Recommended Standards and Guidance for Performance, Application, Design, and Operation & Maintenance

Sand Lined Trench Systems

March 2014

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Preface

The recommended standards contained in this document have been developed for statewide application. Regional differences may, however, result in application of this technology in a manner different than it is presented here. In some localities, greater allowances than those described here may reasonably be granted. In other localities, allowances that are provided for in this document may be restricted. In either setting, the local health officer has full authority in the application of this technology, consistent with Chapter 246-272A WAC and local jurisdictional rules. If any provision of these recommended standards is inconsistent with local jurisdictional rules, regulations, ordinances, policies, procedures, or practices, the local standards take precedence. Application of the recommended standards presented here is at the full discretion of the local health officer.

Local jurisdictional application of these recommended standards may be:

1) **Adopted as part of local rules, regulations or ordinances -** When the recommended standards, either as they are written or modified to more accurately reflect local conditions, are adopted as part of the local rules, their application is governed by local rule authority.

2) **Referred to as technical guidance in the application of the technology -** The recommended standards, either as they are written or modified to more accurately reflect local conditions, may be used locally as technical guidance.

Application of these recommended standards may occur in a manner that combines these two approaches. How these recommended standards are applied at the local jurisdictional level remains at the discretion of the local health officer and the local board of health.

The recommended standards presented here are provided in typical rule language to assist those local jurisdictions where adoption in local rules is the preferred option. Other information and guidance is presented in text boxes with a modified font style to easily distinguish it from the recommended standards.

The recommended standards contained in this document have been primarily written to support the design of on-site sewage systems with design flows less than 3500 gpd, but may also be applied to large on-site sewage systems (LOSS).

With the adoption of the revised LOSS rule, chapter 246-272B WAC, in 2011, some provisions of the RS&Gs may not be appropriate or allowed for LOSS. Many applicable requirements from the RS&Gs have already been included in the LOSS rule. Design engineers and others interested in LOSS are directed to consult the rule and LOSS program staff before or instead of the RS&Gs.

Glossary of Terms: A glossary of common terms for all RS&Gs can be found on the DOH Web site at **http://www.doh.wa.gov/Portals/1/Documents/Pubs/337-028.pdf**

Typical RS&G Organization:

Standards Section	Explanation
Performance	How this technology is expected to perform (treatment level and function).
Application	How this technology is to be applied. This section includes conditions that must be met prior to proceeding with design. Topics in this section describe the "approved" status of the technology, component listing requirements, permitting, installation, testing and inspection requirements, etc.
Design	How this technology is to be designed and constructed (includes minimum standards that must be met to obtain a permit).
Operation and Maintenance	How this technology is to be operated and maintained (includes responsibilities of various parties, recommended maintenance tasks and frequency, assurance measures, etc).
Appendices	Design examples, figures and tables, specific applications, design and installation issues, and bibliography.

Introduction

Sand lined trenches provide biodegradation or decomposition of wastewater constituents by bringing the wastewater into close contact with a well developed aerobic biological community attached to the surfaces of the filter media. This process requires unsaturated downward flow of the effluent through the filter media. The media may be coarse mineral sand or equivalently sized crushed glass meeting one of the media specifications listed in Appendix A. As a departure from the intermittent sand filter, the media is not contained in a watertight vessel. Instead, the media is placed in trenches or beds in the native soil. Proper function requires that influent to the sand filter be distributed over the media in controlled, uniform doses. In order to achieve accurate dosing, these systems require timed dosing with associated pump chambers, electrical components, and distribution network, with a minimum of 4 to 18 doses per day (depending on sand media used) spread evenly over a 24 hour period. The effluent is absorbed into the native soil at the bottom of the sand lined trenches, which accomplishes dispersal into the subsoil environment and some further treatment. A sand lined trench is a combined treatment component and soil dispersal component.

Possible Applications:

A sand lined drainfield trench (sand filter) may be selected for a site with excessively permeable (Type 1) soils. The addition of 24 inches of filter media (coarse sand) to a pressure distribution soil dispersal component provides the wastewater treatment not provided by the Type 1 soil. Treated wastewater is discharged directly to the receiving soil for dispersal into the subsoil environment. See Figure 2.1. If the soil adjacent to the layer of drainrock atop the sand media is Type 1, additional filter media sand or an impervious material must be placed between the type 1 soil and the drainrock making up the trench's sidewalls and end walls to prevent short-circuiting. When sand is used for protection against short-circuiting, a minimum of six (6) inch width of filter media sand is required. The sand bed under the drainrock will also be widened by six (6) inches on each side. See Figures 2.2 and 2.3. When an impervious material is used, it must be 30 mil PVC and must extend from above the gravel bed to six (6) inches below the gravel/sand interface. See Figure 2.4.

A sand lined drainfield trench (sand filter) may also be selected for a site that has its more suitable soils for dispersal (and further treatment) at a depth greater than three feet. Filter media (course sand) is placed below the drain rock to provide adequate levels of treatment so deeper soils more suitable for dispersal into the subsoil environment can be "reached." See Figure 3.

A bottomless sand filter is a special case of sand lined drainfield trench in which a 30 mil PVC lined enclosure is designed and installed for containing the distribution system and/or filter bed above grade. It is quite similar operationally to an intermittent sand filter, but is not lined on the bottom. A bottomless sand filter is selected typically to utilize more suitable soils high in the soil profile for dispersal and treatment. The enclosure for the filter bed must be designed by a professional engineer if the containment walls are over four feet in height measured from the bottom of the footing to the top of the walls. See Figure 4.

Figure 1 - Process Flow

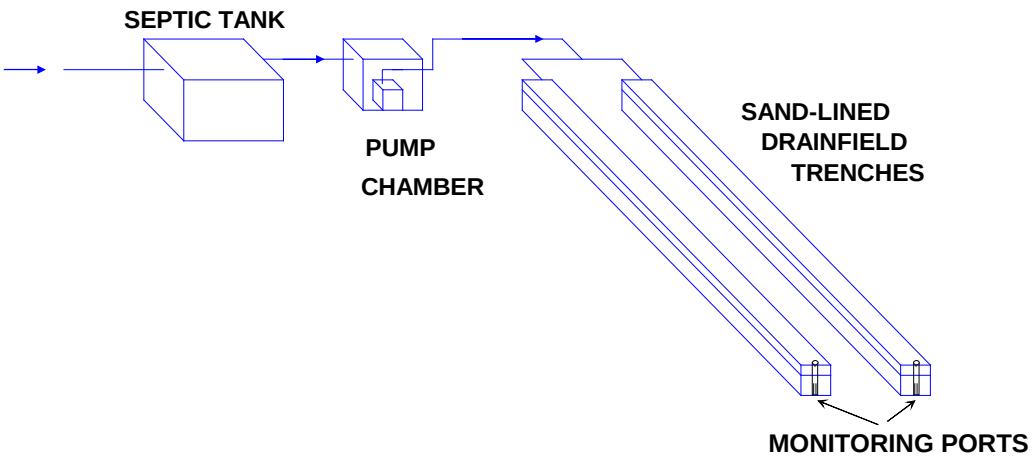


Figure 2.1 - Soil Type 1 at Bottom of Trench/Bed
(Extends to or Below Bottom of Gravel/Gravelless Trench/Bed)

