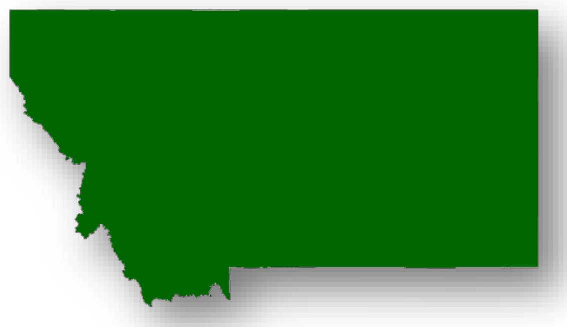
The Presby Wastewater Treatment System

Montana

Design and Installation Manual

for

Advanced Enviro-Septic® Wastewater Treatment System



✔ **Minimizes the Expense** ✔ **Protects the Environment** ✔ **Preserves the Site**

Presby Environmental, Inc.

The Next Generation of Wastewater Treatment Technology

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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.

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IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® Wastewater Treatment Systems. The use of this Manual with any other product is prohibited. The processes and design criteria contained herein are based solely on our experience with and testing of Advanced Enviro-Septic® and Simple-Septic®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

Date of Issue: October 17, 2016

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1.0 Background

Liquid that exits from a septic tank ("effluent") contains suspended solids that can cause traditional systems to fail prematurely. Solids can overload bacteria, cut off air required for aerobic bacterial activity, and/or seal the underlying soil, interfering with its ability to absorb liquid.

1.1 What Our System Does

By utilizing simple yet effective natural processes, the Presby Treatment System treats septic tank effluent in a manner that prevents suspended solids from sealing the underlying soil, increases system aeration, and provides a greater bacterial treatment area ("biomat") than traditional systems.

1.2 Why Our System Excels

The Presby Treatment System retains solids in its pipe and provides multiple bacterial surfaces to treat effluent prior to its contact with the soil. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. This all combines to create a unique eco-system that no other passive wastewater treatment system is designed to offer. The result is a system that excels by being more efficient, lasting longer, and having a minimal environmental impact.

1.3 System Advantages

a) costs less than traditional systems
b) eliminates the need for washed stone
c) often requires a smaller area
d) installs more easily and quickly than traditional systems
e) adapts easily to residential and commercial sites of virtually any size
f) adapts well to difficult sites
g) develops a protected receiving surface preventing sealing of the underlying soil
h) blends "septic mounds" into sloping terrain
i) increases system performance and longevity
j) tests environmentally safer than traditional systems
k) recharges groundwater more safely than traditional systems
l) made from recycled plastic

1.4 Patented Presby Technology

At the heart of Advanced Enviro-Septic® is a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges. All Presby Pipe is surrounded by one or more filtering, treatment and dispersal layers. Presby Systems are completely passive, requiring no electricity, motors, alarms, computers, etc. Presby Pipes are assembled and installed in a bed of specified System Sand which can either be below the ground or above.

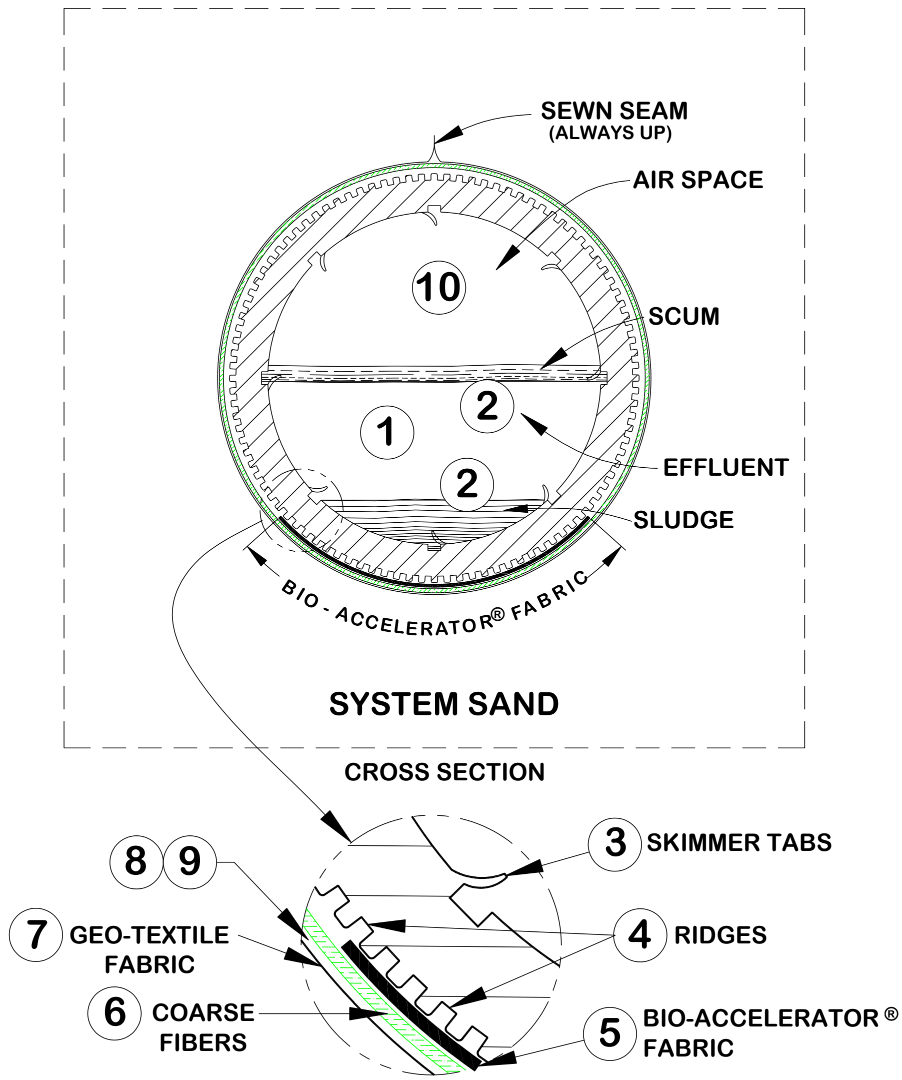
1.5 Advanced Enviro-Septic® (AES)

