ADVANCED ENVIRO-SEPTIC®

Design and Installation Manual for Advanced Enviro-Septic® (AES) Wastewater Systems

For more detailed design and installation information on AES, please contact Infiltrator Water Technologies at (800) 221-4436 or Presby Environmental, Inc. at (800) 473-5298.

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Illinois

INFILTRATOR® water technologies

Table of Contents

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The information in this Manual is subject to change without notice. We recommend that you check your state's page on our website on a regular basis for updated information. Your suggestions and comments are welcome. Please contact us at:

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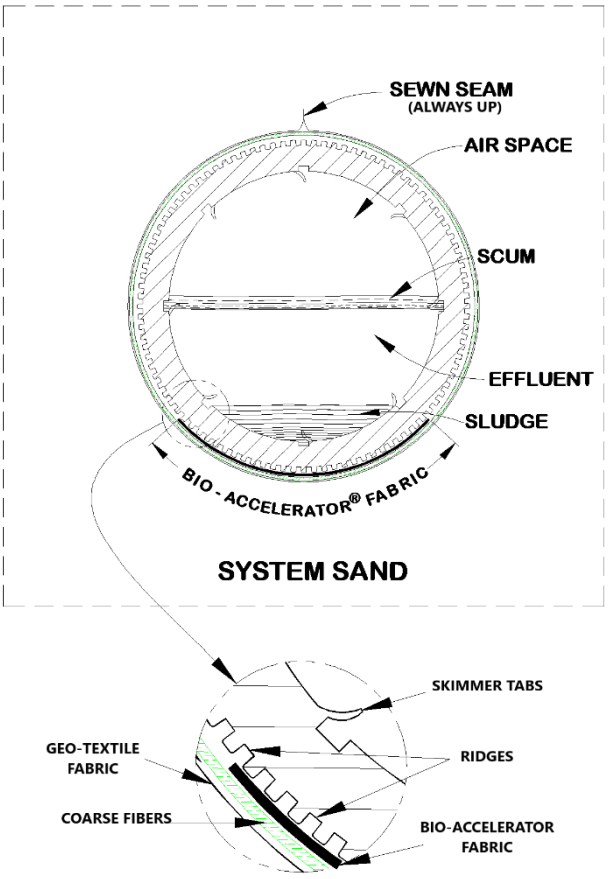
The products and methods depicted in this Manual are protected by one or more patents. For more information: www.presbyeco.com/patents

IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® Wastewater Treatment Systems. The processes and design criteria contained herein are based solely on our experience with and testing of Advanced Enviro-Septic®. Substitution of any other product Is prohibited.

1.0 INTRODUCTION

1.1 Background

The Advanced Enviro-Septic® (AES) Wastewater Treatment System utilizes a unique combination of components that work together to treat effluent and prevent suspended solids from sealing the underlying soil. Comprised of a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges, the large-diameter pipe retains solids while the Bio-Accelerator® fabric, coarse fibers, and geo-textile fabric provide multiple bacterial surfaces to treat effluent prior to its contact with the receiving soils. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. The AES system is completely passive, and yet provides increased aeration and a greater bacterial treatment area than traditional systems. The result is a system that is more efficient, lasts longer, and has a virtually no negative environmental impact.



The AES system has been successfully tested and certified to NSF/ANSI 40, Class I (a certification typically given to mechanical aeration devices) and BNQ of Quebec Class I, II, III standards.

Additional system benefits include:

- requires a smaller area
- installs easily and quickly
- eliminates the need for environmentally impactful washed stone
- adapts easily to residential, commercial and difficult sites
- prevents formation of organic material at the receiving soil interface
- blends “septic mounds” into sloping terrain
- safely recharges groundwater

Environmental Standards and Technical Support

All AES systems shall be designed and installed in compliance with the procedures and specifications detailed in this Manual, the product’s Illinois approval, and Illinois Section 905 Private Sewage Disposal Code (Illinois Code). In the event of contradictions between this Manual and the Illinois Code, Presby Environmental, Inc. (PEI) should be contacted for technical assistance at (800) 473-5298.

Certification Requirements

Designers and installers who have not previously attended a PEI certification course are required to obtain certification. Certification is obtained by attending a certification course presented by PEI or its sanctioned representative or by viewing tutorial videos on our website and then successfully passing a short assessment test. PEI recommends professionals involved in the inspection or review of AES systems also become PEI certified.

1.2 System Components

AES Pipe

- nominal exterior diameter of 12in
- holding capacity of 5.8 gallons per foot
- 10 ft length of AES pipe is flexible enough to bend up to 90° and can be cut to any length
- made with a significant amount recycled material

Offset Adapter - A 12 in plastic fitting with a single inlet hole oriented in the twelve o'clock position and designed to accept a 4 in sewer line, raised connection or vent pipe.

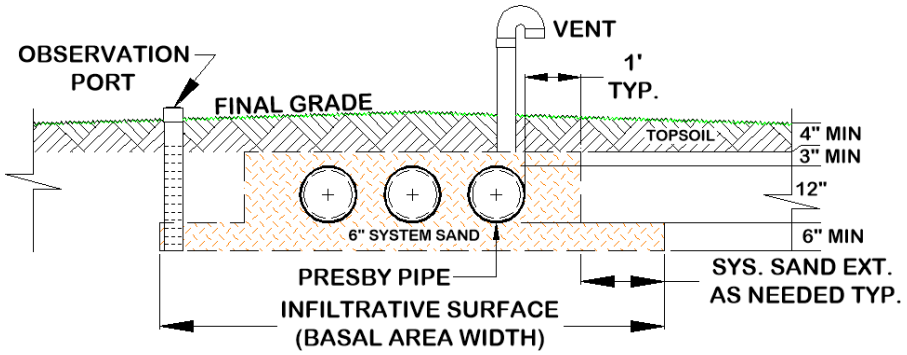
Coupling - A plastic fitting used to create a connection between two pieces of AES pipe.

System Sand Requirements for All Beds - It is critical to the proper functioning of the AES system that the correct amount and type of system sand be installed. System sand must be clean, granular sand, free of organic matter and must adhere to ASTM C-33 sand requirements. Material passing the #200 sieve must be verified by washing the sample. The Presby Spec-Check® is a device created to help determine the suitability of material for use as system sand without the need for an expensive lab test. Go to www.PresbyEnvironmental.com for more details.

System Sand Bed Height Dimension

The height of an AES sand bed measures a minimum of 21 in (not including cover material):

- minimum of 6 in of system sand below the AES pipe;
- 12 in diameter AES pipe; and
- minimum of 3 in of system sand above the AES pipe.
- When a bed slopes over 10%, a minimum 3 ft system sand extension area is required and shall be a minimum of 6 in deep.



Sand Fill - Clean coarse sand free of organics and other debris is to be used as "sand fill" whenever sand fill is required. System sand may be used in place of sand fill.

Observation Port

All beds require at least one perforated observation port, with a minimum diameter of 4 in, wrapped with geo-textile fabric and installed to reach the bottom of the infiltrative surface (bed bottom). For level beds, the port is to be located at the outermost edge of the tall portion of the system sand or system sand extension (if present). For sloping beds, locate the port at the lowest elevation of the system sand extension. The port must extend to final grade for easy access and have a threaded cap (see illustrations above).

2.0 SYSTEM DESIGN

2.1 System Sizing

AES Pipe Requirement

Minimum AES pipe requirements are detailed in Table A:

Table A – AES Pipe Required

System Type	AES Pipe Requirement
Residential	70 linear feet per bedroom
Commercial or Large	2.14 gallons per linear foot

AES Sand Bed Area (SSBA) Required

Using the conventional soil loading rate (SLR), find the corresponding AES soil loading rate (AES-SLR) in Table B below to determine the System Sand Bed Area (SSBA).

Table B – Minimum System Sand Bed Area (SSBA) Required (ft^2)

Conventional Soil Loading Rate (SLR) (gpd/ft^2)	AES Soil Loading Rate (AES-SLR) (gpd/ft^2)	Bedrooms / Gallons per Day (br/gpd)								
		2	3	4	5	6	7	8	9	10
		300	450	600	750	900	1,050	1,200	1,350	1,500
1.20	1.800	167	250	334	417	500	584	667	750	834
0.75	1.125	267	400	534	667	800	934	1,067	1,200	1,334
0.60	0.900	334	500	667	834	1,000	1,167	1,334	1,500	1,667
0.50	0.750	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
0.30	0.450	667	1,000	1,334	1,667	2,000	2,334	2,667	3,000	3,334
0.25	0.375	800	1,200	1,600	2,000	2,400	2,800	3,200	3,600	4,000
		Minimum System Sand Bed Area (SSBA) (ft^2)								

Note: To calculate AES soil loading rates not shown in Table B: divide conventional loading rates (from Rule) by 0.67.

Table C: System Pipe Row Length and Pipe Layout Width (PLW)

		Total Linear Feet of AES Pipe													
Row Length Ft	**30**	60	90	120	150	180	210	240	270	300	330	360	390	420	450
	35	70	105	140	175	210	245	280	315	350	385	420	455	490	525
	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
	45	90	135	180	225	270	315	360	405	450	495	540	585	630	675
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750
	55	110	165	220	275	330	385	440	495	550	605	660	715	770	825
	60	120	180	240	300	360	420	480	540	600	660	720	780	840	900
	65	130	190	260	325	390	455	520	585	650	715	780	845	910	975
	70	140	210	280	350	420	490	560	630	700	770	840	910	980	1050
	75	150	225	300	375	450	525	600	675	750	825	900	975	1050	1125
	80	160	240	320	400	480	560	640	720	800	880	960	1040	1120	1200
	85	170	255	340	425	510	595	680	765	850	935	1020	1105	1190	1275
	90	180	270	360	450	540	630	720	810	900	990	1080	1170	1260	1350
	95	190	285	380	475	570	665	760	855	950	1045	1140	1235	1330	1425
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
# Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.5 ft Spacing		2.50	4.00	5.50	7.00	8.50	10.00	11.50	13.00	14.50	16.00	17.50	19.00	20.50	22.00

Pipe Layout Width (PLW) in feet (outermost width of rows)

2.2 Design Procedure and Examples

Step #1: *Determine Amount of AES Pipe Required*
From Table A:
a) Residential Systems: Multiply the number of bedrooms by 70 ft/br.
b) Commercial/Large Systems: Divide the daily design glow by 2.14 gpd/ft.