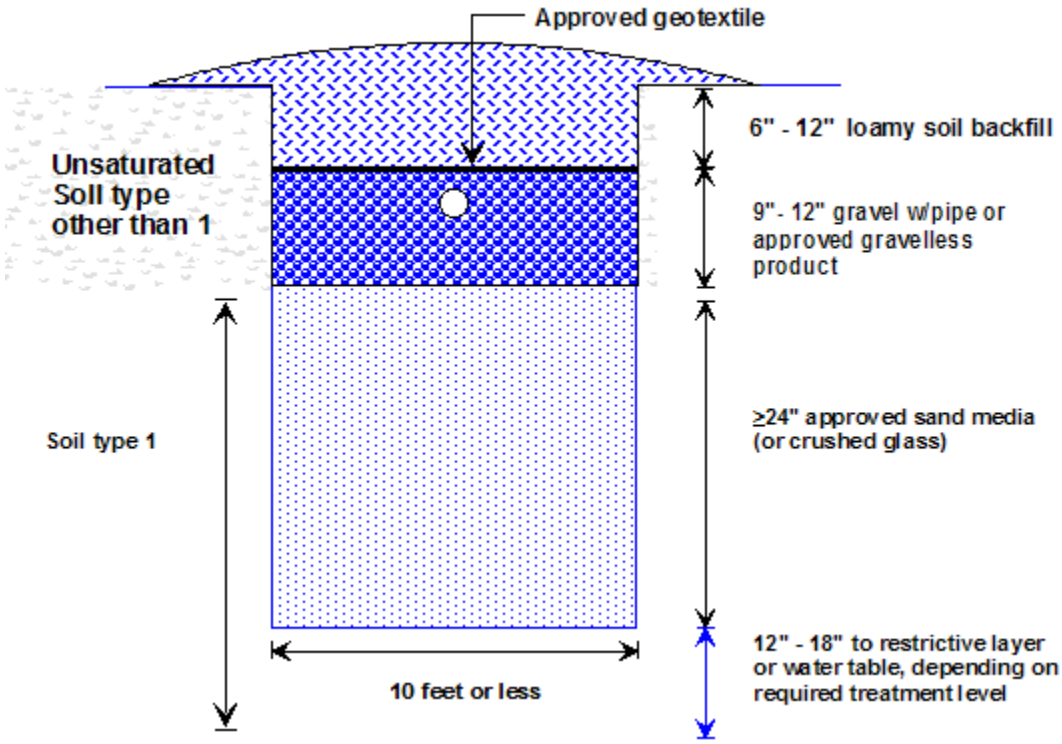


Figure 2.2 - Type 1 Soil Extending up into Trench/Bed Zone (Option 1)
(Extends Above Bottom of Gravel/Gravelless Trench/Bed)

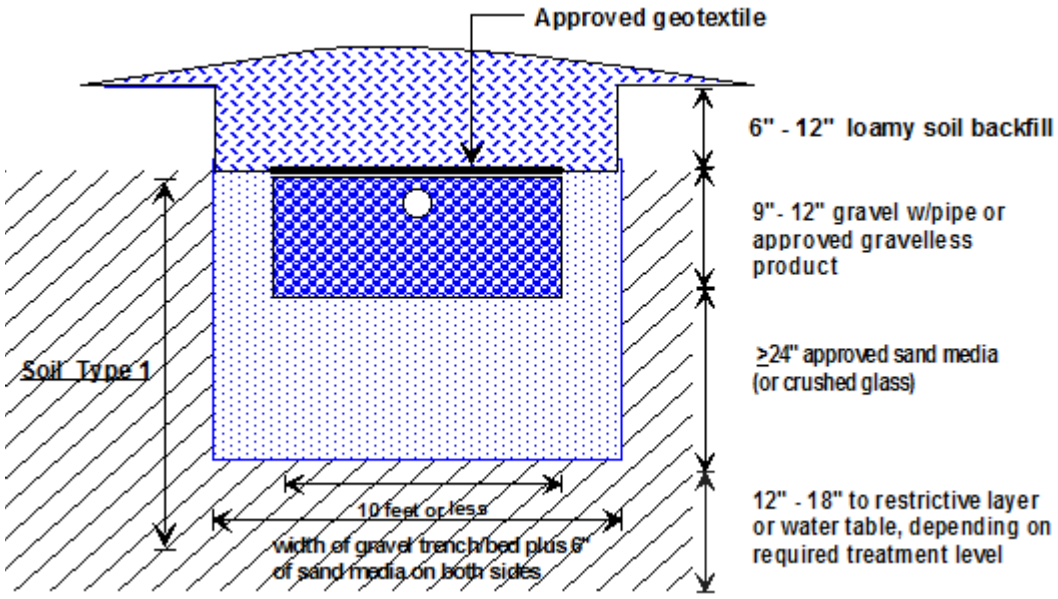


Figure 2.3 - Type 1 Soil Extending up into Trench/Bed Zone (Option 2)
(Extends Above Bottom of Gravel/Gravelless Trench/Bed)

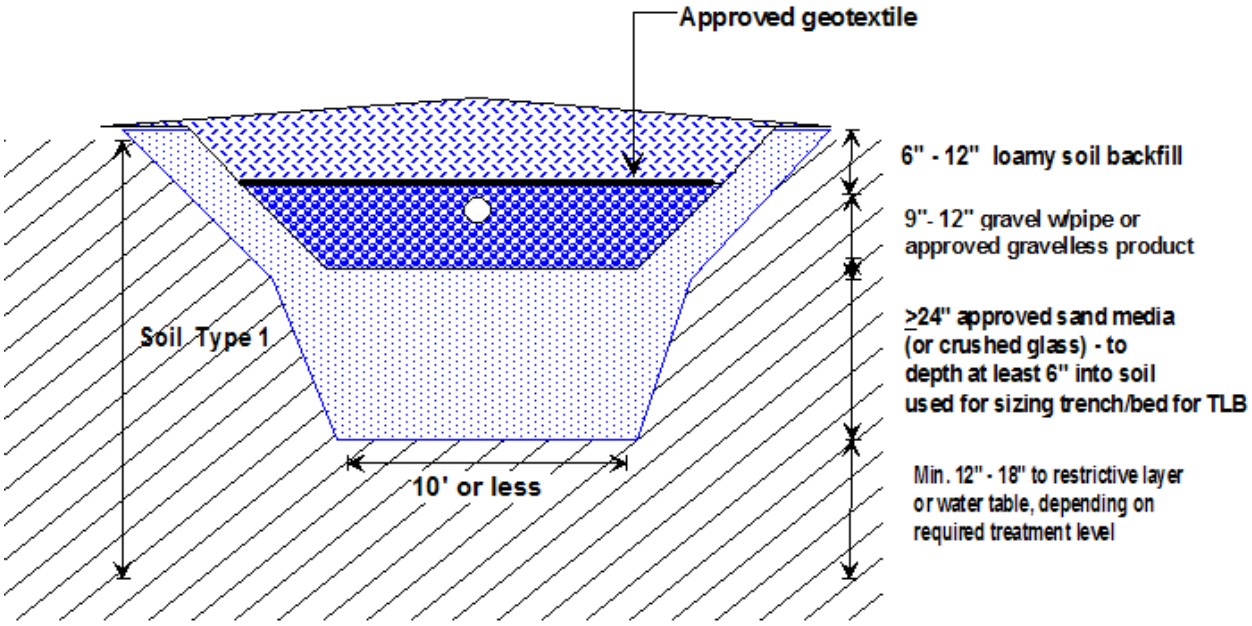


Figure 2.4 - Type 1 Soil Extending up into Trench/Bed Zone (Option 3)
(Extends Above Bottom of Gravel/Gravelless Trench/Bed)

