diameter or greater DWV or equivalent underdrain piping should be laid on a grade of three to six inches per 100 feet, sloped to the outfall pipe.

b. Underdrain piping should be located between the distribution laterals to optimize movement of the effluent travel through the filter sand.

c. Underdrain piping holes should be equal or greater in number and size to the distribution piping holes.

d. Underdrain piping should have two rows of holes placed at approximately 45-degree angles from each other along the bottom half of the pipe.

e. Underdrain piping should have a cleanout extended to grade at a minimum of one foot from the sidewall and baffle.

f. The outfall pipes from the underdrain header should have an anti-seep collar and a bentonite clay plug or leak-proof boot sealed to the RSSF liner, in accordance with the manufacturer's instructions.

25.27 Filter Base and Liner

a. The base of the filter should be sloped to the underdrain pipe (one percent maximum).

b. An impervious liner of hyplon, high density polyethylene (HDPE), or polyethylene sheeting of 30 mil thickness or equal should be installed on a tamped earth base to prevent seepage to the groundwater, unless a concrete bottom and sides are used.

c. A 2-inch layer of sand or a layer of 10-ounce porous geotextile material should be placed on each side of the liner to prevent punctures and tears.

d. Seams should be made according to the liner manufacturer's specifications.

25.28 Recirculation

The optimal effluent recirculation to outfall drain ratio is 3:1. This ratio can be achieved by one of the following methods or equivalent:

a. The underdrain may be divided by an 8-inch high baffle placed under the liner and perpendicular to the long sidewall of the filter.

    1. Seventy-five percent of the effluent collected by the underdrain should be recirculated back to the RSSF dose tank through a T-configured drainpipe and gravity discharge pipe.

    2. The remaining 25 percent of the effluent should be collected by a drainpipe set parallel to the baffle with gravity discharge to the disinfection unit and outfall.

b. A typical flow splitter may be installed.

    1. 75 percent of the effluent collected by the underdrain should be recirculated back to the RSSF dose tank.

2. Remaining 25 percent of the effluent should be conveyed by gravity discharge to the disinfection unit and outfall.

25.3 Free Access Sand Filter System

25.31 Location

a. A free access sand filter should not be installed in areas where bedrock is encountered unless a concrete bottom and sides are used.

b. Where the seasonal high water table rises above the bottom of the sand filter, a suitable liner and padding as described in Section 25.36 should be used to prevent sewage exfiltration or groundwater infiltration. For these cases, the design should consider the buoyant force on the filter unit.

c. A free access sand filter should not be constructed in unstabilized fill.

25.32 Size

a. It is standard design practice for the area of the sand filter to be the largest of the following:

1. The hydraulic loading as calculated in a. below;

2. The organic loading, as calculated in b. below;

3. 200 square feet.

b. Hydraulic Loading

The area needed for the sand filter should be determined using an application rate of 1.25 gpd per square foot of filter area based on the design flow calculated in Section 20.2.

c. Organic Loading

It is standard design practice for the area needed for the sand filter to be determined using an application rate of five lbs BOD_5 per day per 1,000 square feet of filter area based on the design loading calculated in Section 20.2.

25.33 Media

25.331 Coarse Aggregate

a. Aggregate should be placed around the underdrain to a total depth of five inches from the bottom of the tank. The coarse aggregate should have the following characteristics:

1. Coarse aggregate used in the underdrains and distribution system should meet the Type B requirements posted in the Department of Transportation specifications Publication #408, Section 703, Table B. See Appendix C.

2. The uniform size and grading of the aggregate should meet AASHTO No. 57 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

b. A minimum depth of four inches of aggregate should be placed over the aggregate underdrain material. Coarse aggregate used in the transition layer should meet the following charachteristics:

1. Type B requirements posted in the Department of Transportation specifications Publication #408, Section 703, Table B. See Appendix C.

2. The size and grading should meet AASHTO No. 8 requirements, as described in Form 408, Section 703.2, Table C from a Department of Transportation certified stockpile. See Appendix D.