Step #2: *Determine the Minimum System Sand Bed Area (SSBA)*
From Table B, find the minimum SSBA using the AES SLR.

Step #3: *Determine Number of Serial Sections Required*
Calculate the number of serial sections required (note: not applicable if using parallel configuration). The serial sections required = design daily flow ÷ 750 gpd/section. Round up to nearest whole number.

Step #4: *Determine Pipe Row Length and Number of Rows Required*
Select a row length that is suitable for the site and calculate the number of rows required by dividing the pipe required from Step #1 by your selected row length.. The number of rows must be evenly divisible by the number of serial sections required. Increase the number of rows if needed.

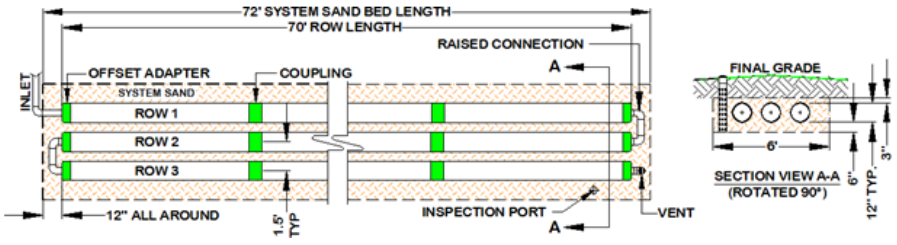
Step #5: *Determine System Pipe Layout Width (PLW)*
Using Table C, find the PLW for the row length and number of rows being used.

Step #6: *Calculate the Minimum System Sand Bed Width (SSBW)*
a) For beds sloping 10% or less: Divide the SSBA from Step #2 by the (row length + 2 ft). If this is greater than (PLW + 2 ft), there will be a system sand extension(s). If the bed is level: the AES pipe rows are centered in the middle of the basal area. If the bed is sloping: the AES pipe rows are grouped at the top of the basal area.
b) For beds sloping over 10%: Divide the SSBA from Step #2 by the (row length + 2 ft). If this is greater than or equal to (PLW + 5 ft) no increase to the SSBW is needed otherwise the minimum SSBW = (PLW + 5 ft). The system sand extension is placed entirely on the down slope side of the bed and = SSBW just calculated – (PLW + 2 ft).

Example #1 Single Family Residence:
Design criteria = 3 bedrooms, 450 gpd; conventional SLR = 0.75 gpd/ft² (AES SLR = 1.125 gpd/ft²); subsurface, level bed with basic serial distribution.

Step #1: AES pipe required from Table A = 70 ft/br x 3 bedrooms = minimum 210 ft of pipe
Step #2: Minimum SSBA from Table B = 400 ft²
Step #3: Serial sections required: 450 gpd ÷ 750 gpd/section = 0.60. Round up to 1 section
Step #4: Choose a row length of 70 ft. Minimum of 210 ft of pipe ÷ 70 ft = 3 pipe rows
Step #5: Table C calls for a PLW of 4 ft
Step #6: a) The minimum SSBW is 400 ft² ÷ 72 ft = 5.6 ft, which is less than the PLW of 4 ft + 2 ft = 6 ft, therefore no system sand extensions are needed. Basal area provided by this bed = 72 ft x 6 ft = 432 ft².
b) Isn't required because the bed is being constructed level.

Illustration of example #1 using AES pipe:

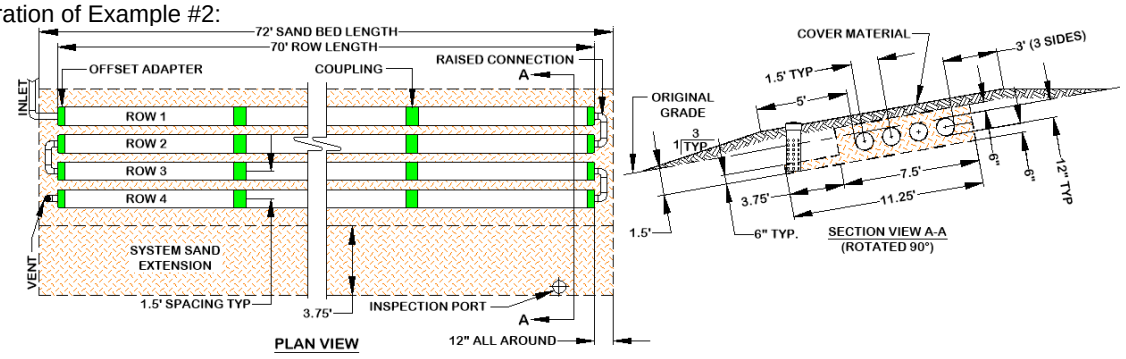


2.0 SYSTEM DESIGN

Example #2: Single Family Residence:
Design criteria: 4 bedrooms, 600 gpd; conventional SLR = 0.50 gpd/ft² (AES SLR = 0.75 gpd/ft²); 11% sloping site, subsurface bed with basic serial distribution.

Step #1: AES pipe required from Table A = 4 x 70 ft = minimum of 280 ft of pipe
Step #2: Minimum SSBA from Table B = 800 ft²
Step #3: Serial sections required: 600 gpd ÷ 750 gpd/section = 0.80. Round up to 1 section
Step #4: Choose a row length of 70 ft. Minimum 280 ft of pipe ÷ 70 ft = 4 rows.
Step #5: Table C shows a PLW of 5.5 ft for a row length of 70 ft, row spacing of 1.5 ft and the 280 ft of pipe
Step #6: a) Bed slopes > 10% use next step.
b) Minimum SSBW = 800 ft² ÷ 72 ft = 11.11 ft, which is more than the (PLW of 5.5 ft), so the minimum SSBW = 11.11 ft. Round up to 11.25 for ease of construction. The SSE must be placed entirely on the down slope edge of the sand bed because this bed is sloping over 10%. The SSE = 11.25 ft – (5.5 ft PLW + 2 ft) = 11.25 ft – 7.5 ft = 3.75 ft

Illustration of Example #2:



2.3 Design Specifications

The AES system shall be designed in accordance with this Manual and the Illinois Code. The AES can be installed utilizing any of the design configurations outlined in this Manual.

Design Daily Flow

The peak daily flow of wastewater to a system, expressed in gallons per day (gpd); systems are typically sized based on the design daily flow. Design flow is calculated in accordance with the Illinois Code.

Effluent (Wastewater) Strength

The AES pipe requirement for bed or trench systems is based on residential strength effluent, which has received primary treatment provided by an Illinois Code-compliant septic tank. Designing a system that will treat higher strength wastes requires additional AES pipe. In these situations, our Technical Advisors shall be consulted for recommendations at (800) 473-5298.

Filters, Alarms and Baffles

- Effluent filters are not required or recommended for use with AES systems.
- If used, effluent filters shall be maintained on at least an annual basis. Follow manufacturer's instructions regarding required inspections, cleaning and maintenance of the effluent filter.
- Effluent filters must allow the free passage of air to ensure the proper functioning of the system.
- All pump systems must have a high-water alarm float or sensor installed inside the pump chamber.
- All septic tanks shall be equipped with baffles to prevent excess solids from entering the AES system.
- Charcoal filters in vent stacks (for odor control) are not recommended by PEI. They can block air flow and potentially shorten system life. Contact PEI for recommendations to correct odor problems.

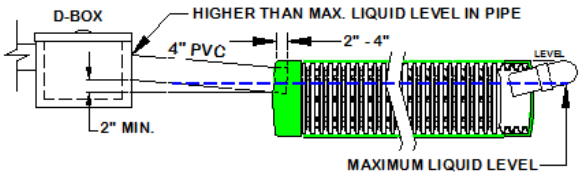
2.0 SYSTEM DESIGN

Flow Equalizers Required

All distribution boxes used to divide effluent flow require flow equalizers in their outlets. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever flow is divided. Each bed or section of combination serial distribution is limited to a maximum of 15 gallons per minute (gpm), due to the flow constraints of the equalizers. Flow equalizers are shall not be placed on distribution box outlets which are used for venting. All systems with combination serial distribution or multiple bed distribution shall use flow equalizers in each distribution box outlet.

Two-Inch Rule

The outlet of a septic tank or distribution box shall be set a minimum of 2 in above the highest inlet of the AES row, with the connecting pipe slope not less than 1% (approximately 1/8 in per foot).



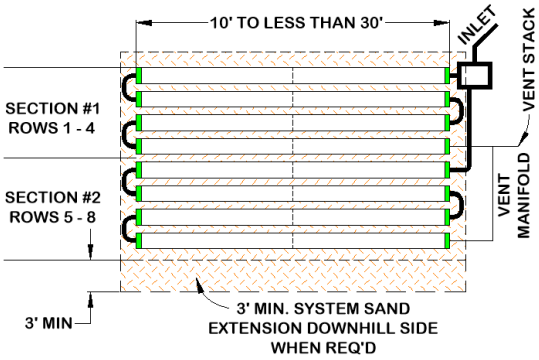
AES Pipe Requirement

AES systems use the bed sizing tables, pipe lengths and installation requirements noted in this Manual.