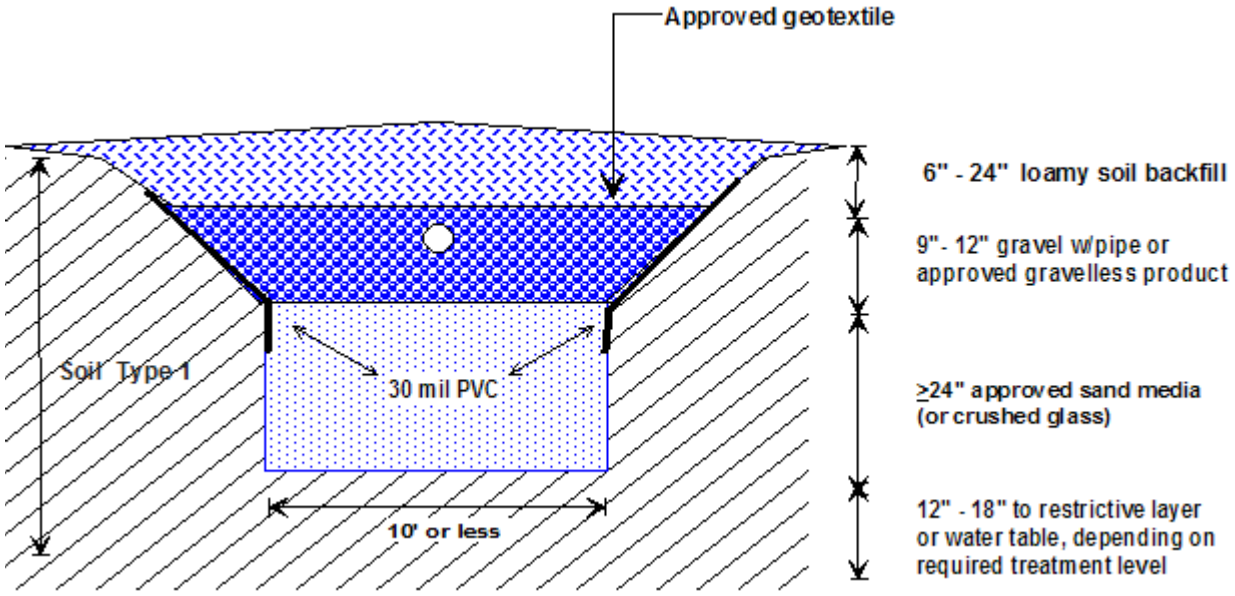


Figure 3 - Reaching More Suitable Soils at a Depth Greater Than 3 Feet

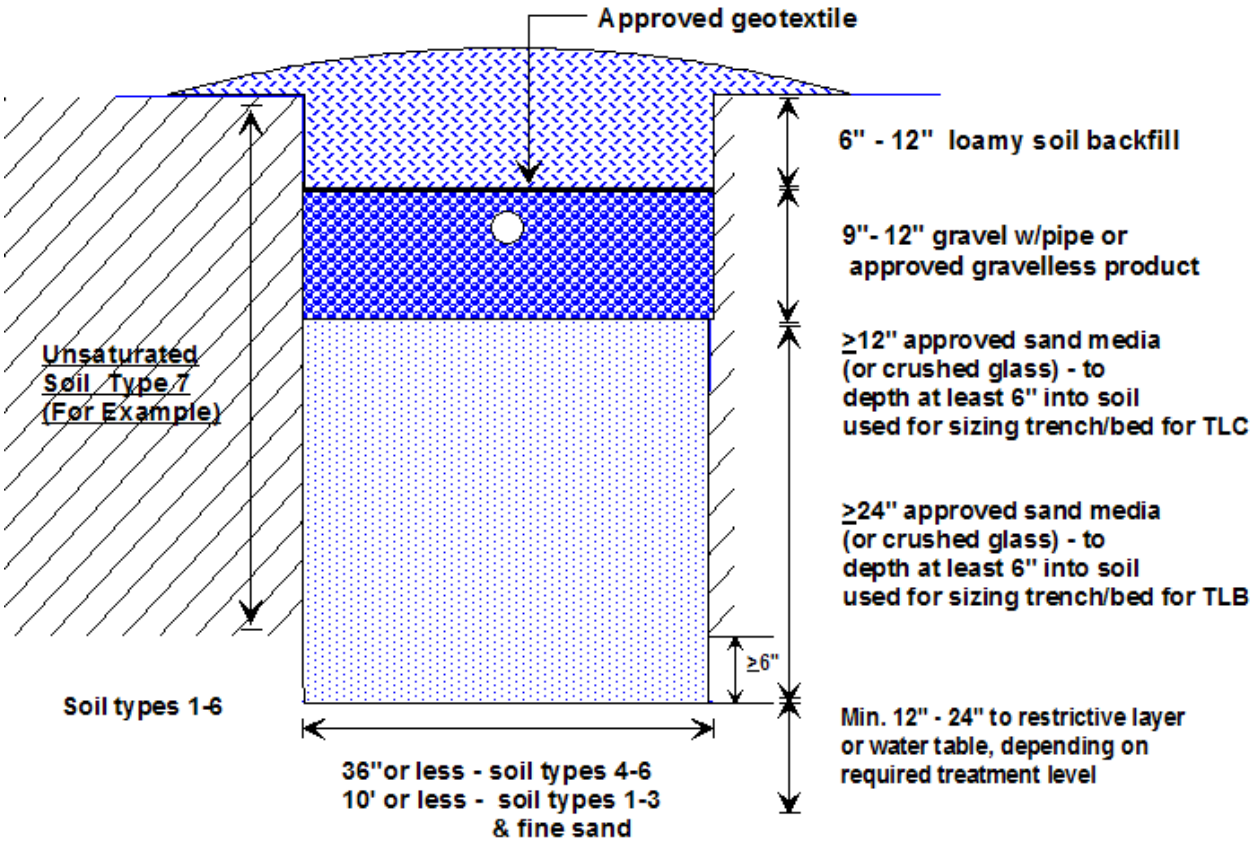
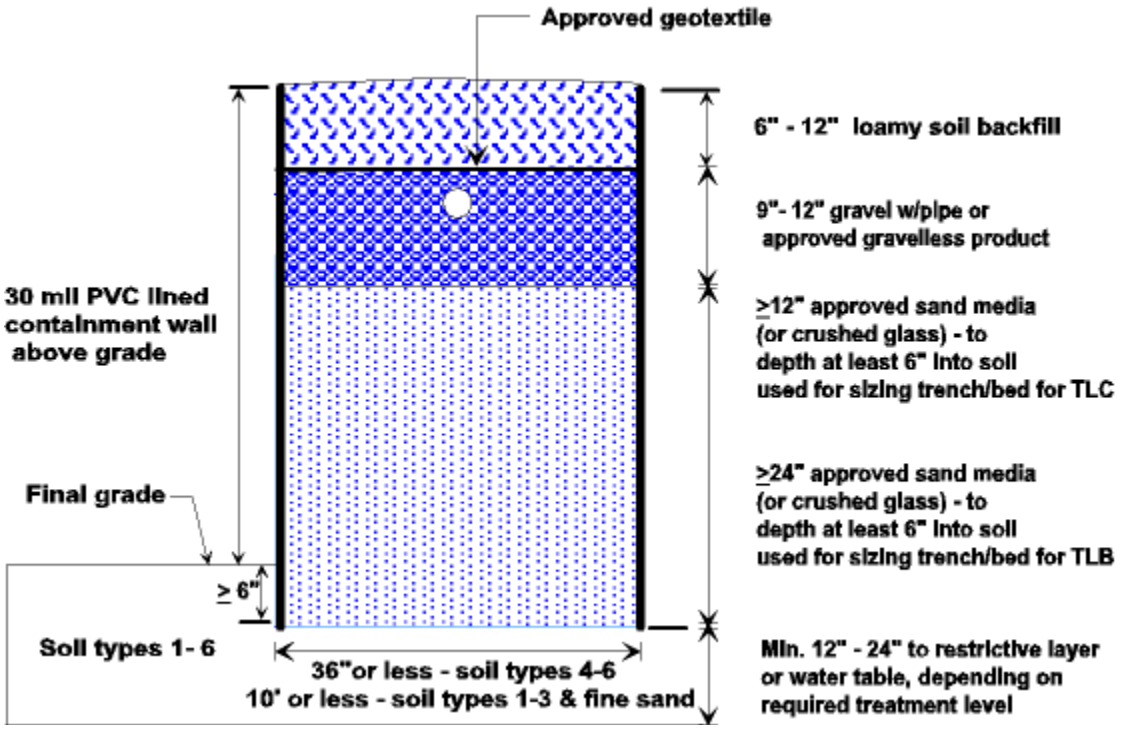


Figure 4 – Bottomless Sand Filter



1. Performance Standards

1.1. Performance Criteria

When properly sited, designed, installed, operated and maintained, a sand lined trench system consistent with these recommended standards and guidance is expected to achieve treatment performance equal to Treatment B or C.