25.332 Sand

a. Sand should be placed over the aggregate to a depth of at least 24 inches.

b. The sand in The filter should not be greater than 36 inches deep.

c. PennDOT Cement Concrete Sand Type A or ASTM C-33 sand may be used. The following sand specification includes the preferred characteristic of sand for wastewater filtration

1. Effective Size: 0.3 – 0.6 mm.

2. Uniformity Coefficient: < 3.5.

3. Percent passing 200 mesh: < 3.

4. The sand should not contain more than five percent by weight deleterious material as determined by AASHTO-104 or ASTM-3-88.

5. The sand should be washed prior to installation.

d. The design engineer should submit a sieve analysis for each sand considered in the design.

1. If the chosen sand does not meet the standard listed, a justification for the use of the chosen sand should be provided.

2. The justification should compare and contrast the standard material specifications to the chosen sand specifications.

3. The justification should show that the material will not have an adverse effect on the performance of the filtration system.

25.34 Dosing

a. Type – It is standard design practice for the filter system to be time-dose.

b. Frequency – The estimated daily flow should be discharged to the filter area in 12 or more doses.

c. Dose Volume

1. Minimum dose volume should be five times the internal liquid capacity of the delivery pipe, manifold and laterals, or a volume sufficient to cover the filter to a depth of 3/16 inch, whichever is greater.

2. When an establishment produces more than 50 percent of its total daily flow during a peak flow period, the minimum dose volume should equal the anticipated flow during that peak period.

25.35 Underdrain Piping

a. A 4-inch diameter or greater DWV or equivalent perforated underdrain pipe should be placed on the bottom of the tank.

b. Underdrain piping should be located between the distribution laterals to optimize movement of the effluent through the filter sand.

c. Underdrain piping holes should be equal or greater in number and size to the distribution piping holes.

d. Two rows of perforations between 0.5 to 0.75 inch in diameter should be drilled in the underdrain pipe at 6-inch intervals and the pipe should be placed so the perforations face downward and the rows are approximately 45° from each other.

e. Underdrain piping should have a cleanout extended to grade at a minimum of one foot from the sidewall and baffle.

f. The outfall pipes from the underdrain header should have an anti-seep collar and a bentonite clay plug or leak-proof boot sealed to the base, in accordance with the manufacturer's instructions.

25.36 Filter Base

The filter should be constructed in a tank meeting the following specifications:

a. Tanks should be watertight and made of a sound, durable material which is not subject to excessive corrosion or decay.

b. Concrete tanks should have a minimum wall thickness of 2.5 inches and be adequately reinforced.

c. If precast slabs are used as tank tops to support the access covers, the slabs should have a thickness of least three inches and be adequately reinforced.

d. Tanks should be designed and constructed so that the depth from the cover to the top of the sand layer provides sufficient freeboard to allow for maintenance of the sand surface.

e. Access – Access to the filter surface should be provided by one of the following methods:

1. Access openings

i. Access should be provided by a minimum of two access openings.

ii. The access openings should be a minimum of 36 inches by 36 inches.

iii. The access opening should provide access to the entire surface of the filter.

iv. The tank wall should be extended a minimum of six inches above the final grade.

v. Access covers should be insulated against severe weather.

vi. Access covers should be secured by bolts or locking mechanisms.

vii. Access covers should prevent water infiltration and the entrance of debris.

viii. Access covers should be lightweight to facilitate routine maintenance.

2. Building

i. The entire filter may be enclosed within a building or structure to allow access to the entire filter surface area.

ii. All exposed surfaces of the building should be insulated and the building should be secured against unauthorized access.

iii. Ventilation should be provided for filter buildings. Switches for operation of ventilation equipment should be marked and conveniently located.

iv. Consideration should be given for the use of automatic controls. If automatic controls are used, it is standard design practice for a manual ventilation switch to also be installed and to override the automatic controls.

v. The fan wheel should be fabricated from non-sparking material.

25.37 Distribution

a. A concrete splash plate or other suitable material should be located under each effluent outlet to prevent scouring of the sand surface. Movement of the splash plate during the flooding operation should be prevented.

b. The central distribution system should be designed and installed to convey a minimum 2-inch flood dose of effluent to the surface of the sand filter.

c. The height of the central distribution system's effluent outlet above the sand surface should allow for the installation of a splash plate and the maximum flooding depth of the sand filter.

d. A high-water alarm should be installed in the filter tank which produces an audible and visual alarm when effluent backs up on the filter surface to 12 inches above the surface of the sand.

e. It is standard design practice for the filter distribution system to be designed and constructed to allow for isolation of a portion of the filter surface area during the annual inspection and raking of the sand.