The Advanced Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I (a certification typically given to mechanical aeration devices), BNQ of Quebec, Class I, II, III and Cebedeau, Belgium standards. Advanced Enviro-Septic® is comprised of corrugated, perforated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric. Advanced Enviro-Septic® creates an eco-system designed to simultaneously purify and disperse effluent after primary treatment by a septic tank. Advanced Enviro-Septic® is the "next generation" of our Enviro-Septic® technology. The AES product incorporates Bio-Accelerator®, a proprietary enhancement that screens additional solids from effluent, accelerates treatment processes, assures even distribution and provides additional surface area. Each foot of Advanced Enviro-Septic® pipe provides over 40 sq ft of total surface area for bacterial activity.

2.0 Ten Stages of Wastewater Treatment

The Presby Wastewater Treatment System

10 Stages of Advanced Enviro-Septic® (AES) Treatment



Stage 1: Warm effluent enters the pipe and is cooled to ground temperature.

Stage 2: Suspended solids separate from the cooled liquid effluent.

Stage 3: Skimmers further capture grease and suspended solids from the existing effluent.

Stage 4: Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.

Stage 5: Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable.

Stage 6: A mat of coarse, randomly oriented fibers separates more suspended solids from the effluent.

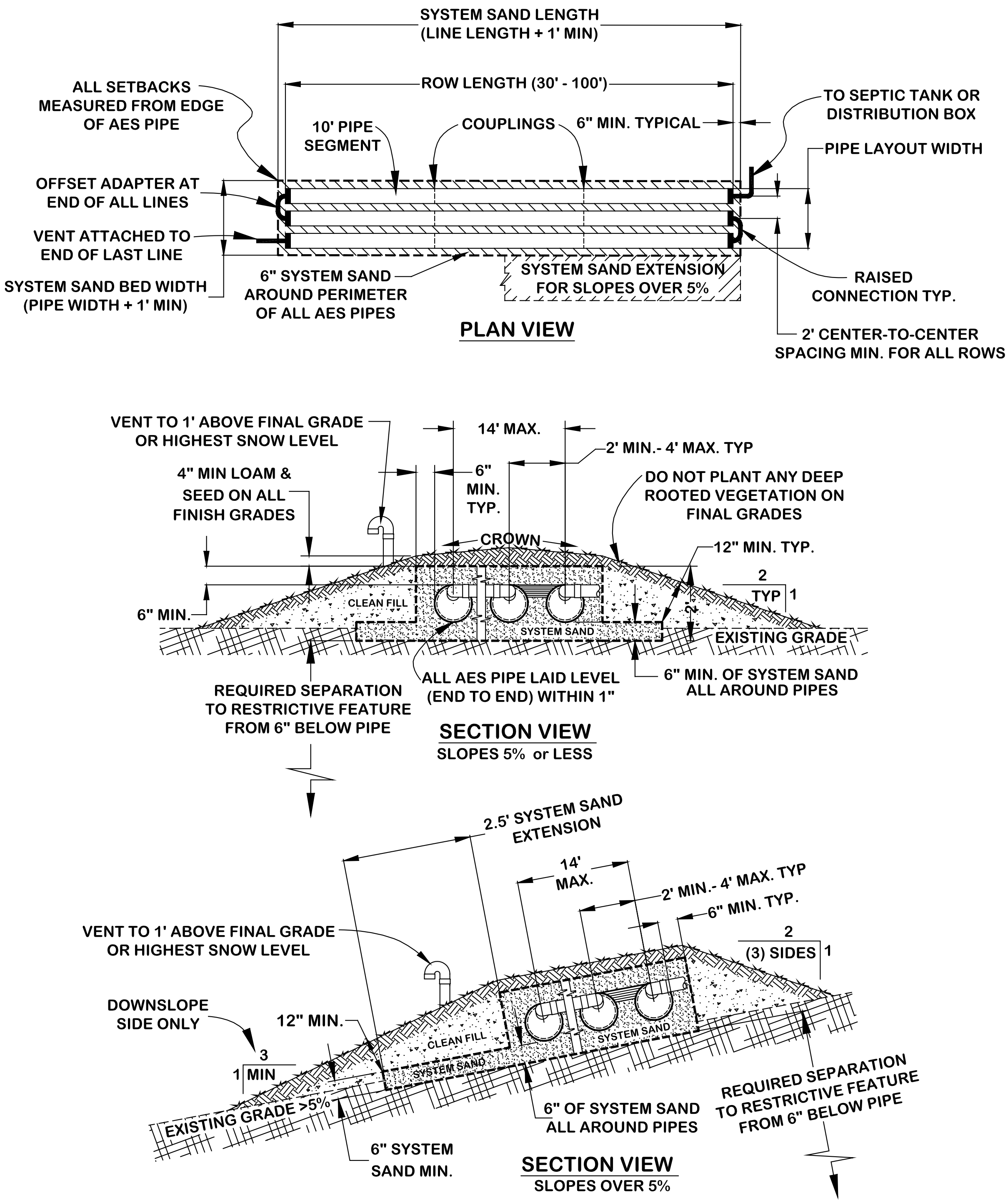
Stage 7: Effluent passes into the geo-textile fabrics and grows a protected bacterial surface.