1.1.1. **Treatment Level B.** Sand lined trenches, when constructed and used according to these standards and guidance with a minimum depth of 24 inches of filter media, are expected to perform to Treatment Level B. When using a sand lined trench system to meet Treatment Level B a minimum of 12 inches of vertical separation is required according to WAC 246-272A, Table VI. This provides for a total unsaturated flow of a minimum of 3 feet in the combined treatment component and soil dispersal component.

1.1.2. **Treatment Level C.** Sand-lined trenches, when constructed and used according to these standards and guidance with a minimum depth of 12 inches of filter media, are expected to perform to Treatment Level C. When using a sand lined trench system to meet Treatment Level C a minimum of 24 inches of vertical separation is required according to WAC 246-272A, Table VI. This provides for a total unsaturated flow of a minimum of 3 feet in the combined treatment component and soil dispersal component.

1.2. Treatment Level A Treatment Sequence

When preceded by a treatment technology (treatment component or product) listed on the List of Registered On-site Treatment and Distribution Products as meeting Treatment Level B, a sand lined trench system meeting Treatment Level B (properly sited, designed, installed, operated, and maintained in a manner consistent with these recommended standards and guidance) is expected to achieve treatment performance equal to Treatment Level A in the treatment sequence.

2. Application Standards

2.1. Listing

Sand lined trenches are a public domain treatment technology and are included in the Department of Health's List of Registered On-site Treatment and Distribution Products (Registered List) as a Category 1 combined treatment and soil dispersal technology (designed to treat residential sewage).

2.2. Permitting

Installation and, if required, operational permits must be obtained from the appropriate local health officer prior to installation and use.

3. Design Standards

3.1. Design Approval

Before construction can begin, the design must be approved by local health or other appropriate jurisdiction. All site inspections before, during, and after the construction must be accomplished by local health, other appropriate jurisdiction, or by a designer or engineer appointed by the appropriate jurisdiction.

3.2. Influent Characteristics

3.2.1. Residential Wastewater: Sand lined trenches are designed for treating residential strength wastewater. The wastewater applied to sand lined trenches must not be higher in strength than Treatment Level E (or grab samples with results no greater than 220 mg/l BOD5, or 145 mg/l TSS). Lower wastewater strengths, without increased flow rates are preferable for assuring long term operation of a sand lined trench system.

3.2.2. Non-Residential Wastewater: High-strength wastewater and wastewater from non-domestic sources (such as restaurants, hotels, bed and breakfast establishments, industrial and commercial wastewater sources) must be individually evaluated for treatability and the degree of primary treatment required prior to distribution to sand lined trenches for final treatment and dispersal.

3.3. Design Flow (Daily Wastewater Flow Estimates)

3.3.1. Residential - For all residential applications, a minimum wastewater design flow of at least 120 gallons/bedroom/day must be used.

3.3.2. Non-Residential - For non-residential applications, a minimum wastewater design flow equal to 150% of the estimated daily flow should be used.

3.4. Primary Treatment

3.4.1. If the wastewater is residential sewage, settleable and floatable solid separation by a properly sized two-compartment septic tank with effluent baffle screening will suffice.

3.4.2. Primary treatment with some other wastewater sedimentation/initial treatment unit may be used, if included on the Registered List as a treatment product, instead of a septic tank.

3.4.3. If the wastewater is from a non-domestic source, influent to the sand lined trenches must be equivalent to residential strength septic tank effluent.

Aerobic treatment or some other treatment process may be needed to modify the influent to the sand lined trenches to within the range of residential septic tank effluent quality.

3.5. Location Requirements

The minimum setback requirements for sand lined trenches are the same as required for a soil dispersal component (WAC 246-272A-0210).

3.6. Sand Lined Trench Design

3.6.1. Media Specifications - Filter media must meet either the Coarse Sand Media or ASTM C-33 specification for particle size graduation detailed in Appendix A. Filter media used in constructing a sand lined trench must be accompanied with a written certification from the supplier that the media fully conforms to one of the media specifications listed in Appendix A as determined by ASTM C-136 (dry sieving) and ASTM C-117 (wet sieving).

3.6.2. Sizing the Infiltrative Surface - The minimum required infiltrative surface area (the top surface of the filter media) must be determined by dividing the design flow estimate by the hydraulic loading rate.

3.6.2.1. Table 1 displays the hydraulic loading rates to be used when sizing sand lined trenches, using the appropriate daily wastewater design flows. As is evident from Table 1, the loading rate for the sand lined trench is dependent on the soil type (the original, undisturbed soil) at the bottom of the filter media that receives the treated effluent. Soil types and textures are noted in Table 1, Column A.

3.6.2.2. Table 1, Column B contains the maximum hydraulic loading rates assuming septic tank effluent is being discharged to the underlying soils. When these loading rates are used, the designer is choosing not to use a reduction due to the treatment effluent receives as it flows through the filter media.

3.6.2.3. Table 1, Column C contains the maximum hydraulic loading rates available when a designer chooses to use a reduction due to the treatment effluent receives upon flowing through the filter media. This will only impact the size of the system that is initially installed, not the area needed to be saved. Whenever a reduction is used, the designer must assure and show on the design that sufficient area exists for 100% of the area needed using the loading rates in Table 1. Column B for both the primary and reserve areas.

3.6.2.4. Increases in hydraulic loading rates beyond a maximum 1.0 gallons/day/square foot (reductions in installed infiltrative surface area of sand media) are not permitted due to the use of either a gravelless distribution product in the sand lined trench or bed or a treatment technology preceding the sand lined trench that meets or exceeds the treatment performance of Treatment Level D.

Local health jurisdictions may have lower hydraulic loading rates for soil dispersal components receiving treated effluents that are different than those listed here. Check the local rules, policy, or guidance on this issue.