26. Disinfection

26.1 Chlorination

26.11 Chlorine Residual

Chlorination is a common method of disinfection. The chlorine residual should be maintained at a range of 0.3 mg/L to 0.5 mg/L.

26.12 Chlorine Feed Equipment

a. Equipment providing for erosion of chlorine tablets is preferred, although a hypochlorite solution feeder may be substituted.

b. Chlorine should be applied at the inlet end of the chlorine contact tank.

26.13 Chlorine Contact Tank

a. Volume of the chlorine contact tank should be equivalent to 50 percent of the estimated design sewage flow.

b. The chlorine contact tank should be constructed of a durable, impervious material.

c. Baffles should be used within the tank to minimize short-circuiting.

d. The chlorine contact tank should be equipped with a sturdy, lockable cover and should have provision for access to allow maintenance, sampling and inspection.

e. The influent line should be of a sound, durable material of watertight construction and have a 3-inch minimum diameter unless otherwise specified by local plumbing or building codes.

f. The line should be laid on a firm foundation, sloping toward the chlorine contact tank, at a minimum grade of 0.25 inch per foot.

g. All bends should be made with standard fittings.

26.14 Dechlorination Equipment (if necessary)

a. Dechlorination should be accomplished by erosion of sodium sulfite tablets in an erosion tablet feeder.

b. Dechlorination equipment should meet the design standards of Section 26.13.

c. Sodium sulfite should be applied at the outlet of the chlorine contact tank with treatment occurring in the effluent pipe.

26.2 Ultraviolet (UV) Radiation

26.21 Equipment

a. It is necessary that UV radiation at a level of 254 nanometers be applied at a minimum dosage of 25,000 microwatt-seconds per square centimeter at all points throughout the water disinfection chamber.

   1. A higher dosage may be necessary, based on the specific transmittance of the wastewater.

   2. 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.

b. The maximum water depth in the chamber, measured from the tube surface to the chamber wall, should not exceed three inches.

c. The UV tubes should be jacketed so that a proper operating tube temperature of about 105ºF is maintained, and the jacket should be of quartz or high silica glass with similar optical characteristics.

d. The units should be designed to permit frequent mechanical cleaning of the water contact surface of the jacket, sampling and inspection without disassembly of the unit.

e. A flow control device, accurate within the expected pressure range, should be installed to restrict flow to the maximum design flow of the treatment unit.

f. To ensure that appropriate UV dose levels are maintained, a warning alarm should be installed to ensure prompt replacement of a burned-out tube.

g. To ensure continued optimal performance of the unit, an accurately calibrated UV intensity meter, properly filtered to restrict its sensitivity to the point of the disinfection spectrum, may also be installed in the wall of the disinfection chamber at the point of greatest water depth from the tube or tubes.

h. A spare UV tube and other necessary equipment should be available to allow prompt repair by qualified personnel properly instructed in the operation and maintenance of the equipment.

27. Systems Classified as Advanced Alternate

Proprietary systems that have been evaluated as SFTFs by DEP's Bureau of Clean Water and that are capable of achieving the average monthly effluent standards of 10 mg/L for $CBOD_5$, 10 mg/L for TSS, and 200 No./100 mL for fecal coliform are consistent with this manual and may be approved for coverage under WQG-01 and PAG-04. A list of these systems is maintained by DEP. As of the publication date of this manual, the following proprietary technologies have been evaluated by the DEP's Bureau of Clean Water and have been determined to be capable of achieving the above effluent limitations, when used in conjunction with disinfection (tablet chlorinator and chlorine contact tank, or ultraviolet disinfection).