Stage 8: Sand wicks liquid from the geo-textile fabrics and enables air to transfer to the bacterial surface.

Stage 9: The fabrics and fibers provide a large bacterial surface to break down solids.

Stage 10: An ample air supply and fluctuating liquid levels increase bacterial efficiency.

3.0 System diagram



Notes:

1. All rows spaced 2 ft center-to-center minimum

2. Rows grouped in middle of System Sand bed for level fields.

3. Venting required for all configurations

4.0 Presby System Components

4.1 Advanced Enviro-Septic® Pipe

a) Plastic pipe made with a significant percentage of recycled material
b) 10 ft sections (can be cut to any length)
c) Ridged and perforated, with skimmer tabs on interior
d) Bio-Accelerator® along bottom of pipe (sewn seam is always placed up).
e) Surrounded by a mat of randomly-oriented plastic fibers
f) Wrapped in a non-woven geo-textile fabric stitched in place
g) Exterior diameter of 12 in.
h) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
i) A 10 ft length of AES pipe is flexible enough to bend up to 90°

4.2 Component Handling & Care

The outer fabric of the Presby 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.

a) Keep mud, grease, oil, etc. away from all components.
b) Avoid dragging pipe through wet or muddy areas.
c) Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.

4.3 Coupling

A coupling is a plastic fitting used to create a connection between two pieces of Presby Pipe. Note that the couplings are wide enough to cover 1 or 2 pipe corrugations on each of the two pipe ends being joined. The couplings feature a snap-lock feature that requires no tools. When assembling pipes into rows, note that the geo-textile fabric does not go under couplings. Pull fabric back, install coupling, and then pull fabric over coupling. Also note, during installation in cold weather, couplings are easier to work with if stored in a heated location (such as a truck cab) before use.

4.4 Double Offset Adapter

A double offset adapter is a plastic fitting 12 in. in diameter with two 4 in. holes designed to accept a 4 in. inlet pipe, raised connection, vent or vent manifold, and/or bottom drain, depending upon the particular requirements of the design configuration. The 4 in. holes are to be aligned in the 12 o'clock and 6 o'clock positions. The holes are positioned 1 in. from the outside edge of the double offset adaptor and 2 in. from each other.

4.5 Distribution Box

A Distribution Box, also called a "D-box," is a device used to distribute effluent coming from the septic tank in a system that contains more than one section or more than one bed. D-boxes are also sometimes used for velocity reduction. D-boxes come in various sizes and with a varying number of outlets. Concrete D-boxes are preferred; some are made of plastic. Flow equalizers (see below) are installed in the D-box openings to equalize distribution; they help ensure equal distribution in the event that the D-box settles or otherwise becomes out of level. Unused openings in D-boxes are to be covered, plugged or mortared.

4.6 Flow Equalizers

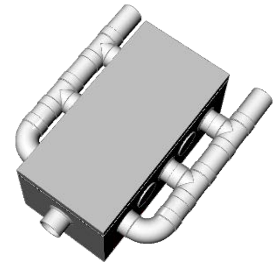
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever flow is divided. Each Bed or section of Combination Serial distribution is limited to a maximum of 15 gallons per minute, 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. Always provide a means of velocity reduction when needed.

4.7 Offset Adapter

An offset adapter is a plastic fitting 12 in. in diameter with an inlet hole designed to accept a 4-inch sewer line, raised connection or vent pipe. The hole is to be installed in the 12 o'clock position. The distance from the bottom of the Offset Adapter to the bottom of its inlet hole is 7 in. When assembling pipes into rows, note that the geo-textile fabrics are placed over the edges of the Offset Adapter and Couplings.

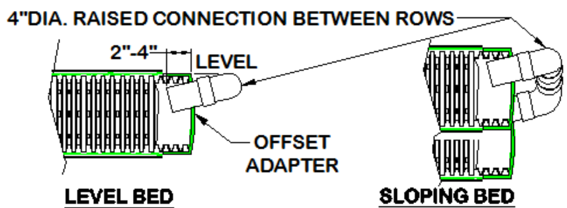
4.8 Manifolded Splitter Box

A manifolded splitter box joins several outlets of a D-box to help divide flow more accurately (see illustration to right). Dividing flow to multiple beds is a common use of splitter boxes. All outlets delivering effluent to the Presby field must have a flow equalizer. Do not place an equalizer on vent outlets.



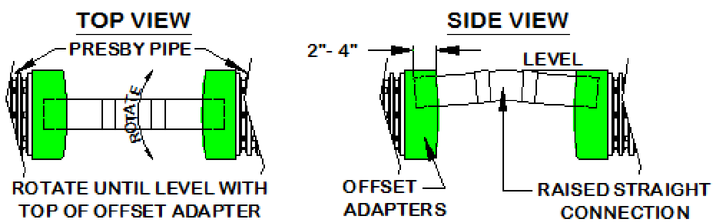
4.9 Raised Connection

A raised connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby Rows. Raised connections extend 2 in. to 4 in. into pipe and are installed on an angle (as shown below). All PVC joints should be glued or mechanically fastened.