Table 1. Hydraulic Loading Rates for Sand Lined Trenches

A Soil Type	B Septic Tank Effluent Application Rate (gpd/ft^2)	C Sand Lined Trench Application Rate (gpd/ft^2)
Soil Type 1: Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding soil types 5 & 6, all soil types with greater than or equal 90% rock fragments	1.0[1]	1.0[1]
Soil Type 2: Coarse sands	1.0[1]	1.0[1]
Soil Type 3: Medium sands, loamy coarse sands, loamy medium sands	0.8	1.0[1]
Soil Type 4: Fine sands, loamy fine sands, sandy loams, loams	0.6	1.0[1]
Soil Type 5: Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams, and silty clay loams with a moderate or strong structure (excluding a platy structure)	0.4	0.6[2]
Soil Type 6: Other silt loams, sandy clay loams, silty clay loams, and clay loams	0.2	0.3[2]
Soil Type 7: Sandy clay, clay, silty clay, and strongly cemented firm soils, soils with a moderate or strong platy structure, any soils with a massive structure, any soils with appreciable amounts of expanding clays	Not suitable	Not suitable

[1] A loading rate of 1.0 gpd/ft^2 for ASTM C-33 sand may be too high for long term service. Concern has been expressed with premature failure and/or clogging of sand lined trench systems with ASTM C-33 sand as the filter media. Several possible contributing factors have been discussed including: a) the ASTM C-33 specification allows for too large of a percentage of fine material (passing a No. 100 sieve) which may cause the finer material to become suspended in the filter causing an impermeable barrier near the top of the filter, b) loading rates of 1.0 $gal/ft^2/day$ are inappropriate and should be reduced. While the Technical Review Committee recognizes the concerns, the committee feels that the data presented is inconclusive at this time. To address premature clogging of ASTM C-33 sand, different strategies are available, including: a) reduce loading rates applied to sand lined trench systems to no more than 0.8 $gal/ft^2/day$; b) incorporate into the system design methods of improving oxygen exchange within the filter such as; increasing the dose frequency and/or including a venting system in the filter with vents extended to the atmosphere (vents may need to include an odor scouring device such as an activated carbon filter installed on the end of the vent); c) quality control of the sand media, such as frequent testing of the media to ensure that the media used consistently meets the ASTM C-33 specification.

[2] The maximum increase in loading rates for Soil Types 5 and 6, as noted in WAC 246-272A-0236(7), is a factor of 1.5.

3.6.3. Depth of filter media - The depth of filter media is dependent upon the treatment level requirement of a given site.

3.6.3.1. The filter media depth must be a minimum 24 inches when using a sand lined trench system to meet Treatment Level B. A minimum of 12 inches of vertical separation is required at this treatment level according to WAC 246-272A, Table VI. This provides for a total unsaturated flow of a minimum of 3 feet in the combined treatment component and soil dispersal component. This allows the use of loading rates in Table 1. Column C and will produce an effluent quality that is expected to meet Treatment Level B. This will also allow the use of a sand lined trench system, preceded by a treatment technology identified on the List of Registered On-site Treatment and Distribution Products as meeting Treatment Level B, to meet treatment performance equal to Treatment Level A in the treatment sequence.

3.6.3.2. The filter media depth must be a minimum 12 inches when using a sand lined trench system to meet Treatment Level C. A minimum of 24 inches of vertical separation is required at this treatment level according to WAC 246-272A, Table VI. This provides for a total unsaturated flow of a minimum of 3 feet in the combined treatment component and soil dispersal component. This allows the use of loading rates in Table 1. Column C and will produce an effluent quality that is expected to meet Treatment Level C.

3.6.4. Minimum Vertical Separation – The required minimum vertical separation (original, undisturbed, unsaturated soil) is dependent on the Treatment Level to be achieved. Depending on the vertical separation used, Table VI in WAC 246-272A-0230(2) (g) determines which treatment level must be met. For Treatment Level B, a minimum of 12 inches of vertical separation must be maintained below the bottom of the trench where the treated effluent is applied to the native soil of Soil Type 2-6. If the receiving soils are Soil Type 1, a minimum vertical separation of 18 inches must be maintained for treated effluents meeting Treatment Level B. For Treatment Level C, a minimum vertical separation of 24 inches is required in Soil Types 2-6 and a minimum vertical separation of 60 inches is required in Soil Type 1. These vertical separations must be free of the following conditions:

3.6.4.1. The maximum seasonal high groundwater level.

3.6.4.2. A layer of creviced or porous bedrock.

3.6.4.3. A stratum of impermeable soil or bedrock.

Generally, when the site evaluation indicates the depth of soil to a water table is less than 18 inches, there is a need to confirm that there are at least 12 inches during the wet season. Therefore when there is any doubt that there is sufficient unsaturated soil depth, the permit should be held for a wet season evaluation to identify accurately the location of high water tables. As potential vertical separation (or soil depth) decreases seasonal site checks to evaluate water table levels become increasingly critical to the on-site sewage system design, function, and to the protection of public health.

3.6.5. Excavation Depth - The infiltrative surface at the bottom of the filter media (the bottom of the excavation) must be installed at least 6 inches into original, undisturbed soil, except where the original soil is Soil Type 1. The maximum excavation depth for filter media placement shall not exceed ten feet from finished grade.

3.6.6. Use of Beds

3.6.6.1. Sand lined beds are allowed (in lieu of trenches) if the receiving soil is Soil Type 1, 2, 3 or fine sand. The maximum bed width must be no greater than 10 feet.

3.6.6.2. Bottomless sand filter – bed width: When a bed in a bottomless sand filter is permitted (see subsection 3.12.), the bed width is dependent on the available vertical separation (See Table 2.)

Table 2. Maximum Bed Width for Bottomless Sand Filters When a Bed is Permitted

Type of Restrictive Layer	Available vertical separation (inches)		
	≥12 - <18	≥18 - <24	≥24
Water table or other restrictive layer, excluding non-creviced bedrock.	5 ft.	7.5 ft.	10 ft.
Bedrock, non-creviced.	Not allowed	7.5 ft.	10 ft.

3.6.6.3. Bottomless sand filter bed enclosures: The enclosure for the filter bed must be designed watertight and to resist lateral backfill and fluid pressures. All above grade bottomless sand filters with containment walls over four feet in height measured from the bottom of the footing to the top of the walls must be designed by a professional engineer. See Appendix C for design requirements for bottomless sand filter enclosures.

3.7. Wastewater Distribution

3.7.1. Pressure distribution: A method providing pressure distribution with timed dosing throughout the sand lined trench/bed is required. The distribution system and pump chamber must be designed according to the Recommended Standards and Guidance for Pressure Distribution or Recommended Standards and Guidance for Subsurface Drip Systems. This requirement applies to all pressure distribution related components.

3.7.1.1. Sand lined trench system following a timed dosed treatment component: A sand lined trench system can be demand dosed and still meet the requirements of timed dosing if it follows a timed dosed treatment component. The timer for the treatment component indirectly controls the downstream demand dosed delivery of effluent to the sand lined trench/bed so that a second timer for the sand lined trench is not needed. For example, a sand lined trench can be demand dosed when it follows a timed dosed intermittent sand filter. The sand lined trench system is considered to be timed dosed since it will have been timed dosed earlier in the treatment sequence by the intermittent sand filter.

3.7.2. The wastewater must be applied to the layer of drainrock atop the filter media by pressure distribution or applied to the filter media by pressure distribution using a proprietary distribution product, such as a gravelless distribution or subsurface dripline product, in place of the layer of drainrock.

3.7.3. When a proprietary distribution product is used in a sand lined trench system, the pressure distribution network must be designed to assure the wastewater is applied to the filter media in a manner to achieve uniform distribution while minimizing erosion of the infiltrative surface. For example, pointing orifices up in pressure distribution laterals to spray effluent upward against the top of gravelless chambers to dissipate the energy of the applied wastewater flow.

3.7.4 When a proprietary distribution product, such as a gravelless distribution or subsurface dripline product, is used in place of drainrock in a sand lined trench, only those distribution products on the current List of Registered On-site Treatment and Distribution Products may be permitted by the local health jurisdiction.

3.7.5 Minimum Dosing Frequency: A timed dosing system is required. The dosing frequency or dose volume is dependent on the media specification used. To assure that appropriate dose volumes are delivered to the sand lined trench system, the timer must be set to dose the filter at the following minimum dosing frequency:

Media Specification	Minimum Number of Doses/Day
Coarse Sand Media	18 times per day
ASTM C-33	4 times per day

3.8. Reserve Area

3.8.1. Replacement or reserve area must be sized at least 100% of that required for sand lined trench system receiving residential septic tank effluent by using the hydraulic loading rates in Table 1. Column B.