- Residential systems: 70 ft/br.
- Non-residential/commercial systems comprised of residential strength effluent: 2.14 gpd/ft.

Row Requirements

- All beds shall have at least 2 rows.
- Maximum row length for any system is 100 ft of pipe.
- Recommended minimum row length is 30 ft of pipe.
  - A combination (or D-box) distribution system shall be used if any row length is less than 30 ft. The D-box shall feed at least 30 ft of AES pipe, a minimum of two D-box outlets must be used and the field must be vented.
- Minimum center-to-center spacing is 1.5 ft for all systems. Spacing may be increased at the discretion of the system designer or as needed to meet the required SSBA.



- For level beds: the AES rows shall be centered in the middle of the system sand bed area and any system sand extensions divided evenly on both sides.
- For sloping beds: for beds with slopes of greater than 10%, the elevations for each AES row must be provided on the drawing. All rows shall be grouped at the high side of the SSBA with any system sand extensions placed entirely on the downslope side.
- Sewn seam must be oriented in the 12 o'clock position. This correctly orients the Bio-Accelerator® fabric in the 6 o'clock position.
- Each row must be laid level to within +/- ½ in (total of 1 in) of the specified elevation and preferably should be parallel to the contour of the site.
- It is most convenient if row lengths are designed in exact 10 ft increments to accommodate the length of the AES pipe as manufactured. However, AES pipe lengths can be cut to any length.

Pressure Distribution

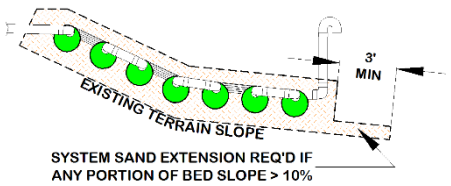
The use of pressure distribution lines in AES systems is prohibited. Pumps may be utilized when necessary only to feed a distribution box which then distributes effluent by gravity to the AES field. Systems incorporating pumps to gain elevation must use differential venting and velocity reduction to control liquid flow (see Section 2.5 Pump Systems, page 16).

2.0 SYSTEM DESIGN

System Sand Extensions

Systems that slope more than 10% require a minimum 3 ft system sand extension on the down slope side of the system sand bed (see illustration on page 11 below). System sand extensions are required to be a minimum of 6 in deep. System sand extensions are equally divided on each side of level systems. The system sand extension should not be confused with the "cover material extension," which refers to the material used to cover the field.

Sloping Sites and Sloping Systems



- The percentage of slope in all system drawings in this Manual refers to the slope of the system, not the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
- The system slope and the site slope do not have to be the same.
- Maximum site slope is 33% and maximum system slope is 25%.
- The slope of the site and/or the system may contain more than one slope provided the maximum allowed slope is not exceeded.

Table D: Allowable Slopes

Percolation Rate Minutes per Inch (mpi)	% Site Slope Maximum	% System Slope Maximum
1.79 – 1.12	33	25
0.90 – 0.75	20	15
0.45 – 0.37	15	6*

*Note: for 0.45–0.37 SLR a 15% system slope allowed when the sand bed bottom is 4 inches or more below the original grade.

Separation Distances (Horizontal and Vertical)

Vertical separation distances to the seasonal high-water table (SHWT) or other restrictive features are measured from the outermost edge of the system sand, including system sand extensions if present. Minimum vertical separation distance to restrictive features and the seasonal high-water table (SHWT) is 12 inches. Perimeter drains may be used to lower the SHWT to this level. Horizontal separation distances per Illinois Code.

System Side Slope Tapers

If a bed extends above grade, the sand fill and the cover soils on the system must have side slope tapers until it meets the original grade. Side slope tapering is to be no steeper than 3:1; steeper side slopes require IDPH approval. The side slope taper begins 3 ft from the AES pipe, measured parallel to the system slope - if any – (see illustrations on page 11).

Infiltrative Surface

The infiltrative surface is defined as the bottom of the system sand bed. Vertical separation distances are measured from the infiltrative surface.

Cover Material Extension

Cover material extensions are utilized in constructing elevated systems to blend the raised portion of the system with the side slope tapering (see illustration on page 11 below). Cover material extensions are a minimum of 3 ft wide on all sides, measured from the AES pipe. Systems sloping greater than 10% require a 5 ft cover material extension on the down slope side of the field.

Topsoil

Suitable earth cover similar to the naturally occurring soil at the site and capable of sustaining plant growth is required as the uppermost layer over the entire system (including cover material extensions, side slope extensions and system sand extensions). The topsoil layer should be a minimum of 4 inches deep and should be immediately seeded or mulched in order to prevent erosion.

2.0 SYSTEM DESIGN

Barrier Materials over System Sand

No barrier materials (hay, straw, tarps, etc.) are to be placed between the system sand and cover material.

Converging Flows Restriction

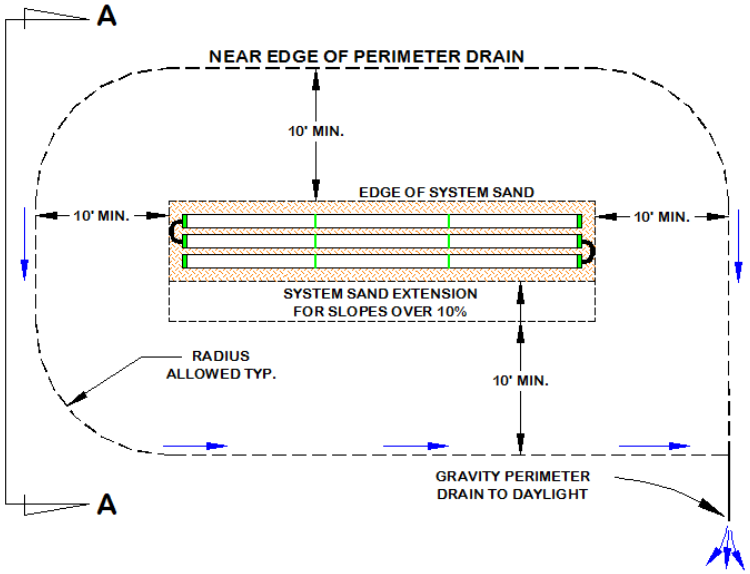
The AES system shall not be located where surface or ground waters will converge, causing surface water flow to become concentrated or restricted within the soil absorption field.

Perimeter Drains

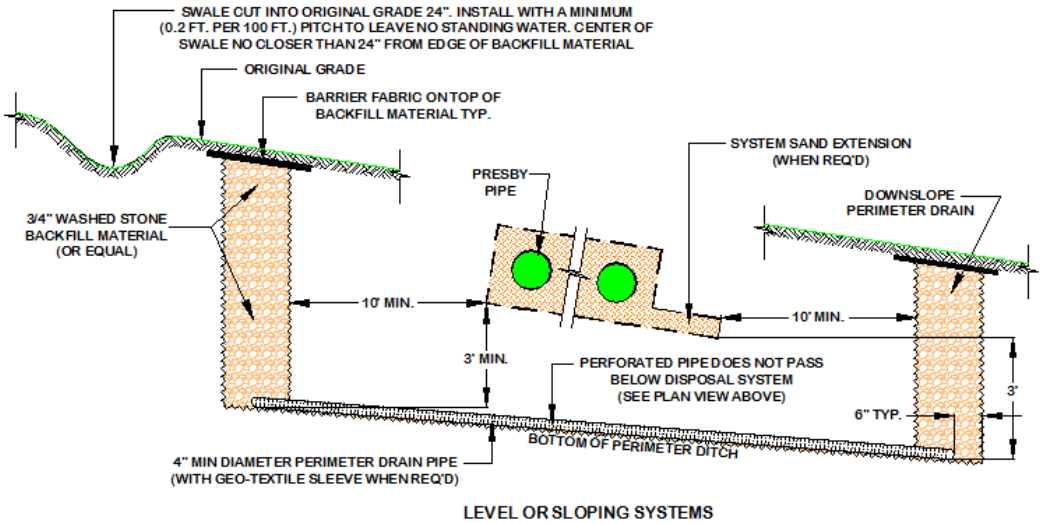
Perimeter drains may be installed around the entire perimeter of any AES system. A properly constructed perimeter drain surrounds the system on all four sides and is a minimum of 10 ft away from the outer edges of the system sand or system sand extension if present. Ongoing maintenance by the owner to ensure that the outlet remains unobstructed is essential to proper functioning; animal guards are required on the drain outlet to prevent animal activity that could result in obstruction. No other drainage systems (such as foundation drains, sump pumps, etc.) should be incorporated into the perimeter drain design or discharge in the area of the onsite system.

- Drains shall be installed with a minimum (0.2 ft per 100 ft) slope toward drain outlet.
- Side-by-side configuration requires a segment drain between the beds. See illustrations on page 15.