4.10 Raised Straight Connection

A raised straight connection is a PVC Sewer & Drain pipe configuration which is used to connect Presby 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 below). All PVC joints should be glued or mechanically fastened. Offset Adapters will accept 4 inch schedule 40 PVC if the edge to be inserted into the adapter is rounded.



4.11 Septic Tank

The Advanced Enviro-Septic® System is designed to treat effluent that has received “primary treatment” in a standard septic tank. Septic tank capacity should be in accordance with state and local regulations. In addition:

a) System must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Advanced Enviro-Septic®.
b) Effluent filters on septic tank outlets are required by state rules.
c) The effluent filter selected must allow the free passage of air to ensure the proper functioning of the system and maintained properly.

4.12 System Sand

The System Sand that surrounds the Advanced Enviro-Septic® pipes is an **essential** component of the system. It is **critical** that the correct type and amount of System Sand is used during construction. System Sand must be coarse to very coarse, clean, granular sand, free of organic matter. System Sand is placed a minimum of 6 in. below pipes and between rows; and a minimum of 3” above the pipes. It must adhere to **all** of the following percentage and quality restrictions:

Presby System Sand Specification

Sieve Size	Percent Retained on Sieve (by weight)
3/4 in. (19 mm)	0
#10 (2 mm)	0 - 35
#35 (0.50 mm)	40 - 90
Note: not more than 3% allowed to pass the #200 sieve (verified by washing sample per requirements of ASTM C-117)	

4.13 System Sand Acceptable Alternative

ASTM C-33 (concrete sand), natural or manufactured sand, with not more than 3% passing the #200 sieve (verified by washing the sample per the requirements of ASTM C-117 as noted in the ASTM C-33 specification) may be used as an acceptable alternate material for use as System Sand.

5.0 Table A: Application Rates by Soil Texture and Percolation Rates; System Sand Bed Area

Texture	Estimated Percolation Rate (MPI)	Typical Application Rate (gpd/ft²) Reference Only	AES Application Loading Rate (ALR) (gpd/ft²)	System Sand Bed Area (sq ft) by Number of Bedrooms				
				2 225 GPD	3 300 GPD	4 350 GPD	5 400 GPD	Add'l 50 GPD
Gravelly Sand or very coarse sands	< 3	0.8	1.60(2)	141	188	219	250	32(2)
Loamy sand, coarse sand	3-5	0.8	1.60(2)	141	188	219	250	32(2)
Medium sand, sandy loam	6-9	0.6	1.20(2)	188	250	292	334	42(2)
Fine sandy loam, loam, silt loam	10-15	0.5	1.00(2)	225	300	350	400	50(2)
Very fine sand, sandy clay loam	16-30	0.4	0.80(1)(2)	282	375	438	500	63(2)
Clay loam, silty clay loam	31-50	0.3	0.60(1)(2)	375	500	584(2)	667(2)	84(2)
Sandy clay, clay or silty clay	51-79	0.2	0.266(1)(3)	846(3)	1,128(3)	1,316(3)	1,504(3)	188(3)
Clays, silts, silty clays (Soil is reported throughout the soil profile) (Use EVTA BED)	80-120	0.15	0.20(1)(3)	1,125(3)	1,500(3)	1,750(3)	2,000(3)	250(3)
Clays or silts, pan evaporation rates do not allow for EVTA use	120+	Not Permitted						

[1] Percolation (perc) tests may be required to help distinguish between types of clays and compacted silts and their permeability as a result of mineralogy, structure, compactness and other factors. If the local reviewing authority has experience with the soil type encountered, the percolation test may be waived and the application rate provided in the table may be used. If percolation rates are faster than the estimate shown the application rate provided in the appropriate column must be used as the maximum. (In other words, use the most conservative of the two, either soil texture or percolation rates).

[2] To conform with Circular DEQ 4 section 4.2.3.3, systems requiring over 500 sq ft of sand bed area (after reductions) may require multiple beds to avoid pressure distribution which is not allowed or needed with this technology.

[3] To conform with Circular DEQ 4 section 4.2.3.3, systems requiring over 750 sq ft of sand bed area (after reductions) may require multiple beds to avoid pressure distribution which is not allowed or needed with this technology.

6.0 Table B: Presby Pipe Requirement & Slope Limitations

Percolation Rate Minutes per Inch (MPI)	Presby Pipe per Bedroom Minimum* (ft)	% System Slope Maximum	% Site Slope Maximum
15 or less	50	25	30
16-30	60	25	30
31-40	70	20	25
41-50	70	15	20
51 – 60	70	10	15
61 - 120	70	0	5

* Presby pipe requirement for commercial systems calculated at 1 ft for every 2 GPD of design flow. Ex: 300 GPD commercial design flow requires 150 ft of Presby pipe (300 ÷ 2). Pipe requirements for both residential and commercial systems assumes normal strength wastewater. Contact Presby Environmental for recommendations for higher strength effluent.