3.9. Installation Issues

3.9.1. Check the moisture content of the soil at 7-8 inches deep. If it is too wet, smearing and compaction will result, reducing the infiltration capacity of the soil. Soil

moisture can be determined by rolling a soil sample between the hands. If it rolls into a wire, the site is too wet to prepare. If it crumbles, site preparation can proceed. If the site is too wet to prepare, do not proceed until the soil moisture decreases.

3.9.2. In order to prevent differential settling when the sand lined trench system is put into service, the filter media must have a uniform density throughout.

Uniform density may be accomplished one of two ways, depending on the moisture content of the filter media during construction. If the filter media is so dry that it can be poured (like salt or sand in an hourglass), it can simply be poured to fill the sand filter excavation, then settled lightly (not compacted) to allow about 5% settling -i.e., volume reduction. However, if the filter media is moist enough that it cannot be poured, it should be placed in successive 6-inch lifts with each lift lightly settled. The intent of the settling in both cases is no large voids in the media that will collapse later when effluent is added. The light settling may be accomplished by walking on the sand, then raking (with hand tools) into the corners, along the sides, and around monitor ports. The final bulk density should be approximately 1.3 to 1.4 g/cm^3 (81.2 to 87.4 lb/ft^3). Higher densities will reduce infiltration rates and oxygen exchange potential.

3.9.3. A geotextile filter fabric must be placed on top of the gravel bed. The cover soil must be capable of maintaining vegetative growth while not impeding the passage of air (sandy loam or coarser).

3.10. Monitoring Ports

The installation of monitoring ports in a sand lined drainfield trench is for the purpose of monitoring system status and aiding in problem analysis. To be effective they must be installed in a representative location on each trench line or bed. One observation port must be installed to the bottom of the drainrock/top of the filter media interface or the top of the media if gravelless chambers are used in place of the layer of drainrock. A second observation port must be installed to the bottom of the filter media. Some lines may require additional monitoring ports to achieve observations representative of the entire trench line. Well-designed and installed monitoring ports:

- Extend to at least the ground surface of the final landscape grade surface.
- Are firmly anchored so as to prohibit unauthorized removal.
- Are accessible for routine observation.
- Are secured or otherwise protected from accidental or unauthorized access.
- Provide visual access to the trench-bottom in the gravel portion of a gravel-filled sand lined drainfield and, in gravelless chambers to the interior of the chamber.

See Appendix B for monitoring port design examples.

3.11. Filter Media Surface and Excavation Surfaces

Both the top surface of the filter media and the bottom of the excavation must be level within ±0.5 inch. However, the soil infiltrative surface should be broken up with the backhoe teeth to minimize the formation of a distinct layer between the sand and the original, undisturbed soil.

3.12. Bottomless Sand Filter Placement

3.12.1 While most of the following design conventions are recommended for all sand lined trenches, for system layout and placement of a bottomless sand filter (above grade) they must be followed.

3.12.2 On sloping sites, the bottomless sand filter must be aligned with its longest dimension parallel to the contours so as not to concentrate the effluent into a small area as it moves laterally downslope.

3.12.3 The bottomless sand filter must not be aligned, by design or construction, perpendicular to the contours.

3.12.4 On all sites the bottomless sand filter must be as long and narrow as possible to limit the linear loading rate of effluent to assure that all the effluent infiltrates into the natural soil before it reaches the toe of the filter media.

3.12.5 If the site does not permit the design of a "long and narrow" bottomless sand filter along the contours of the site, other on-site sewage treatment and dispersal technology must be selected. Bottomless sand filter systems are only suitable for sites where all of the design and siting criteria can be satisfactorily met.

4. Operation and Maintenance Standards

4.1. Management

4.1.1. The local health officer may require a maintenance agreement with supporting legal documents prior to the issuance of approval for a proposed sand lined trench system. It is recommended that a maintenance agreement be required when, in the opinion of the local health authority, the ongoing operation of the sand lined trench sewage system is best assured by the existence of such an agreement.

4.1.2. Owner Responsibilities - The owner of the residence or facility served by a sand lined trench system is responsible for assuring proper operation and providing timely maintenance for all components of the on-site wastewater treatment and soil dispersal system. This includes inspecting the entire system at a frequency appropriate for the site conditions and the type of on-site sewage system as specified by the local health department/district. Assuring that complete evaluations of all system components are provided to determine functionality, maintenance needs and compliance with local regulations and permits are the responsibility of the system owner. Contact the local health department/district for

what qualifications are required of a person to perform any specialized monitoring and maintenance activities.

4.2. Operation and Maintenance (O&M) Manual

4.2.1. An O&M manual for the sand lined trench system must be provided by the system designer. The manual must contain the following, at a minimum:

4.2.1.1. Owner responsibilities: including established system operation, inspection, recording keeping, reporting, and permit requirements.

4.2.1.2. Key contact information: including names and telephone numbers of the local health authority, system designer, component manufacturer, installer, service provider and/or the management entity to be contacted in the event of an emergency or system failure.

4.2.1.3. Design Description: including a narrative that describe how the system works, its intended performance, and operating limits of the design. The narrative should include a brief description of each major process or component and discuss its function in the system and its expected performance. For proprietary products, include manufacturer's standard product literature, including performance specifications and recommendations needed for operation, monitoring, and maintenance.

4.2.1.4. Diagrams of the all major system components: include process diagram, system design drawings, system record drawing, and schematics for all electrical and mechanical components installed.

4.2.1.5. Information on routine monitoring and maintenance requirements of the sewage system: list and describe monitoring and maintenance activities for septic tank, dosing tanks, sand lined trenches, control panel, pumps, motors, switches, alarms, etc. including recommended component settings for routine operation and monitoring. Provide maintenance schedules, recordkeeping, and reporting forms.

4.2.1.6. List and description of key operating activities and measures that should be employed or avoided to protect the sewage system's treatment processes and components. Examples include use of low flow fixtures, spreading out laundry and other high water use activities over several days, selective and limited use of bleach and other household chemicals, elimination of garbage grinders, not disposing unwanted and outdated medications down the drain, and maintaining suitable soil cover, landscaping and vegetation over the sand lined trench system and the reserve area.

4.2.1.7. Trouble shooting Guide: Information on "trouble-shooting" common operational problems that might occur. This information should be as detailed and complete as needed to assist the system owner to make

accurate decisions about when and how to attempt corrections of operational problems, and when to call for professional assistance.

4.3. Monitoring and Maintenance

4.3.1. Monitoring and maintenance activities for sand lined trench systems include at a minimum:

4.3.1.1. Septic tank: inspecting yearly for structural integrity, proper baffling, ground water intrusion, and proper sizing. Inspect and clean effluent baffle screen and also pump tank as needed;

4.3.1.2. Pump (dosing) tanks: cleaning the effluent screen (spraying with a hose is a common cleaning method), inspect and clean the pump switches and floats yearly. Pump the accumulated sludge from the bottom of the chambers, whenever the septic tank is pumped, or more often if necessary;

4.3.1.3. Checking monitoring ports for ponding. Conditions in the monitoring ports must be observed and recorded by the service provider during all operation and maintenance activities for the sand lined trenches/bed and other system components. The person monitoring the system needs to be aware of the impact of dose frequency has on the observed ponding level.