- Anua – Puraflo Peat Fiber Biofilter Models P150N*XB (where X ranges from 3 to 10)
- Norweco Singulair – Combination of (Models 960, 960LP, 960OP, or Green 960) and Model 960-HKBFR
- Orenco AdvanTex – Models AX20N, AX20RTN, AX25RTN, AX100
- Premier Tech – Ecoflo Models ECC-XXX-P, ECP-XXX-P, STB-570PR, STB-650PR, STB-730-PR

The following procedure was used to evaluate the treatment technologies.

a. The effluent data was collected by a third party.

b. The data was collected during testing which followed establish certification protocol under national standardize testing protocols (National Sanitation Foundation/American National Standards Institute, Bureau de normalisation du Québec/Standards Council of Canada).

c. The certification testing occurred in a climate which is similar to or colder than the climate in Pennsylvania.

d. The certification data was statistically evaluated to determine if the technology is capable of meeting the effluent limits of 10 mg/L CBOD and 10 mg/L TSS.

    1. Using the sum of the sample data set mean plus one standard deviation, the DEP determined that the data supports the conclusion that the technology is capable of meeting the applicable effluent limits.

    2. The statistical analysis provides evidence that the proprietary system is capable of meeting the effluent limits in accordance with the NPDES permit.

    3. An important note concerning sample data, data samples only represent the full range of the data sets values.

    4. The statistical analysis provides a measure of the variability of the data which is important when evaluating a sample data's compliance with effluent performance.

    5. The statistical evaluation of the sample mean plus one standard deviation provides for an 85% probability the technology, when properly operated and maintain, should operate within the effluent limits.

28. Outfall Sewer

a. The outfall sewer should be extended to the approved outfall point reflected in an approved sewage facilities plan.

b. It is standard design practice for the outfall sewer to be made of a sound, durable material (DWV or better) and be a minimum of three inches in diameter.

c. It is standard design practice for the outfall sewer to be placed on a firm foundation sloping toward the point of discharge at a minimum grade of 0.25 inch per foot.

d. All bends should be made with standard fittings.

e. Consideration should be given to using a perforated outfall sewer and surrounding the outfall sewer with crushed stone to maximize exfiltration, particularly in the summer and fall months when stream flow is reduced. The perforated pipe should be used not more than 10 feet from the discharge outfall.

f. The outfall sewer should be designed in such a manner as to ensure rapid mixing and dispersion in the receiving stream and minimize the potential for human contact, as required by WQG-01.

g. In many cases, a water obstruction and encroachment permit or authorization is required under Chapter 105 where structures or activities are located in, along or across, or projecting into a stream or its floodway, a wetland or other body of water. Contact the regional Waterways & Wetlands program for additional information.

DIVISION 30: INSTALLATION

30. General

a. An SFTF should be installed by a competent, experienced individual to ensure that the treatment units and structures are constructed in accordance with the guidelines in this manual and all manufacturer's recommendations.

b. Notify DEP and the municipality at the completion of construction to schedule an inspection. The engineer of record will inspect subsurface facilities, such as sand filters, and certify the installation was conducted in accordance with the design plans and specifications prior to backfilling.

c. Extreme care should be exercised in the operation of machinery and vehicles during and after installation to prevent damage to the system.

d. As required by the WQM permit, the design engineer must certify that the design was installed in accordance with the design and submit the certification to the regional office that issued the construction permit.

e. Construction may not begin until the necessary permits are acquired.

DIVISION 40: OPERATION AND MAINTENANCE

40. General

a. Operation and maintenance are required in accordance with approved Act 537 planning, manufacturer-specific requirements, NPDES permit, and WQM permit.

b. Any person receiving permit(s) to construct and operate an SFTF to treat and discharge sewage is responsible for the operation and maintenance of the facility and for any health nuisances or pollution problems that may result. To assure proper operation and maintenance, each permit will entail a level of inspection monitoring and maintenance to be conducted by a service provider of the management agency, if applicable, or contracted by the permittee.

c. To minimize water usage, water conservation fixtures should be installed (such as 1.6 gal. flush toilets, shower and faucet flow restrictors and front-loading washers).

d. The system designer should provide an operation and maintenance manual, which may be supplemented with manufacturer's manuals and instructions, to the permittee that includes, as a minimum, that septic tanks, dosing tanks, lift pump tanks and chlorine contact/storage tanks should be inspected every 6 months for structural integrity of the tank, inlet and outlet baffles, solids retainer, pumps and electrical connections.