Plan view of perimeter drains:



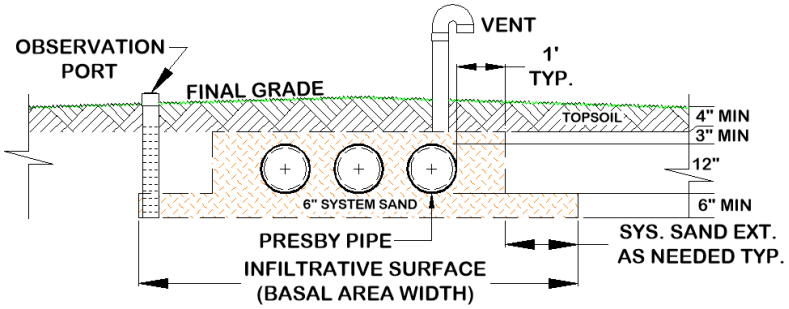
End View A-A of perimeter drains:



2.4 System Configurations

In-Ground Bed Systems

Systems are installed below existing grade for sites with no soil restrictive features to limit placement. Illustration of an in-ground system on a level site:

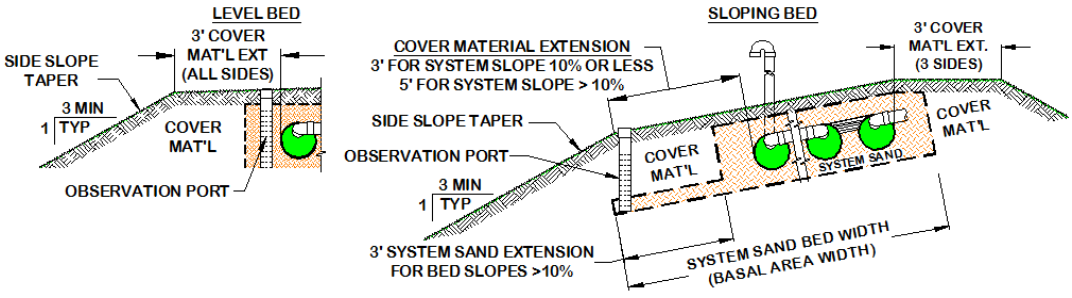


Elevated Bed Systems

Elevated bed systems are designed for sites with soil, depth to groundwater or restrictive feature constraints that do not allow for in-ground bed systems. An elevated bed system is a soil absorption field with any part of the AES bed extending above the original grade. Cover material extensions and side slope tapers are required for elevated systems and must meet the following requirements:

- A 3 ft cover material extension (measured from the AES pipe) is required on each side of any bed that extends above the original grade, which has a system slope of 10% or less, before the side slope tapering can begin.
- If the system slope is greater than 10%, the soil cover material extension must be increased to 5 ft, but only on the down slope side of the field (the remaining three sides only require a 3 ft cover material extension).
- Side slope tapers are to be a minimum of 3 horizontal feet for each 1 foot of vertical drop. Refer to Section 3.1 Site Preparation Prior to Excavation on page 20 for erosion control and surface water diversion procedures. Do not confuse the “cover material extension” with a system sand extension. The cover material extension refers to the material used to cover the AES field.

Illustrations of beds that extend above the original grade:



Basic Serial Distribution

Basic Serial distribution may be used for single beds of 750 gpd or less. AES rows are connected in series at the ends with raised connections, using offset adapters.

- Incorporates rows in serial distribution in a single bed.
- Rows are connected at the ends with raised connections, using offset adapters and PVC pipe Rows shall meet requirements outlined in the design criteria above.
- Gravity fed basic serial systems may be fed directly from the septic tank.
- Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

2.0 SYSTEM DESIGN

Illustration of level basic serial system bed design:

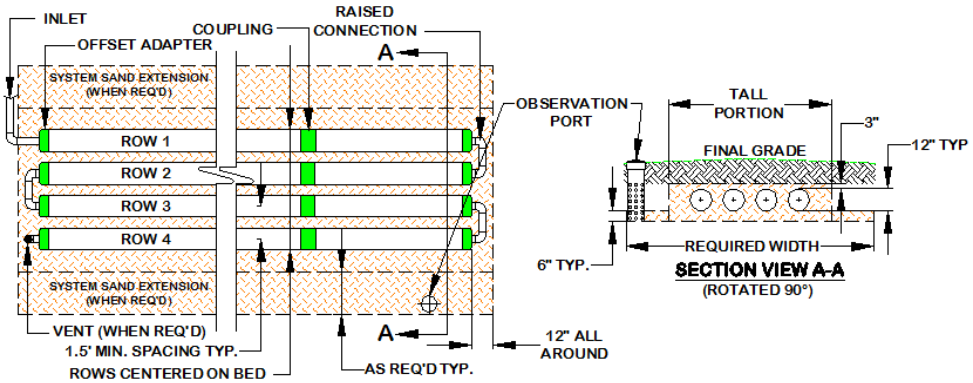
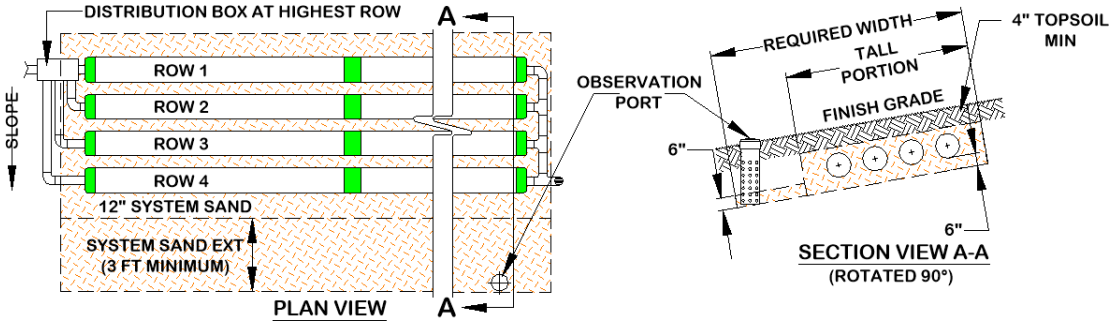


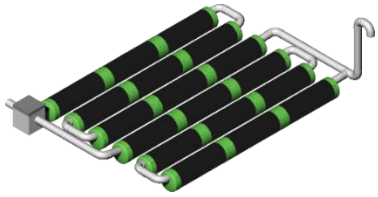
Illustration of sloping basic serial system bed design:



Combination Serial Distribution

Combination serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 gpd. Effluent flow is divided evenly to each section using a distribution box with flow equalizers.

- Consists of two or more serial sections (with a maximum loading of 750 gpd/section) installed in a single bed.
- Each section consists of a series of AES rows connected at the ends with raised connections, using offset adapters and PVC sewer and drainpipe.
- There is no limit on the number of sections within a bed.
- Each section shall have the same linear feet of pipe determined by dividing the total linear feet required in the system by the number of sections required.
- When the vent manifold is on the same side as the serial section inlets, the manifold runs over the top of these inlets (as shown in illustration).



2.0 SYSTEM DESIGN

Illustration of level combination serial system (two serial sections):

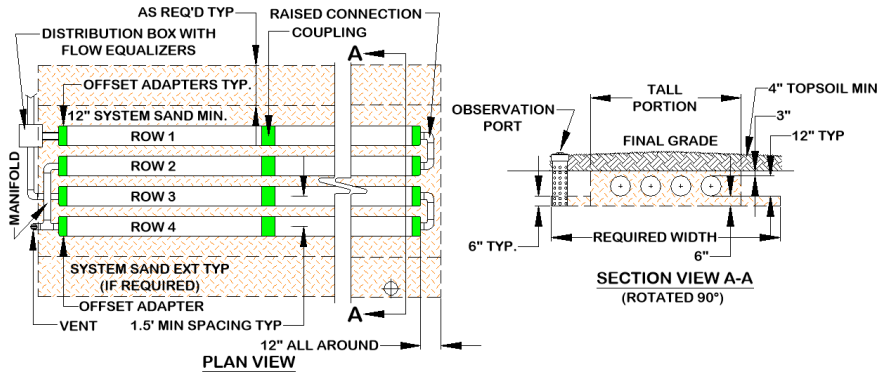
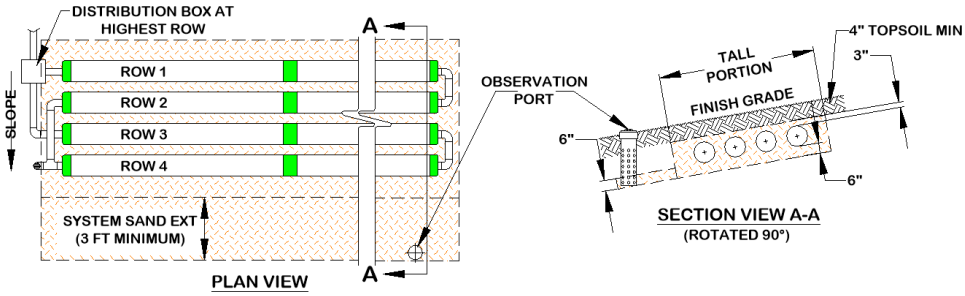
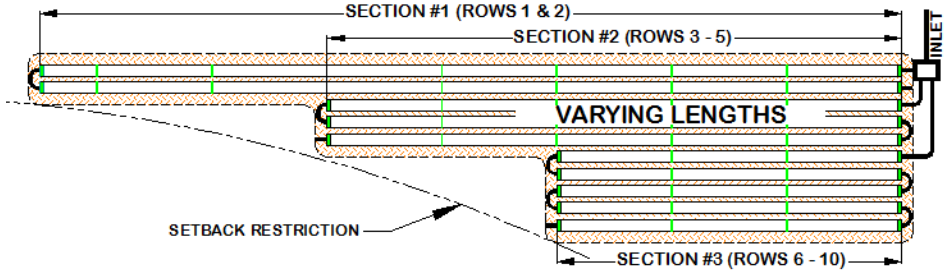


Illustration of sloping combination serial system (two serial sections):



Rows must meet requirements outlined in the design criteria above except rows within a section may vary in length to accommodate site constraints.