4.3.1.4. Inspecting and testing yearly for malfunction of electrical equipment such as timers, counters, control boxes, pump switches, floats, alarm system or other electrical components, and repair as needed. System checks should include improper setting or failure, of electrical, mechanical, or manual switches;

4.3.1.5. Checking for mechanical malfunctions (other than those affecting sewage pumps) including problems with valves, or other mechanical or plumbing components;

4.3.1.6. Checking for material fatigue, failure, corrosion problems, or use of improper materials, as related to construction or structural design;

4.3.1.7. Checking for system neglect or improper use, such as hydraulic or organic loading beyond the operating capacity, introduced toxic or hazardous substances into the system, extraneous flows into system, drainage from surface runoff or non-sewage drains directed towards where the system is located, soil compaction, damage by soil removal and grade alteration, and unsuitable cover material or vegetation;

4.3.1.8. Checking building usage for changes in wastewater strength, hydraulic flow, or other conditions that could affect the performance of the sand lined trench/ bed and/or the entire system. Sampling and testing may be required by the local health officer on a case-by-case basis, or to troubleshoot depending on the nature of the problem, availability of laboratories, or other

factors. This may include sampling of specific chemical/biological indicators, such as BOD, TSS, fecal coliforms, etc;

4.3.1.9. Checking for system installation problems, such as improper location or failure to follow design;

4.3.1.10. Checking for overflow or backup problems where sewage is involved;

4.3.1.11. Maintaining a written chronological record of ponding level observations and monitoring and maintenance activities. If the system has a reduced sized drainfield, this should be included in the report to the local health jurisdiction responsible for permitting the system;

4.3.1.12. Servicing all system components as needed, including product manufacturer's requirements/ recommendations for service.

4.4. Observed Conditions/Actions

4.4.1. When a system evaluation or any other observation, reveals either of the following listed conditions, the owner of the system must take appropriate action to correct the situation, according to the direction and satisfaction of the local health officer:

4.4.1.1. Sand lined trench or bed failure, as defined in WAC 246-272A-0010; or

4.4.1.2. A history of long-term, continuous, and increasing ponding of wastewater within the sand lined trench or bed, which if left unresolved, will probably result in system or component failure.

4.4.2. Appropriate actions may include:

4.4.2.1. Evaluation of building usage for a change in wastewater quality or quality, or other conditions that could be causing the observed sand lined trench or bed ponding or failure.

4.4.2.2. Repair or modification of the sand lined trench system.

4.4.2.3. Expansion of the sand lined trench system.

4.4.2.4. Modifications or changes within the structure relative to wastewater strength or hydraulic flows.

Local permits must be obtained before system construction begins, according to local health jurisdiction requirements. Any observed problem, repair or modification activity must be reported as part of the monitoring activity for the site. For an on-site sewage system with a reduced size sand lined trench or bed, the repair or modification required may include the installation of additional drainfield to enlarge the system to 100% of the initial design size. Repair or modification is not limited to this option.

Appendix A – Filter Media Specifications

I Particle Size Analysis - The standard method to be used for performing particle size analysis must comply with one of the following:

A. the sieve method specified in ASTM C-136 and ASTM C-117

B. the method specified in Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples, Soil Survey Investigation Report #1, US Department of Agriculture, 1984.

II Sand Lined Trench System Media - The filter media must meet either specification A. or specification B, below as determined by section I. Particle Size Analysis. Media may be either mineral sand or equivalently sized crushed glass.

A. Coarse Sand Media Specification - The filter media must meet items 1, 2, and 3 below: (Source: State of Oregon On-Site Sewage Disposal Rules and the State of Wisconsin Single Pass Sand Filter Component Manual)

1. Particle size distribution:

Sieve	Particle Size	Percent Passing
3/8 in	9.50 mm	100
No. 4	4.75 mm	95 to 100
No. 8	2.36 mm	80 to 100
No. 16	1.18 mm	45 to 85
No. 30	0.6 mm	15 to 60
No. 50	0.3 mm	3 to 15
No. 100	0.15 mm	0 to 4

2. Effective Particle Size (D_{10}): 0.3 mm – 0.5 mm

3. Uniformity Coefficient (D_{60}/ D_{10}): < 4.0

B. ASTM C-33 Specification - The filter media must meet items 1, 2, and 3 below: (Source: ASTM C-33-99a, Specification for Fine Aggregate)

1. Particle size distribution:

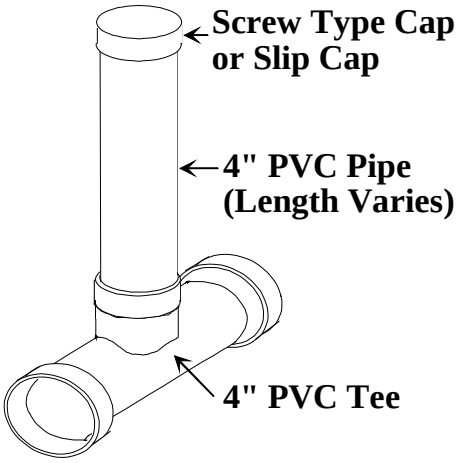
Sieve	Particle Size	Percent Passing
3/8 in	9.50 mm	100
No. 4	4.75 mm	95 to 100
No. 8	2.36 mm	80 to 100
No. 16	1.18 mm	50 to 85
No. 30	0.6 mm	25 to 60
No. 50	0.3 mm	5 to 30
No. 100	0.15 mm	0 to 10 (prefer <4)
No. 200	0.075 mm	0 to 3 (prefer 0)

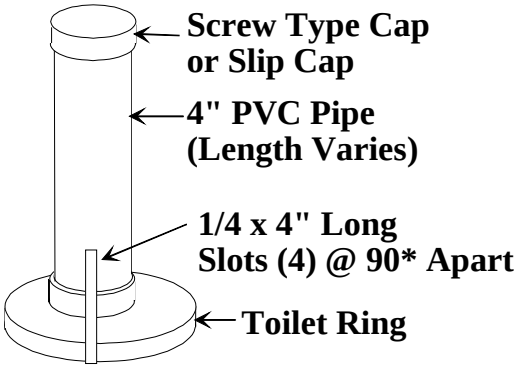
2. The sand must have not more than 45% pass any one sieve and be retained on the next consecutive sieve of those shown above.

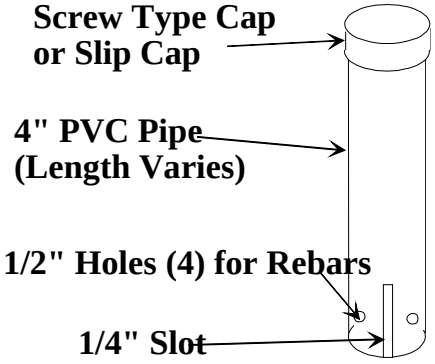
3. The fineness modulus must be neither less than 2.3 nor more than 3.1. The fineness modulus is calculated by adding the cumulative percentages of material in the sample retained in the sieves shown above and dividing the sum by 100.

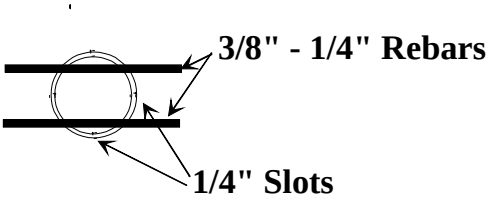
Appendix B – Monitoring Ports

Note: ports should only be perforated at the bottom









END VIEW (BOTTOM)

Appendix C – Bottomless Sand Filter Enclosures

I. All bottomless sand filter enclosures with containment walls over four feet in height measured from the bottom of the footing to top of the walls must be designed by a professional engineer. Unique site conditions or local regulations may exist that require an engineer designed for containment walls less than 4 feet in height. Contact the local building department for any additional local requirements.