41. Septic Tanks

a. The depth of sludge and scum in the septic tank should be measured at least once a year.

b. When the top of the sludge layer in the tank or any compartment of the tank is found to be less than 12 inches below the bottom of the outlet baffle, or if the bottom of the scum layer is within three inches of the outlet baffle, the tank should be pumped.

c. Annual pumping may be substituted for measurement. This cleaning is recommended to minimize plugging of the sand filter with solids and to avoid deterioration of the treated effluent.

d. Failure to pump treatment and dosing tanks often results in costly repairs or replacement.

e. Following septic tank cleaning, all interior surfaces of the tank should be inspected for leaks and cracks using a strong light.

f. Pumped-out septic tanks may contain toxic gases; therefore, only a properly equipped, trained and experienced person should attempt to enter or repair a septic tank if this should become necessary. **THE HOMEOWNER SHOULD NOT ENTER A SEPTIC TANK.**

g. The use of biological or chemical additives in the septic tank is neither recommended nor necessary.

42. Aerobic Tanks

a. The system designer should provide an operation and maintenance manual, which may be supplemented with manufacturer's manuals and instructions, to the permittee that includes, as a minimum, the following operation and maintenance provisions should be met by the permittee:

1. Aerobic tanks should be inspected every 6 months for structural integrity of the tank, inlets and outlet baffles, buoyed solids retainer, pumps and electrical connections.

2. The inspection and concurrent pumping of excess solids should be conducted in accordance with manufacturer's and NSF requirements.

b. Aerobic treatment plants should be maintained in accordance with the manufacturer's instructions and be pumped at least once a year to remove excess solids in order to minimize plugging of the sand filter and avoid deterioration of the discharge.

c. For mechanical equipment (such as aerobic treatment units, spray nozzles, etc.), a service contract with the equipment representative should be executed so that periodic inspection and "as needed" services are provided.

43. Buried Sand Filter

a. Buried sand filters should be inspected periodically by the property owner and every six months by the maintenance entity established under 25 Pa. Code § 71.64(c)(5).

b. The areas of the buried sand filter should be free of ponded effluent and downgradient seepage.

44. Recirculating Sand Filter

a. Buried sand filters should be inspected periodically by the property owner and every six months by the maintenance entity established under 25 Pa. Code § 71.64(c)(5).

b. The areas of the buried sand filter should be free of ponded effluent and downgradient seepage.

45. Free Access Sand Filter

a. Free access sand filters should be inspected periodically by the property owner and every six months by the maintenance entity established under 25 Pa. Code § 71.64(c)(5).

b. Accumulated solids on the surface of the sand in the free access sand filter, or greater than 12 inches of effluent ponded over the sand, is indicative of a system failure.

c. The high water alarm should be functional.

d. The surface of the free access sand should be raked and porous and any sand removed should be replaced with sufficient clean sand to maintain the depth at a minimum of 24 inches.

e. The plumbing in the free access sand filter tank should be functional and free of leaks and splash plates should be in place.

f. The free access sand filter tank and cover should be structurally sound and unauthorized access equipment should be in place. Insulation should be in place.

46. Chlorine Disinfection

WARNING: USE ONLY CHLORINE TABLETS THAT ARE APPROVED FOR USE IN WASTEWATER TREATMENT SYSTEMS MADE OF CALCIUM HYPOCHLORITE. DO NOT USE TABLETS DESIGNED FOR SWIMMING POOLS CONTAINING TRICHLOROISOCYANURIC ACID.

a. Adequate disinfection of the sewage should be continuously provided on a year-round basis to minimize public health risk. Therefore, regular and routine maintenance, such as adding chlorine tablets to the erosion feed system, filling the chlorine solution tank, etc., should be given to ensure that the disinfection equipment remains operational.

b. The chlorinator should be functioning within the specifications of the manufacturer.

c. Bridging of chlorine tablets should not be occurring.

d. Chlorine residual sampled after the contact/retention tank should be maintained at a concentration of at least 0.2 PPM.

e. Monthly inspection and filling of the chlorinator is necessary.

f. An annual inspection of the system by the service provider is necessary. ***CHLORINE CONTACT TANKS CONTAIN HAZARDOUS GASES AND CONSTITUTE A CONFINED SPACE. THE HOMEOWNER SHOULD NOT ENTER A CHLORINE CONTACT TANK.***

47. Ultraviolet Disinfection

a. Monthly cleaning and inspection of the water contact surface is necessary.

b. An annual inspection of the system and changing of the UV bulb by the service provider is necessary.