D-box (Parallel) Distribution

- All rows in this configuration must be the same length.
- Flow equalizers must be used in the D-box.
- Use a manifold to connect the ends of all rows. Manifold shall be sloped toward AES pipes.
- D-box placement shall be installed on level, firmly compacted soil.
- All rows shall be laid level end-to-end.
- A 2 in min. drop is required between the D-box outlets and the AES pipe inlets.
- Rows shall meet requirements outlined in the design criteria above.

2.0 SYSTEM DESIGN

Illustration of level D-box (parallel) distribution bed system:

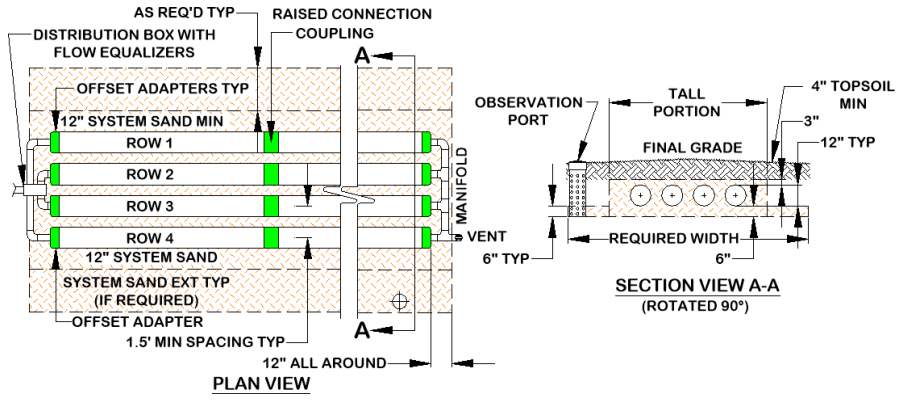
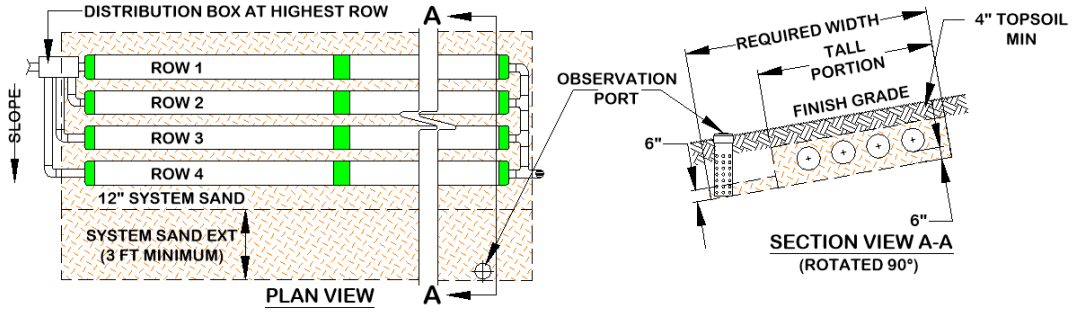


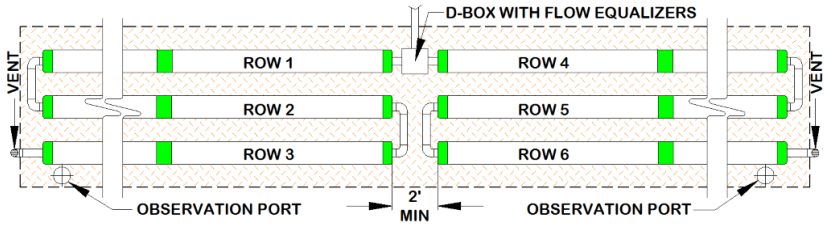
Illustration of sloping D-box (parallel) distribution bed system:



Butterfly Configuration

A butterfly configuration system is considered a single bed (see illustration below).

- Maximum length of any row is 100 ft.
- Serial Section loading limit is 750 gpd.
- Beds can contain any number of serial sections.



Multiple Bed Distribution

Incorporates two or more beds, each bed receiving an equal amount of effluent from a D-box. Multiple beds may be oriented along the contour of the site or along the slope of the site.

- Each bed shall have the same minimum linear feet of pipe. The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the system by the number of beds.
- Rows within a bed may vary in length to accommodate site constraints, except with D-box configuration which requires all rows to be the same length.
- End-to-end configurations are preferred to side-to-side configurations.
- Bed separation distance is measured from outermost edges of pipes in end-to-end configurations; from outermost edges of system sand in side-by-side configurations (see illustrations below).

2.0 SYSTEM DESIGN

Illustration of end-to-end multiple beds:

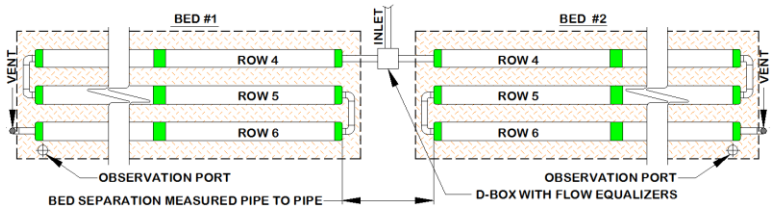
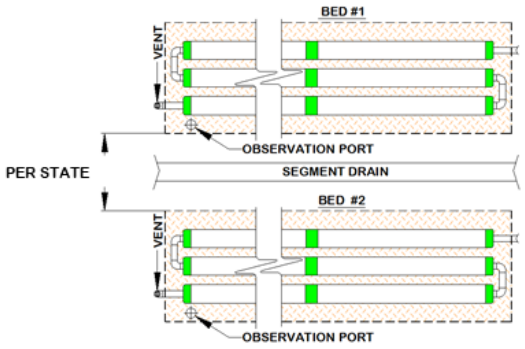
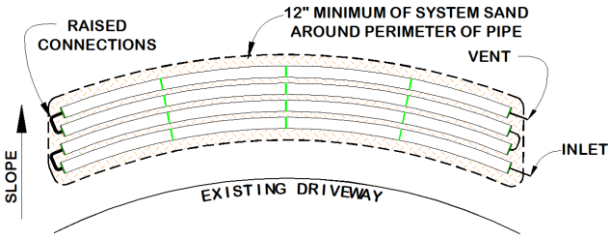


Illustration of side-by-side multiple beds:

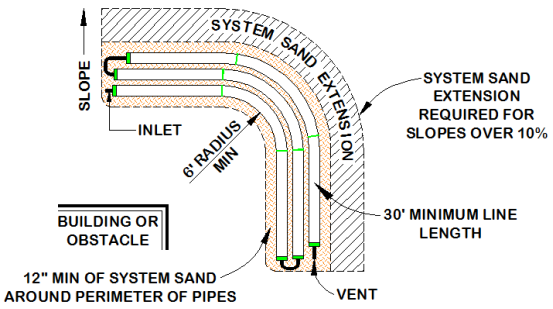


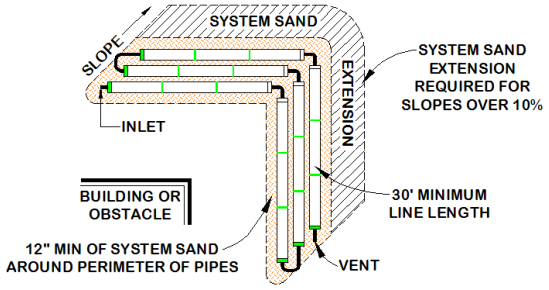
Angled and Curving Beds

Angled and curving beds are used to avoid obstacles and work well around structures, setbacks, and slopes. Multiple curves can be used within a system to accommodate various contours of the site.



- Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters.
- Rows shall meet requirements outlined in the design criteria above.





Other Allowed Bed Configurations

All allowed AES bed configurations may be adapted for use with the provisions of direct discharging treated wastewater. At a minimum this will include basic serial and combination distribution layouts. At a minimum, direct discharge fields require the use of additional system sand below the AES pipes, a means of collecting wastewater for further treatment or discharge, a sampling port to verify treatment compliance and provisions for the installation of a final disinfection unit before discharge (see illustrations below).

Direct discharge requirements:

- The system sand must extend at least 12 inches below the AES pipe (see Item 3 in illustrations below). More system sand is allowed and may reduce the need for an additional disinfection unit (Item 6),

however the vertical separation distance to restrictive features is measured to the bottom of the system sand bed.

- All systems designed for direct discharge shall incorporate the provision to add an additional disinfection unit downstream of the sampling port. Provision to add the unit may include the installation of a chamber to house the unit or simply providing the space to accommodate a unit.
- Systems that slope to match the existing terrain may still utilize direct discharge provided the collection pipe is located at the low end of the system sand bed as show below. If a system sand extension is required, the collection pipe must be placed near the lowest edge of extension.