7.0 Table C: Row Length and Pipe Layout Width

		Total Linear Feet of Presby Pipe													
Row Length (ft)	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
	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	1,050
	75	150	225	300	375	450	525	600	675	750	825	900	975	1,050	1,125
	80	160	240	320	400	480	560	640	720	800	880	960	1,040	1,120	1,200
	85	170	255	340	425	510	595	680	765	850	935	1,020	1,105	1,190	1,275
	90	180	270	360	450	540	630	720	810	900	990	1,080	1,170	1,260	1,350
	95	190	285	380	475	570	665	760	855	950	1,045	1,140	1,235	1,330	1,425
	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
# Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
C/L (ft)	2.00	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00
	2.25	3.25	5.50	7.75	10.00	12.25	14.50	16.75	19.00	21.25	23.50	25.75	28.00	30.25	32.50
	2.50	3.50	6.00	8.50	11.00	13.50	16.00	18.50	21.00	23.50	26.00	28.50	31.00	33.50	36.00
	2.75	3.75	6.50	9.25	12.00	14.75	17.50	20.25	23.00	25.75	28.50	31.25	34.00	36.76	39.50
	3.00	4.00	7.00	10.00	13.00	16.00	19.00	22.00	25.00	28.00	31.00	34.00	37.00	40.00	43.00
	3.25	4.25	7.50	10.75	14.00	17.25	20.50	23.75	27.00	30.25	33.50	36.75	40.00	43.25	46.50
	3.50	4.50	8.00	11.50	15.00	18.50	22.00	25.50	29.00	32.50	36.00	39.50	43.00	46.50	50.00
	3.75	4.75	8.50	12.25	16.00	19.75	23.50	27.25	31.00	34.75	38.50	42.25	46.00	49.75	53.50
	4.00	5.00	9.00	13.00	17.00	21.00	25.00	29.00	33.00	37.00	41.00	45.00	49.00	53.00	57.00
		Pipe Layout Width ft													

Ex: Select a row length and move right until the minimum amount of pipe is found (more is allowed). Then move down to find the number of rows required; continue downward in the same column to find the pipe layout width for your spacing.

8.0 Design Procedure and Examples

Step #1: From Table A: using the soil's percolation rate and find the minimum System Sand Bed Area (SSBA) required from Table A. This can be calculated manually by dividing the daily design flow by the soil's Application Loading Rate (ALR). System over 1,000 sq ft (before reductions) may require additional beds (see Table A).

Step #2: Calculate the minimum amount of Presby Pipe needed (assumes normal strength wastewater):

a) Residential systems → multiply number of bedrooms by Presby pipe required from Table B for system's soils
b) Commercial systems → divide daily design flow by 2 GPD/ft (round up to the nearest whole number

Step #3: From Table B: choose an allowable system slope.

Step #4: Calculate the minimum number of serial sections required (does not apply to Parallel configuration): divide the daily design flow by 600 GPD (round up to nearest whole number).

Step #5: Select a row length suitable for the site and calculate the number of rows (round up to a whole number). The number of rows must be evenly divisible by the number of serial sections required (add rows as necessary).

Step #6: Find the Pipe Layout Width (PLW) from Table C using a 2 ft minimum center-to-center row spacing (larger spacing allowed).

Step #7: Calculate the minimum System Sand Bed Width (SSBW) by dividing the System Sand Bed Area from Step #2 by the selected row length from Step #5 + 1ft (allows 6 inches of sand beyond the ends of the rows).

Step #8: Verify the minimum SSBW from Step #7 will cover all the rows in the bed:

a) Beds sloping 0 - 5%: If the minimum SSBW is less than the (PLW + 1 ft), use (PLW + 1 ft) as the new minimum SSBW.
b) Beds sloping > 5%: If the minimum SSBW is less than the (PLW + 3.5 ft), use (PLW + 3.5 ft) as the new minimum SSBW. Adding 3.5 ft to the pipe layout width accounts for a 2.5 ft System Sand Extension on the down slope side of the field.

Step #9: Calculate System Sand Extension(s):

a) Level beds: System Sand Extension (SSE) are placed on each side of Presby Pipes = [SSBW – (PLW + 1)] ÷ 2. There will be no SSE's if the SSBW = (PLW +1 ft).
b) Sloping Beds: SSE placed entirely on the down slope side of the bed = SSBW – (PLW + 1) and must be at least 2.5 ft (3 ft from the edge of the Presby Pipe) if system slope is over 5%.

Step #10: Verify center-to-center distance of the first and last rows is not more than 14 ft, if so use multiple beds.

8.1 Design Example #1 (residential)

Single-family residence, 4 bedrooms (350 GPD), percolation rate: 15 MPI (fine sandy loam), level site, serial distribution layout if allowed.

Step #1: System Sand Bed Area from Table A: 350 GPD ÷ 1.0 GPD/sq ft ALR = 350 sq ft (≤ 500 sq ft = single bed)

Step #2: Presby Pipe required at 15 MPI per Table B: 4 bedrooms x 50 ft/bedroom = 200 ft minimum.

Step #3: Level site, no need to slope this system.

Step #4: Serial sections required = 350 GPD ÷ 600 GPD/section = 0.59, round up to 1, which is a basic serial system

Step #5: Using a row length of 50 ft requires four rows (200 ft ÷ 50 ft = 4 rows).

Step #6: Table C shows a PLW of 7.0 ft when using four 50 ft long rows spaced at 2 ft center-to-center.