48. Systems Classified as Advanced Alternate Technology

Systems classified as advaced secondary alternate on-lot technologies may have alternate minimum O&M provisions which should be spelled out in the WQM-01 application. These provisions should be made a part of the WGM-01 permit conditions.

DIVISION 50: PERMIT MONITORING AND REPORTING REQUIREMENTS

The permit provides for specific levels of operation, maintenance, monitoring and reporting. Routine testing, such as the monthly chlorine residual test, can be conducted by the permittee. Other monitoring requirements, such as the annual fecal coliform test and inspection and maintenance functions described on the *Annual Maintenance Report, Small Flow Treatment Facilities* (3800-PM-BCW0093e), available on DEP's eLibrary website at www.depgreenport.state.pa.us/elibrary/, are to be conducted by a trained service provider employed by the municipal management agency or contracted by the permittee. Consistent with the permit, this information must be submitted on the *Annual Maintenance Report* form by the service provider to DEP and the local municipality and received by May 31 of each year.

Appendix A: Sewage Flows

The sewage flows from single-family dwellings or from apartments, rooming houses, hotels and motels served by SFTFs should be determined from the following table:

Table 1 – Residential Hydraulic and Organic Loading

Type of Establishment	Gallons/Unit/Day	Lbs. 5 Day BOD/Unit/Day
Multiple-family dwellings and apartments, including townhouses, duplexes and condominiums	400	1.13
Hotels and motels	100	.30
Rooming houses (per unit)	200	.60
Single-family residences [1]	400	.90

[1] For units of three bedrooms or less. For each bedroom over three, add 100 gpd and 0.22 lb BOD_5 per day.

The sewage flow for non-residential establishments served by an individual or community sewage system should be determined from the following table:

Table 2 – Non-residential Hydraulic and Organic Loading

Type of Establishment	Gallons/Day	Lbs. 5 Day BOD/Day
Commercial		
Airline catering per meal served	3	.03
Airports (per passenger - not including food)	5	.02
Airports (per employee)	10	.06
One licensed operator beauty shops*	200	-
Bus service areas not including food	5	.02
Country clubs not including food (per patron and employee)	30	.02
Drive-in theaters (not including food - per space)	10	.06
Factories and plants exclusive of industrial wastes (per employee)	35	.08
Laundries, self-service (gallons/washer)	400	2.00
Mobile home parks, independent (per space)	400	1.00
Movie theaters (not including food, per auditorium seat)	5	.03
Offices (per employee)	10	.06
Restaurants (toilet and kitchen wastes per patron)	10	.06
(Additional for bars and cocktail lounges)	2	.02
Restaurants (kitchen and toilet wastes, single-serve utensils/person)	8.5	.03
Restaurants (kitchen waste only, single-service utensils/patron)	3	.01
Stores (per public toilet)	400	2.00
Warehouses (per employee)	35	-
Work or construction camps (semi-permanent) with flush toilets (per employee)	50	.17
Work or construction camps (semi-permanent) without flush toilets (per employee)	35	.02

Type of Establishment	Gallons/Day	Lbs. 5 Day BOD/Day
Institutional		
Churches (per seat)	3	-
Churches (additional kitchen waste per meal served)	3	-
Churches (additional with paper service per meal served)	1.5	-
Hospitals (per bed space, with laundry)	300	.20
Hospitals (per bed space, without laundry)	220	-
Institutional food service (per meal)	20	-
Institutions other than hospitals (per bed space)	125	.17
Schools, boarding (per resident)	100	.17
Schools, day (without cafeterias, gyms or showers – per student and employee)	15	.04
Schools, day (with cafeterias, but no gym or showers – per student and employee)	20	.08
Schools, day (with cafeterias, gym and showers – per student and employee)	25	.10
Camps, day (no meals served)	10	.12
Camps, hunting and summer residential (night and day) with limited plumbing including water-carried toilet wastes (per person)	50	.12
Campgrounds, with individual sewer and water hookup (per space)	100	.50
Campgrounds with water hookup only and/or central comfort station which includes water-carried toilet wastes (per space)	50	.50
Fairgrounds and parks, picnic – with bathhouses, showers and flush toilets (per person)	15	.06
Fairgrounds and parks, picnic (toilet wastes only, per person)	5	.06
Swimming pools and bathhouses (per person)	10	.06