A. Bottomless sand filter enclosures must meet the following minimum requirements:

1. Containment walls must be watertight and lined with a 30 mil PVC liner with all boots, patches, repairs, and seams having the same physical properties as the liner material. See Figure 5.

2. Any penetration through the PVC lined wall shall be done with a PVC boot attachment glued to the liner with the appropriate vinyl sealer. Check with liner manufacturer for a compatible sealer.

3. Support walls are needed to prevent caving of the filter walls during construction. These walls shall be rigid and made of plywood (or equivalent) and support boards.

4. A permanent top frame structure consisting of decay resistant material must be provided on any portion of the enclosure that is installed above grade. The perimeter of the enclosure may be bermed with native soil or other material such as decorative block or other non-degrading materials. See Figure 6.

Figure 5 – Example of Bottomless Sand Filter Enclosure (filter bed containment walls above grade)

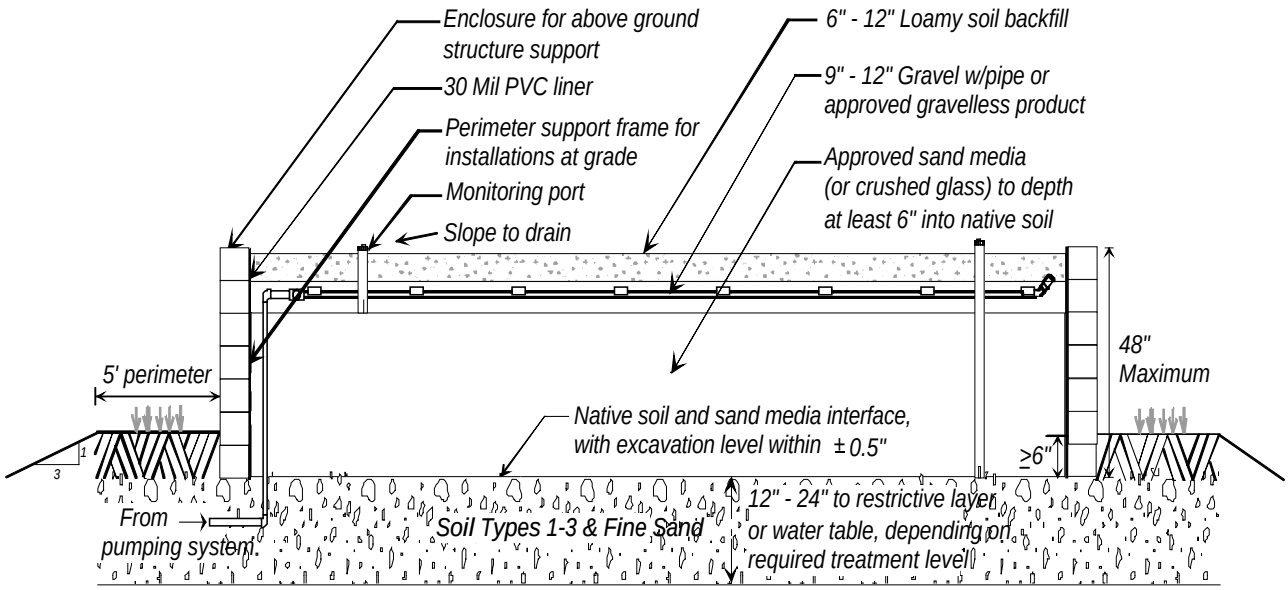
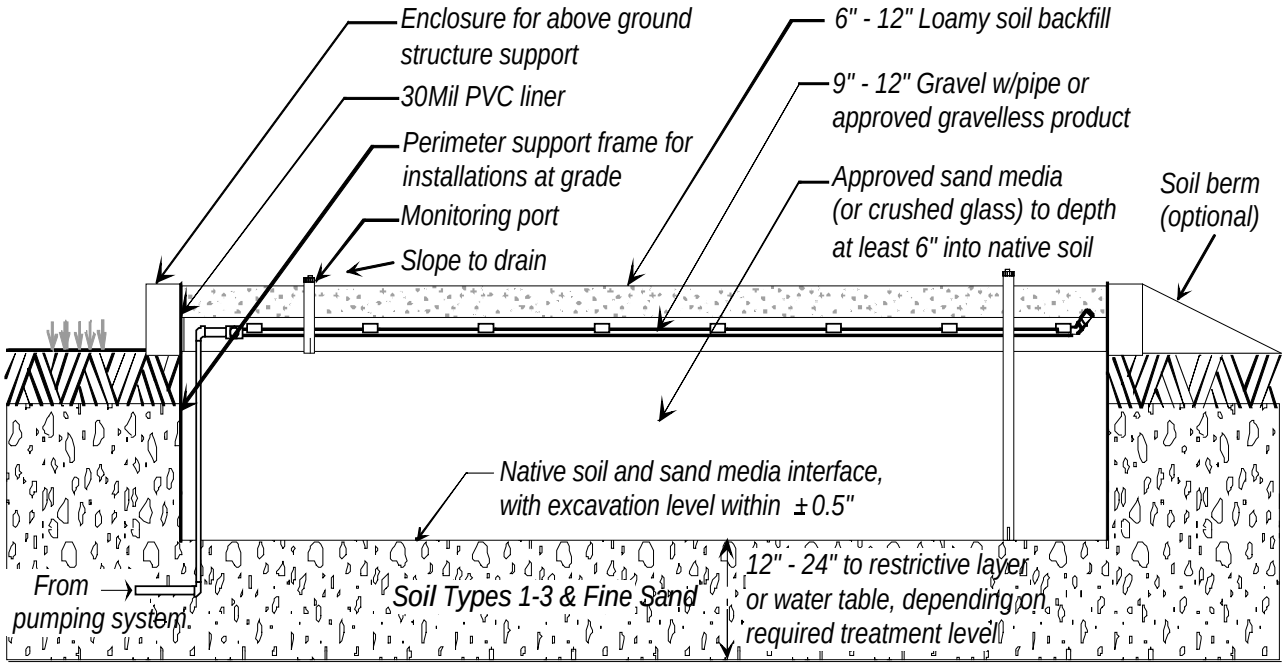


Figure 6 – Example of Bottomless Sand Filter Enclosure (distribution system containment walls above grade)



Appendix D – Disposal of Contaminated Filter Media

Whenever filter media is removed from a used filter, removing and disposing of contaminated filter media is to be done in a manner approved by the local health officer. Handle this material carefully by using adequate protective sanitation measures. Thoroughly wash hands and any other exposed skin with hot water and soap, following contact with contaminated filter media.

The contaminated filter media can be buried with at least 6 inches of cover on a site approved by the local health officer. If the material is to be placed at grade, it must be stabilized with at least a 6 inch soil cap. Sloping sites should be avoided.

For either of these methods, the drainfield setbacks and vertical separations requirements in chapter 246-272A WAC must be met and the material must not be used in agronomic applications for 12 months.

If the material is to be disposed of at the local sanitary landfill, contact them for their requirements.

This material may be applied to the soil, according to the following, only when approved by the local health officer.

	APPLICATION	RESTRICTIONS/TIMETABLE
1.	Root crops, low-growing vegetables, fruits, berries used for human consumption.	Contaminated material must be stabilized and applied 12 months prior to planting.
2.	Forage and pasture crops for consumption by dairy cattle.	Forage and pasture crops not available until one month following application of stabilized material.
3.	Forage and pasture crops for consumption by non-dairy livestock.	Forage and pasture crops not available until two weeks following application of stabilized material.
4.	Orchards or other agricultural area where the material will not directly contact food products. Or where stabilized material has undergone further treatment, such as pathogen reduction or sterilization.	Less severe restrictions may be applicable.

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