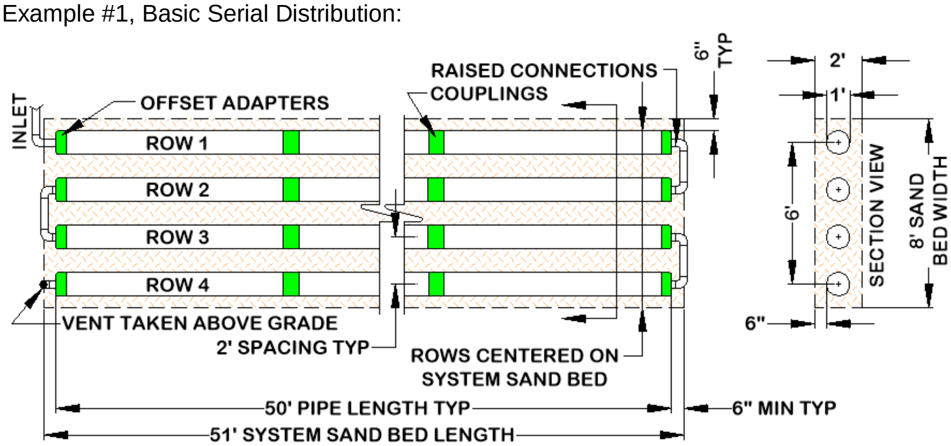
Step #7: Minimum SSBW = 350 sq ft ÷ (50 ft + 1 ft) = 6.9 ft.

Step #8: a) 8 ft SSBW to cover all the Presby pipes (7 ft PLW + 1 ft) is greater than 6.9 ft minimum sand bed width to satisfy the sand bed area requirement. Must us the larger of the two values → 8 ft b) not required.

Step #9: a) System Sand Extensions → SSBW – (7 ft PLW + 1 ft) = 0, so there will not be any System Sand extensions b) not required.

Step #10: Center-to-center distance between first and last rows is 6 ft, which does not exceed 14 ft, bed ok

Illustration of Example #1, Basic Serial Distribution:



8.2 Design Example #2 (residential):

Single-Family Residence, 5 bedrooms (400 GPD), 30 MPI soils (sandy clay loam), design for a 12% sloping system as an elevated bed.

Step #1: Sand Bed Area from Table A = 500 sq ft (≤ 500 sq ft = single bed)

Step #2: Presby pipe required at 30 MPI per Table B: 5 bedrooms x 60 ft/bedroom = 300 ft minimum

Step #3: Table B allows up to 25% system slope for 30 MPI and our system will only slope 12%

Step #4: Serial sections required = 500 GPD ÷ 600 GPD/section = 0.84, round up to 1 (Basic Serial System)

Step #5: Using a row length of 75 ft requires four rows (300 ft ÷ 75 ft = 4 rows)

Step #6: Table C shows a PLW of 7 ft when using four 75 ft long rows spaced at 2 ft center-to-center.

Step #7: Minimum SSBW = 500 sq ft ÷ (75 ft + 1 ft) = 6.6 ft

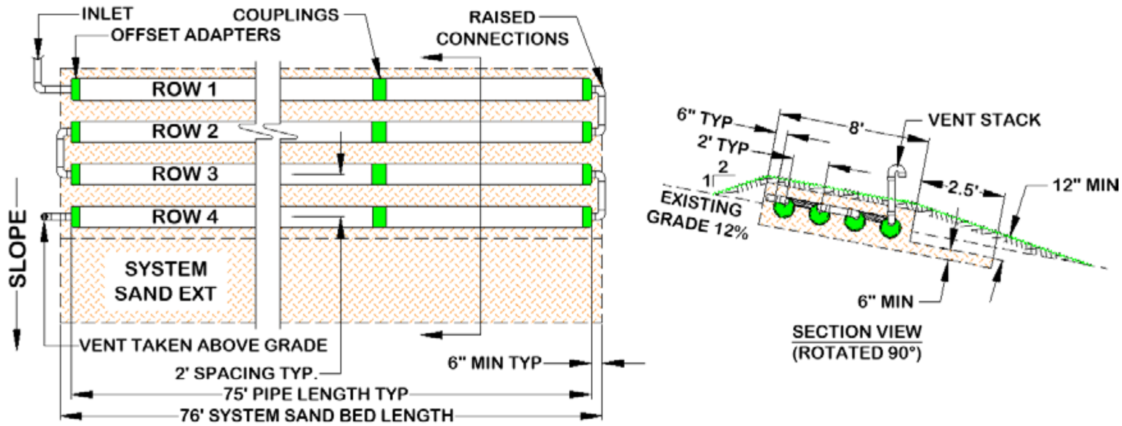
Step #8: a) system slope greater than 5%. b) 6.6 ft SSBW is less than (7 ft PLW + 3.5 ft = 10.5 ft); use 10.5 ft as the new SSBW.

Step #9: a) system slope greater than 5%. b) System Sand extension = 10.5 ft SSBW – (7 ft PLW + 1 ft) = 2.5 ft and placed entirely on the down slope side of the field.

Step #10: Center-to-center distance between first and last rows is 6 ft, which does not exceed 14 ft, bed ok

See illustration of Example #2 on next page.

Illustration of Example #2, Basic Serial Distribution:



8.3 Design Example #3 (commercial):

Commercial system to treat 650 GPD, 31 MPI soils (clay loam), level bed.

Step #1: Sand Bed Area from Table A = 650 GPD ÷ 0.6 GPD/sq ft = 1,084 sq ft [requires multiple beds to conform to Circular DEQ 4, section 4.2.3.3 (1,084 ft^2 ÷ 500 ft^2 = 2.17 round up to 3 beds)]

Step #2: Presby pipe required = 650 GPD ÷ 2 GPD/ft = 325 ft minimum (325 ÷ 3 beds = 108.4 ft, round up to 110 ft per bed)

Step #3: Level site, no need to slope this system.

Step #4: Serial sections required = (650 GPD ÷ 3 beds) ÷ 600 GPD/section = 0.36, round up to 1 section per bed)

Step #5: Using a row length of 55 ft requires six rows (325 ft ÷ 55 ft = 5.9, round up to 6 rows), which will allow 2 rows per bed.