Illustration of standard bed configuration for direct discharge (basic serial distribution shown):

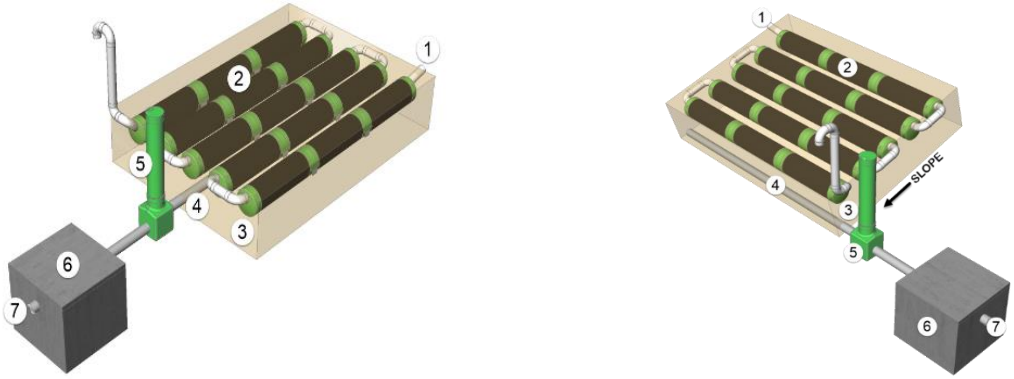
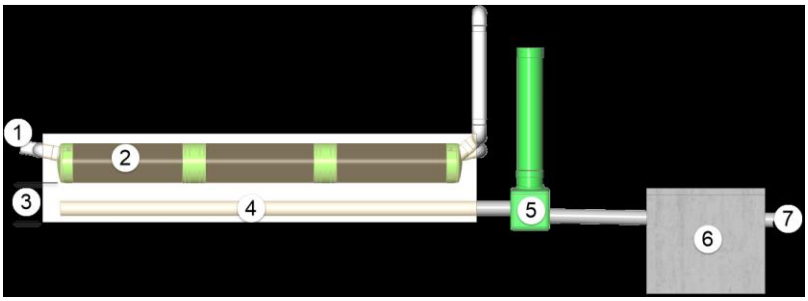


Illustration of standard bed configuration for direct discharge (side view):



Item	Description
1	Wastewater Inlet to AES Field
2	AES Field
3	12 inches of system sand below AES pipes
4	Collection pipe
5	Inspection port
6	Provisions for additional disinfection unit
7	Direct discharge pipe to body of water

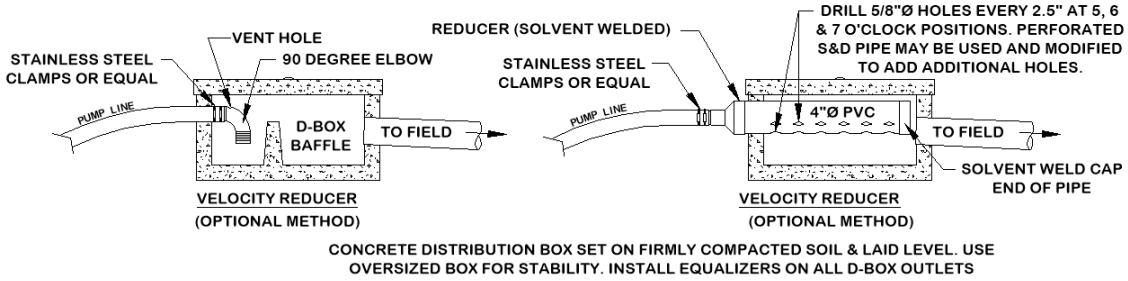
2.5 Pump Systems

Pumped systems supply effluent to the system using a pump and distribution box when site conditions do not allow for a gravity system. Dosing siphons are also an acceptable means of delivering effluent to the system.

- All pump systems require use of a D-box.
- Pump volume per dose shall be no greater than 1-gallon times the total linear feet of AES pipe.
- Pump dosing should be designed for a minimum of 6 cycles per day.

- If possible, the dosing cycle should provide one hour of drying time between doses.
- Pumped systems with basic serial distribution are limited to a maximum dose rate of 40 gpm and do not require the use of a flow equalizer on the D-box outlet.
- Pump systems must have a high-water alarm float or sensor installed inside the pump chamber.
- All pump systems require differential venting.
- Pumped systems with basic serial distribution are limited to a maximum dose rate of 40 gpm.
- All systems with combination serial distribution or multiple bed distribution shall use flow equalizers in each D-box outlet with each bed or section limited to a maximum of 15 gpm, due to the flow constraints of the equalizers.
    - *Example: pumping to a combination system with 3 sections (using 3 D-box outlets). The maximum delivery rate is (3 x 15) = 45 gpm. Higher flow rates can be accommodated by connecting multiple D-box outlets to each line.*
- The rate at which effluent enters the AES pipe shall be controlled. Excessive effluent velocity can disrupt solids that settle in the pipes.
    - Effluent shall never be pumped directly into AES pipes.
    - A distribution box or tank shall be installed between the pumping chamber and the AES pipe to reduce effluent velocity.
    - Force mains shall discharge into a distribution box (or equivalent) with velocity reducer and a baffle, 90° bend, tee or equivalent.

Two methods of velocity reduction:



2.6 Venting

An adequate air supply is essential to the proper functioning of AES systems. Venting is always required. All systems shall utilize differential venting.

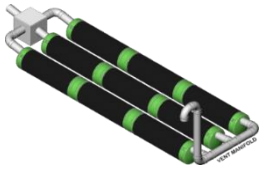
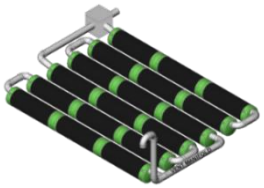
General Rules

- Differential venting is the use of high and low vents in a system.
- In a gravity system, the roof stack acts as the high vent.
- High and low vent openings shall be separated by a minimum of 10 vertical ft.
- If possible, the high and low vents should be of the same capacity.
- Vent openings shall be located to ensure the unobstructed flow of air through the entire system.
- The low vent inlet shall be a minimum of 1 ft above final grade or anticipated snow level.
- Sch. 40 or SDR 35 PVC (or equivalent) should be used for all vent stacks.
- One 4 in vent is required for every 1,000 ft of AES pipe.
- A single 6 in vent may be installed in place of up to three 4 in vents.
- If a vent manifold is used, it shall be at least the same diameter as the vent(s).
- Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.
- Remote venting may be utilized to minimize the visibility of vent stacks.
- When venting multiple beds, it is preferred that each bed be vented separately rather than connecting bed vents together. Multiple vents can be remotely located to the same location if desired.

2.0 SYSTEM DESIGN

Vent Manifolds

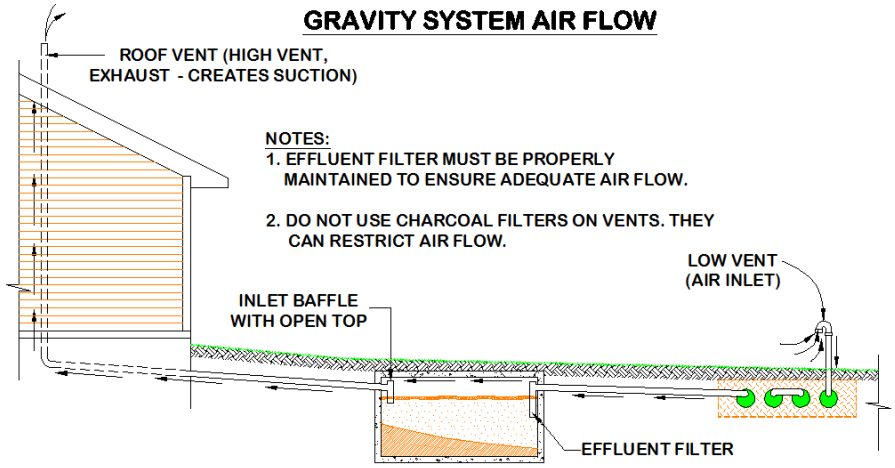
A vent manifold may be incorporated to connect the ends of a number of sections or rows of AES pipe to a single vent opening. D-box configurations require all ends of the rows to be manifolded. The vent stack in these systems must be attached to the manifolded rows. Vent piping should slope downward towards the system toto drain condensation.

Gravity Systems Vent Locations

- A low vent is installed at the end of the last row of each section or the end of the last row in a basic serial bed, or at the end of each row in a D-box distribution configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
- The house (roof) vent functions as the high vent as long as there are no restrictions or other vents between the low vent and the house (roof) vent.
- When the house (roof) vent functions as the high vent, there shall be a minimum of a 10 ft vertical differential between the low and high (roof) vent openings.

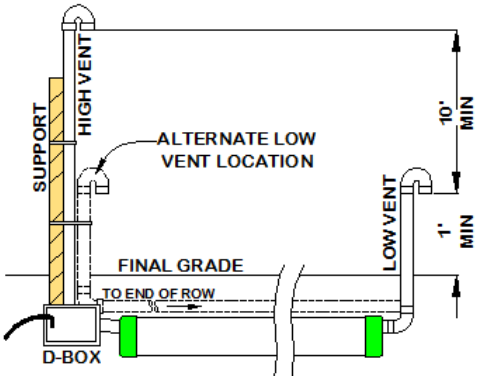
Illustration of gravity system air flow:



VENTING IS ESTABLISHED THROUGH SUCTION (CHIMNEY EFFECT) CREATED BY THE DRAW OF AIR FROM THE HIGH VENT, WHICH DRAWS AIR FROM THE LOW VENT, THROUGH THE LEACH FIELD, THROUGH THE SEPTIC TANK, AND EXHAUSTED THROUGH THE (HIGH) ROOF VENT.

Pump System Vent Locations

- A low vent is installed through an offset adapter at the end of each section, basic serial bed or attached to a vent manifold.
- A high vent is attached to an unused distribution box outlet.
- The low and high vents may be swapped, provided the distribution box is insulated against freezing in cold climates.
- For options to relocate the high vent, see Remote Venting (below).
- For options to eliminate the high vent, see By-pass Venting (below).