*Exclusive of industrial waste.

Actual flow data for any similar nonresidential establishment indicating maximum daily flows over a 1-year period may be accepted for use in sizing the SFTF.

Appendix B: Minimum Maintenance Chart

Component	Maintenance Frequency	
	Monthly	**Annually**
Septic Tank		Inspect and Pump*
Aerobic Tank		Inspect and Pump
Dosing Tank		Inspect and Pump
Subsurface Sand Filter		Inspect
Recirculating Subsurface Sand Filter		Inspect
CO-OP RFS III Recirculating Filter		Inspect
Access Sand Filter		Inspect and Rake
UV Unit	Inspect and Clean	Replace Bulb
Chlorinator	Inspect and Fill	
Dechlorinator	Inspect and Fill	

*Septic tanks should be pumped every three years.

Make all repairs required as a result of the inspections as soon as possible. Maintain aerobic tanks and disinfection units according to the manufacturer's specifications.

Appendix C

Table B

Coarse Aggregate Quality Specifications

	Type B
Soundness, Max. %	12
Abrasion, Max. %	45******
Thin and Elongated Pieces, Max. %	20
Material Finer Than 75 μm (No. 200) Sieve, Max. %	2
Crushed Fragments, Min. %	55**
Compact Bulk Density (Unit Weight), lbs./cu. ft.	70
Deleterious Shale, Max. %	2
Clay Lumps, Max. %	0.25
Friable Particles, Max. % (excluding shale)	1.0
Coal or Coke, Max. %	1
Glassy Particles, Max. %	4 or 10***
Iron, Max. %	3*****
Absorption, Max. %	3.5****
Total of Deleterious Shale, Clay Lumps, Friable Particles, Coal, or Coke Allowed, Max. %	2

** See Section 703.2(c)5.
*** See Section 703.2(c)10.
**** Gravel only. See Section 703.2(a)2.
***** See Section 703.2(c)11.
****** Blast Furnace Slag excluded. See Section 703.2(a)3.

Appendix D

Table C

Size and Grading Specifications for Coarse Aggregates

(Based on Laboratory Sieve Tests, Square Openings)

	Total Percent Passing													
AASHTO Number	**100 mm (4")**	**90 mm (3 1/2")**	**63 mm (2 1/2")**	**50 mm (2")**	**37.5 mm (1 1/2")**	**25.0 mm (1")**	**19.0 mm (3/4")**	**12.5 mm (1/2")**	**9.5 mm (3/8")**	**4.75 mm (No. 4)**	**2.36 mm (No. 8)**	**1.18 mm (No. 16)**	**150 µm (No. 100)**	**75 µm (No. 200)**
1	100	90-100	25-60		0-15		0-5							
3			100	90-100	35-70	0-15		0-5						
467				100	95-100		35-70		10-30	0-5				
5					100	90-100	20-55	0-10	0-5					
57					100	95-100		25-60		0-10	0-5			
67						100	90-100		20-55	0-10	0-5			
7							100	90-100	40-70	0-15	0-5			
8								100	85-100	10-30	0-10	0-5		
10									100	85-100			10-30	
2A**				100			52-100		36-70	24-50	16-38*	10-30		
OGS**				100			52-100		36-65	8-40		0-12		

* Applies only for bituminous mixtures.
** PennDOT Number – Only Type C will be listed in Bulletin 14.
*** For 75 µm (No. 200), see Table D.
Note A: A combination of No. 7 and No. 5 may be substituted for No. 57, provided that not more than 50% or less than 30% of the combination is No. 7.