Step #6: Table C shows a PLW of 3 ft per bed, when using two 55 ft long rows spaced at 2 ft center-to-center.

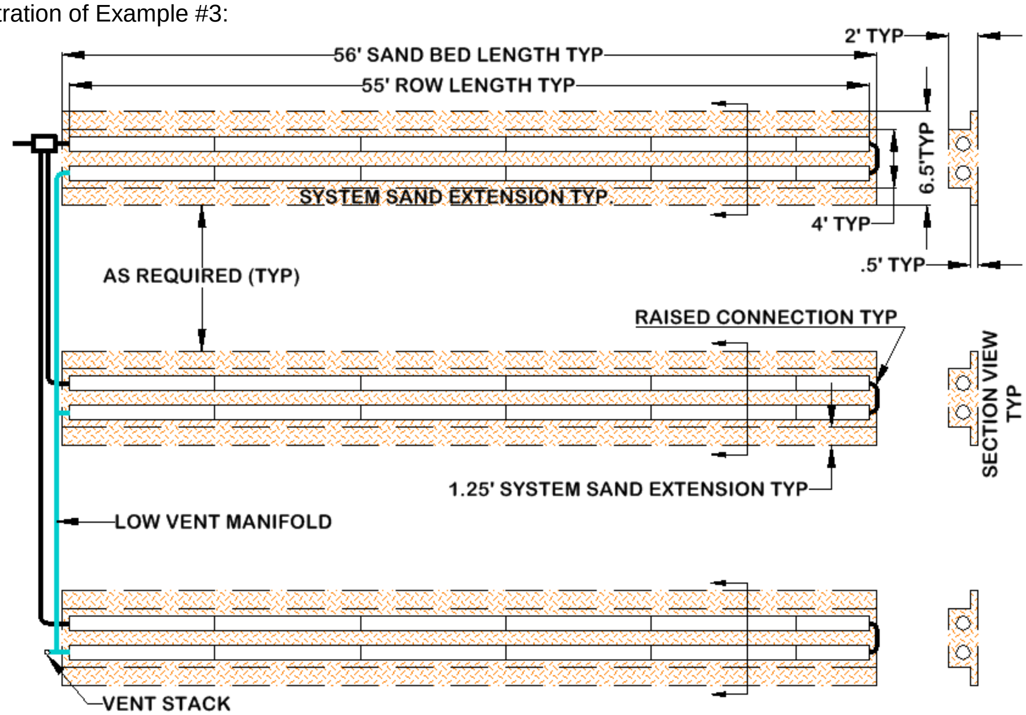
Step #7: Minimum SSBW = (1,084 sq ft ÷ 3 beds) ÷ (55 ft + 1 ft) = 6.46 ft round up to 6.5 ft for ease of construction.

Step #8: a) level bed – 6.5 ft SSBW is larger than 4 ft (3 ft PLW + 1 ft), so must use 6.5 ft as SSBW.
b) not required

Step #9: a) system level – System Sand extensions = (6.5 ft - 4 ft) ÷ 2 = 1.25 ft placed on both sides of pipe
b) not required

Step #10: Center-to-center distance between first and last rows is 2 ft, which does not exceed 14 ft, beds ok

Illustration of Example #3:



9.0 Presby Environmental Standards and Technical Support

All Presby Systems must be designed and installed in compliance with the procedures and specifications described in this Manual and in the product's state approval. In the event of contradictions between this manual and Montana regulations, Presby Environmental, Inc. should be contacted for technical assistance at (800) 473-5298.

10.0 Certification Requirements

Any designers and installers who have not previously attended a Presby Environmental, Inc. are required to attend a Presby Certification Course. Certification is obtained by attending a Certification Course presented by Presby Environmental, Inc. or its sanctioned representative. Certification can also be obtained by viewing tutorial videos on our website (high speed connection required) and then successfully passing a short assessment test, which is also available over the internet. All professionals involved in the inspection, review or certification of Advanced Enviro-Septic® systems should also become Presby Certified.

11.0 Design Criteria

11.1 Advanced Enviro-Septic® Pipe Requirements

a) Sewn seam must be oriented in the 12 o'clock position. This correctly orients the Bio-Accelerator® fabric in the 6 o'clock position.
b) Venting is always required regardless of vertical separation to restrictive features.

11.2 Barrier Materials over System Sand

No barrier materials (hay, straw, tarps, etc.) are to be placed between the System Sand and cover material; such materials may cut off necessary oxygen supply to the system. The only exception is the placement of the specified fabric to achieve H-20 loading requirements. See section 23.15 .

11.3 Converging Flows Restriction

Presby Systems must not be located where surface or ground waters will converge, causing surface water flow to become concentrated or restricted within the soil absorption field.

11.4 Daily Design Flow

Residential daily design flow for Presby Systems is calculated in accordance with Montana rules. Systems servicing more than two residences shall use the Commercial portions of all sizing tables. The minimum daily design flow for any single-family residential system is two bedrooms (225 GPD) and the maximum for any system is 2,500 GPD.

a) Certain fixtures, such as jetted tubs, may require an increase in the size of the septic tank.
b) Daily design flow for a single bedroom apartment with a kitchen connected to a residence (also sometimes referred to as a "studio" or "in-law apartment") shall be calculated by adding two additional bedrooms.
c) When daily design flow is determined by water meter use for commercial systems, PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of at least 2 times.
d) Note that "daily design flows" are calculated to assume occasional "peak" usage and a factor of safety; Systems are not expected to receive continuous dosing at full daily design load.