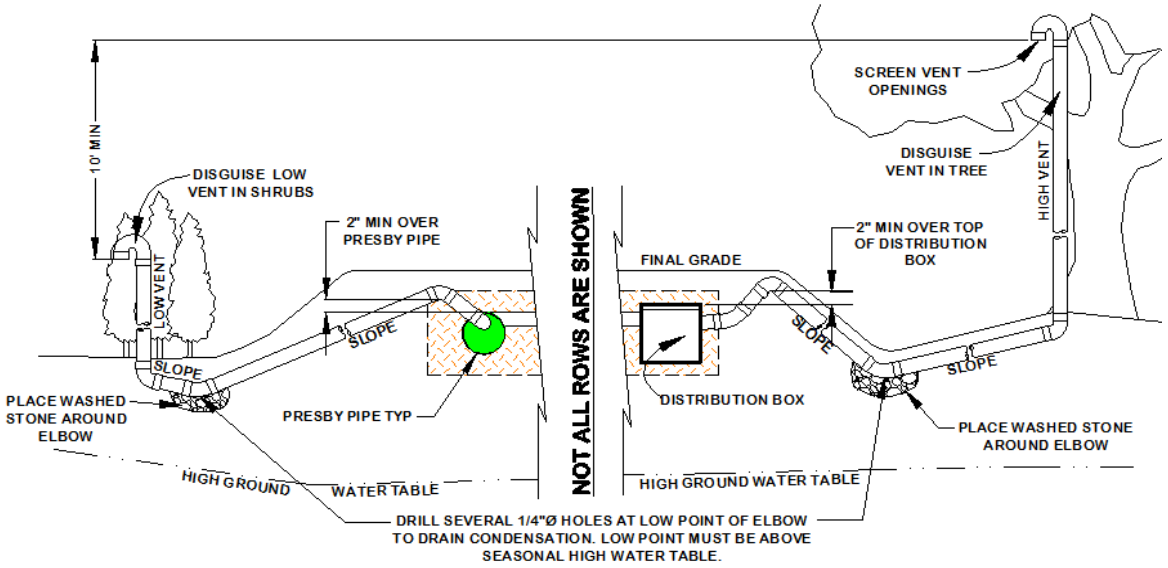


2.0 SYSTEM DESIGN

Remote Venting

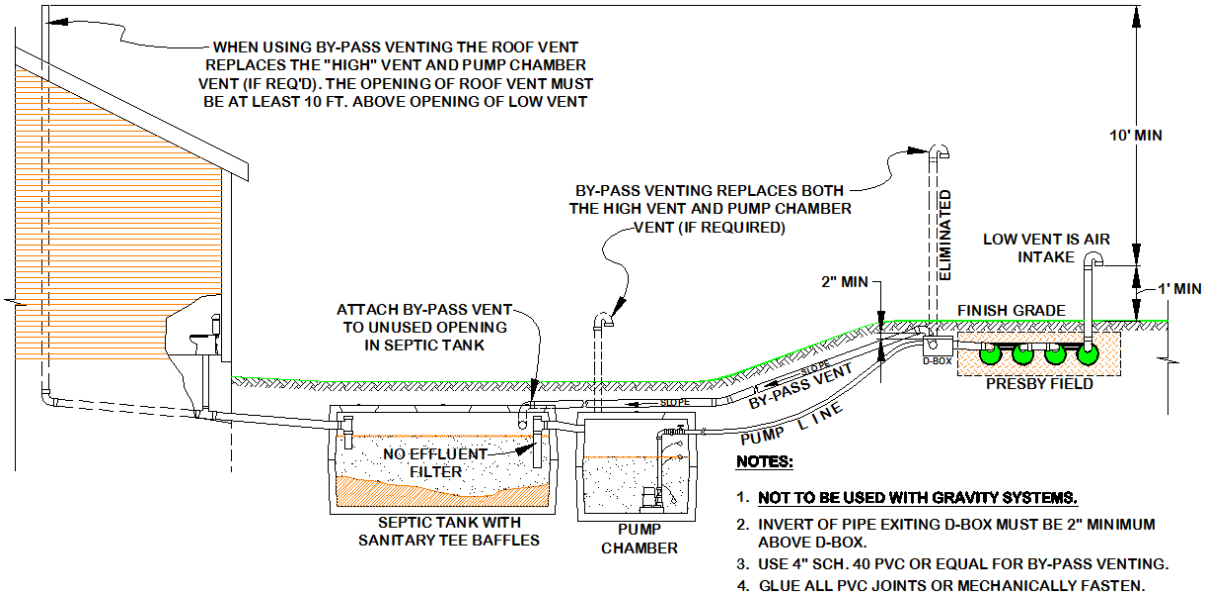
If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in holes to allow drainage of condensation. This procedure may only be used if the vent pipe connecting to the system has:

- A high point that is above the highest point of all AES pipes or the D-box; and,
- A low point opened for drainage which is above the SHWT. (See diagram below.)



By-Pass Venting

When a field is fed using pumping or dosing, it is necessary to provide air flow through the system by using "by-pass venting." In by-pass venting, the system is plumbed by attaching Sch. 40 or SDR 35 PVC to the D-box back to the septic tank or pump chamber if no effluent filter. This process "by-passes" the pump line and allows air to flow from the low vent to the roof vent which acts as the high vent. Bypass vent line invert must rise a minimum of 2 in above D-box before dropping to pump chamber or septic tank.



3.0 INSTALLATION

3.1 Installation Requirements

Component Handling

- Keep mud, grease, oil, etc. away from all components. Avoid dragging pipe through wet or muddy areas. Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
- The outer fabric of the AES pipe is ultra-violet stabilized; however, this protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp if stored outdoors.

Site Preparation Prior to Excavation

1. Locate and stake out the system sand bed, extension areas and soil material cover extensions on the site according to the approved plan.
2. Install sediment/erosion control barriers prior to beginning excavation to protect the system from surface water flows during construction.
3. Do not stockpile materials or equipment within the portion of the site receiving system sand.

Critical Reminder to Prevent Soil Compaction

It is critical to keep excavators, backhoes, and other equipment off the excavated or tilled surface of a bed. Before installing the system sand, excavation equipment should be operated around the bed perimeter; not on the bed itself. It is especially important to avoid using construction equipment down slope of the system to prevent soil compaction.

When to Excavate

- Do not work wet or frozen soils. If a fragment of soil from about 9 in below the surface can easily be rolled into a wire, the soil moisture content is too high for construction.
- Do not excavate the system area immediately after, during or before precipitation.

Tree Stumps

Before tilling, remove all grass, leaves, sticks, brush and other organic matter or debris from the excavated system site. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical “thumb” or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared.

- Avoid soil disturbance, relocation, or compaction.
- Avoid mechanical leveling or tamping of dislodged soil.
- Fill all voids created by stump or root removal with system sand.

Raking and Tilling Procedures

All areas receiving system sand, sand fill and fill extensions shall be raked or tilled. If a backhoe/excavator is used to till the site, fit it with chisel teeth and till the site. The backhoe/excavator shall remain outside of the proposed system sand area and extensions.

- For in-ground bed systems, excavate the system bed as necessary below original grade. Using an excavator or backhoe, tilt the bucket teeth perpendicular to the bed and use the teeth to rake furrows 2 – 6 in deep into the bottom of the entire area receiving system sand or sand fill.
- For elevated bed systems remove the “A” horizon, then use an excavator or backhoe to rake furrows 2 – 6 in deep into the receiving area.

When installing system sand, keep at least 6” of system sand between the vehicle tracks and the tilled soil of the site. Equipment with tires should be avoided due to likely wheel compaction of underlying soil structures. Proper tilling procedures:

- If a chisel plow or a bulldozer with a ripper is used, make only one pass parallel to the contour of the site.
- If a moldboard plow is used, it must have at least 2 bottoms and make only one pass parallel to the contour of the site. On slopes greater than ½%, turn the furrows upslope.

3.0 INSTALLATION

- If a backhoe/excavator is used to till a wooded site, fit it with chisel teeth, till the site using the chisel teeth, and keep the backhoe on untilled soil at all times.
- If a plow pan exists not exceeding 12” from the original grade, till the soil to at least 2” below the bottom of the plow pan.
- The state or local department of health may require field supervision of tilling operations.

Install System Sand and/or Sand Fill Immediately After Excavation

To protect the tilled area from damage by precipitation, system sand should be installed immediately after tilling.

- Work off either end or the uphill side of the system to avoid compacting soil.
- Keep at least 6 in of sand between the vehicle tracks and the tilled soil of the site if equipment must work on receiving soil.

Heavy equipment with tires shall never enter the receiving area due to likely wheel compaction of underlying soil structures. Track construction equipment should not travel over the installed system area until at least 12 in of cover material is placed over the AES pipes.

Distribution Box Installation

To prevent movement, D-box shall be set on a layer of compacted soil, sand, pea gravel base or a concrete footing.

Level Row Tolerances

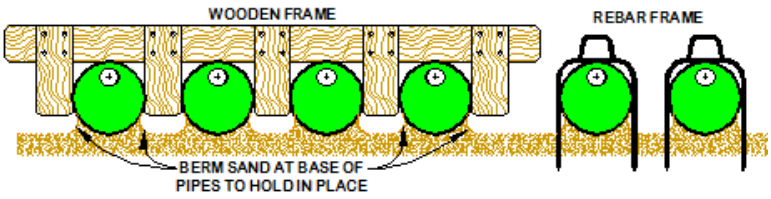
Use a laser level or transit to install rows level. Variations beyond 1 in (±1/2") may affect system performance and are not acceptable.

Correct Alignment of AES Bio-Accelerator® Fabric

The Bio-Accelerator (white geo-textile fabric) is to be positioned centered along the bottom of the pipe rows (sewn seam up – 12 o’clock position).

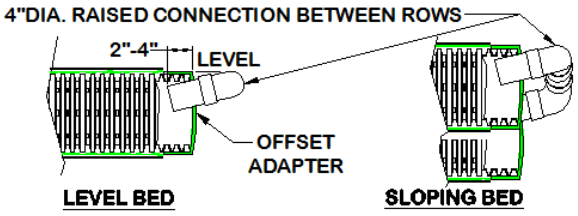
Row Spacers

System sand may be used to keep pipe in place while covering, but simple tools may also be constructed for this purpose. Two examples are shown. One is made from rebar, the other from wood. Caution: Remove all tools used as row spacers before final covering.



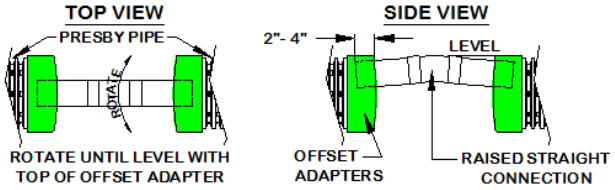
Connect Rows Using Raised Connections

Raised connections consist of offset adapters, 4 in PVC sewer and drainpipe, and 90° elbows. They enable greater liquid storage capacity and increase the bacterial surfaces being developed. Use raised connections to connect the rows of basic serial and combination serial configurations. Raised connections extend 2 in to 4 in into pipe and are installed on an angle (as shown in the drawing to the right). All PVC joints should be glued or mechanically fastened.



Raised Straight Connection

A raised straight connection is a PVC Sewer & Drain pipe configuration which is used to connect AES rows that are placed end to end along the same contour. Raised straight connections extend 2 in to 4 in into pipe and are installed on an angle (as shown in the drawings to the right). All PVC joints should be glued or mechanically fastened.



3.0 INSTALLATION

Backfilling Rows

1. Spread system sand between the rows.
2. Confirm pipe rows are positioned with Bio-Accelerator along the bottom with sewn seam up (12 o'clock position).
3. Straddle each row of pipe and walk heel-to-toe its entire length, ensuring that system sand fills all void spaces beneath the AES pipe.
4. Finish spreading system sand to the top of the rows and leave them exposed for inspection purposes.

Backfilling and Final Grading

1. Spread system sand to a minimum of 3 in over the pipe and a minimum of 12 in on all four sides of the bed beyond the AES pipes.
2. Spread a minimum of 4 in of suitable earth cover (topsoil or loam) with a texture similar to the soil at the site and capable of sustaining plant growth above the installed system.
3. To prevent erosion, soil cover above the system shall be planted with native, shallow-rooted vegetation such as grass, wildflowers and certain perennials or ground covers.

4.0 REJUVENATION AND EXPANSION

4.1 Bacteria Rejuvenation and Expansion

Why Would System Bacteria Rejuvenation Be Needed?

Bacteria rejuvenation is the return of bacteria to an aerobic state. Flooding, improper venting, alteration or improper depth of soil material cover, use of incorrect sand, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to converting bacteria in any system from an aerobic to an anaerobic state. This conversion severely limits the bacteria's ability to effectively treat effluent, as well as limiting liquids from passing through. A unique feature of the AES system is its ability to be rejuvenated in place.

How to Rejuvenate System Bacteria

System bacteria are "rejuvenated" when they return to an aerobic state. By using the following procedure, this can be accomplished in most AES systems without costly removal and replacement. Caution: This procedure must be followed in such a way as to not create a public health hazard:

1. Contact IDPH for appropriate permit.
2. Contact PEI before attempting rejuvenation for technical assistance.
3. Determine and rectify the problem(s) causing the bacteria conversion.
4. Drain the system by excavating at least one end of all the rows and removing the offset adapters. Sewage from the system must be removed by an Illinois licensed private sewage disposal pumping contractor.
5. If foreign matter has entered the system, flush the pipes.
6. Safeguard the open excavation.
7. Guarantee a passage of air through the system.
8. Allow all rows to dry for 72 hours minimum. The system sand should return to its natural color.
9. Re-assemble the system to its original design configuration. As long as there is no physical damage to the AES components, the original components may be reused.

System Expansion

AES systems are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections. All system expansions shall comply with state and local regulations. Permits may be required prior to system expansion.

Reusable Components

AES pipe and components are not biodegradable and may be reused. In cases of improper installation, it may be possible to excavate, clean, and reinstall all system components.

Replacement System

In the event of system malfunction, contact PEI for technical assistance prior to attempting rejuvenation procedures. In the unlikely event that an AES system needs to be replaced …

- PEI does not require a reserve or set-aside area for future use as a system replacement location in the unlikely event an AES system malfunctions, which can often be rejuvenated It can be reinstalled in the same location provided all the contaminated materials are removed and replaced
- All unsuitable material shall be removed prior to replacement system construction.
- Disposal of hazardous materials to be in accordance with state and local requirements.

Permits may be required for system replacement; contact the appropriate local or state agency.
If an AES system requires replacement, follow the procedure outlined below.

1. Secure the required state and local permits/approvals prior to beginning any work.
2. Use an Illinois licensed private sewage disposal pumping contractor to remove any sewage, contaminated components (not being reused) or contaminated soils from the site.
3. Replace damaged components with new AES products. If components are not damaged, they may be flushed and reused.
4. Replace in the same excavated location with new system sand.
5. All system replacements must comply with state and local regulations.

5.0 OPERATION AND MAINTENANCE

5.1 Operation and Maintenance

Proper Use

AES systems do not require a maintenance and monitoring agreement, however they do require minimal maintenance as is standard for conventional onsite systems, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will guarantee system longevity. We encourage all system owners and service providers to obtain and review a copy of our Owner's Manual, available from our website www.presbyeco.com or via mail upon request to (800) 473-5298 or info@presbyeco.com.

System Abuse Conditions

The following conditions constitute system abuse:

- Liquid in high volume (excessive number of occupants and use of water in a short period of time, leaking fixtures, whirlpool tubs, hot tubs, water softening equipment or additional water discharging fixtures if not specified in system design).
- Solids in high volume (excessive number of occupants, paper products, personal hygiene products, garbage disposals or water softening equipment if not specified in system design)
- Antibiotics and medicines in high concentrations
- Cleaning products in high concentrations
- Fertilizers or other caustic chemicals in any amount
- Petroleum products in any amount
- Latex and oil paints
- System suffocation (compacted soils, barrier materials, etc.) without proper venting

Note: PEI does not recommend the use of septic system additives.

System Maintenance/Pumping of the Septic Tank

- Inspect the septic tank at least once every two years under normal usage.
- Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
- If a garbage disposal is used, the septic tank will likely require more frequent pumping.
- After pumping, inspect the septic tank for integrity to ensure that no groundwater is entering it. Also check the integrity of the tank inlet and outlet baffles and repair if needed.
- Inspect the system to ensure that vents are in place and free of obstructions.
- Effluent filters require ongoing maintenance due to their tendency to clog and cut off oxygen to the system. Follow filter manufacturer's maintenance instructions and inspect filters frequently.

Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation, including the entire SSBA, and areas impacted by side slope tapering and perimeter drains (if used). Roots can infiltrate and cause damage or clogging of system components. If a perimeter drain is used, it is important to make sure that the outfall pipes are screened to prevent animal activity. Also check outfall pipes regularly to ensure that they are not obstructed in any way.

6.0 WARRANTY

PRESBY ENVIRONMENTAL INC.
STANDARD LIMITED WARRANTY

(a) The structural integrity of each unit, endcap and other accessory manufactured by Presby Environmental Inc. (collectively referred to as "Units"), when installed and operated in an onsite wastewater system in accordance with Presby Environmental's installation instructions, is warranted to the original purchaser ("Holder") against defective materials and workmanship for one year from the date upon which a septic permit is issued for the septic system containing the Units; provided, however, that if a septic permit is not required for the septic system by applicable law, the one (1) year warranty period will begin upon the date that installation of the septic system commences. In order to exercise its warranty rights, Holder must notify Presby Environmental in writing at its corporate headquarters in Whitefield, New Hampshire within fifteen (15) days of the alleged defect. Presby Environmental will supply replacement Units for those Units determined by Presby Environmental to be defective and covered by this Limited Warranty. Presby Environmental's liability specifically excludes the cost of removal and/or installation of the Units.

(b) THE LIMITED WARRANTY AND REMEDIES IN SUBPARAGRAPH (a) ARE EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE UNITS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

(c) This Limited Warranty shall be void if any part of the Presby Environmental system (unit, endcap or other accessory) is manufactured by anyone other than Presby Environmental. The Limited Warranty does not extend to incidental, consequential, special or indirect damages. Presby Environmental shall not be liable for penalties or liquidated damages, including loss of production and profits, labor and materials, overhead costs, or other losses or expenses incurred by the Holder or any third party. Specifically excluded from Limited Warranty coverage are damage to the Units due to ordinary wear and tear, alteration, accident, misuse, abuse or neglect of the Units; the Units being subjected to vehicle traffic or other conditions which are not permitted by the installation instructions; failure to maintain the minimum ground covers set forth in the installation instructions; the placement of improper materials into the system containing the Units; failure of the Units or the septic system due to improper siting or improper sizing, excessive water usage, improper grease disposal, or improper operation; or any other event not caused by Presby Environmental. This Limited Warranty shall be void if the Holder fails to comply with all of the terms set forth in this Limited Warranty.

Further, in no event shall Presby Environmental be responsible for any loss or damage to the Holder, the Units, or any third party resulting from installation or shipment, or from any product liability claims of Holder or any third party. For this Limited Warranty to apply, the Units must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Presby Environmental's installation instructions.

(d) No representative of Presby Environmental has the authority to change this Limited Warranty in any manner whatsoever, or to extend this Limited Warranty. No warranty applies to any party other than the original Holder.

The above represents the standard Limited Warranty offered by Presby Environmental. A limited number of states and counties have different warranty requirements. Any purchaser of Units should contact Presby Environmental's corporate headquarters in Whitefield, New Hampshire, prior to such purchase, to obtain a copy of the applicable warranty, and should carefully read that warranty prior to the purchase of Units.