11.5 End-to-End Preferred Over Side-to-Side

If site conditions permit, End-to-End multiple bed configurations are preferable to Side-to-Side configurations (see para. 15.0, page 14).

11.6 Fill Extensions for Elevated (Mound) Systems

If any portion of the bed extends above the original grade, the fill covering the field cannot begin the 4:1 side slope taper for a distance of 6 inches minimum from the outmost edge of any Presby Pipe (see ill. in para. 3.0, page 3).

11.7 Filters, Alarms & Baffles

a) Effluent Filters are required in Montana by state rule.
b) Effluent filters must be maintained on at least an annual basis. Follow manufacturer's instructions regarding required inspections, cleaning and maintenance of the effluent filter.
c) Effluent Filters must allow the free passage of air to ensure the proper functioning of the system. A blocked filter in any on-site septic system could interfere with venting, causing the system to convert to an anaerobic state and result in a shortened life.
d) All pump systems to have a high water alarm float or sensor installed inside the pump chamber per state and/or national electric code.
e) All septic tanks must be equipped with baffles to prevent excess solids from entering the Presby System.
f) 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.

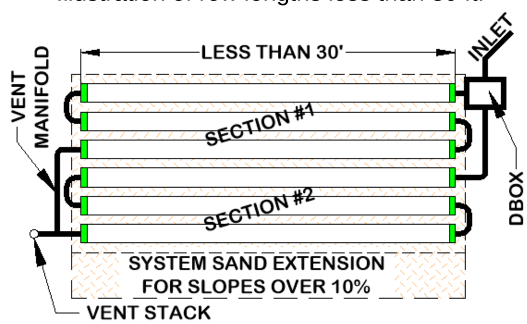
11.8 Flow Equalizers Required
All distribution boxes used to divide effluent flow require flow equalizers in their outlets. Flow equalizers are limited to a maximum of 15 GPM per equalizer.

11.9 Garbage Disposals (a.k.a. Garbage Grinders)
No additional Presby Pipe is required when using a garbage disposal (grinder). If a garbage disposal is utilized, follow the State's requirements regarding septic tank sizing. Multiple compartment septic tanks or multiple tanks are preferred and should be pumped as needed.

11.10 Pressure Distribution
The use of pressure distribution lines in Presby Systems is **prohibited**. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the Presby Field.

11.11 Row Requirements
a) All beds must have 2 rows min. to 8 rows max.
b) Maximum row length for any system is 100 ft.
c) Recommended minimum row length is 30 ft.
d) A combination (or D-Box) distribution system must be used if any row length is less than 30 ft. The D-Box must feed at least 30 ft of Presby Pipe, a minimum of two D-Box outlets must be used and the field must be vented.
e) Row Center-to-Center Spacing is 2 ft to 4 ft for all systems.
f) The distance from the center of the first row to the center of the last row cannot exceed 14 ft.
g) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing.
h) All rows 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.
i) It is easier if row lengths are designed in exact 10 ft increments since Presby Pipe comes in 10 ft sections. However, if necessary, the pipe is easily cut to any length to meet site constraints.

Illustration of row lengths less than 30 ft:



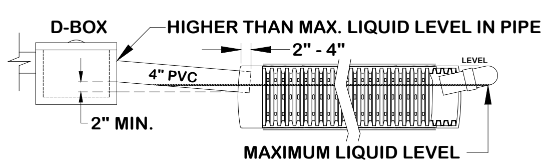
11.12 Side Slopes (Side Slope Tapers)
Side slope tapering begins 6 inches from the edge of the Presby Pipe and is to be no steeper than 2:1 without a state waiver (see illustration in para. 3.0, page 3). For sloping systems, the taper can be no steeper than 3:1 on the downslope side of the field. At least 12 inches of material cover is required over the end of the System Sand extension.

11.13 Separation Distances (Horizontal and Vertical)
Separation distances to the seasonal high water table (SHWT) or other restrictive features are measured from the outermost edge of the System Sand bed area.

11.14 Sloping Sites and Sloping Mound Systems
a) The percentage of slope in all system drawings refers to the slope of the Presby System, <u>not</u> the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
b) The system slope and the site slope do not have to be the same (see para. 0, page 16).
c) Maximum site slope is 33% and maximum system slope is 25% (see Table B, page 6).

11.15 System Sand Bed Height Dimension
The height of a Presby Sand Bed measures 21 in. minimum (not including cover material):
a) 6 in. minimum of System Sand below the Presby Pipe; and
b) 12 in. diameter of the pipe; and
c) 6 in. minimum of System Sand above the Presby Pipe.
d) When a bed slopes over 5%, a minimum 2.5 ft System Sand Extension area is required and is to be a minimum of 6 in. deep (see illustration in para. 3.0, page 3).

11.16 Two Inch Rule
The outlet of a septic tank or distribution box must be set at least 2 in. above the highest inlet of the Presby Row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.) Illustration of 2 in. rule at right:



11.17 Topographic Position Requirement
The system location must be located in an area that does not concentrate water, both surface and subsurface. If allowed by state and local authorities, altering the terrain upslope of a system may alleviate this requirement if the waters are sufficiently altered to redirect flows away from the field.

11.18 Wastewater Strength

Systems designed in accordance with this manual assume residential strength wastewater. Please contact Presby for design recommendations when dealing with high strength effluent.

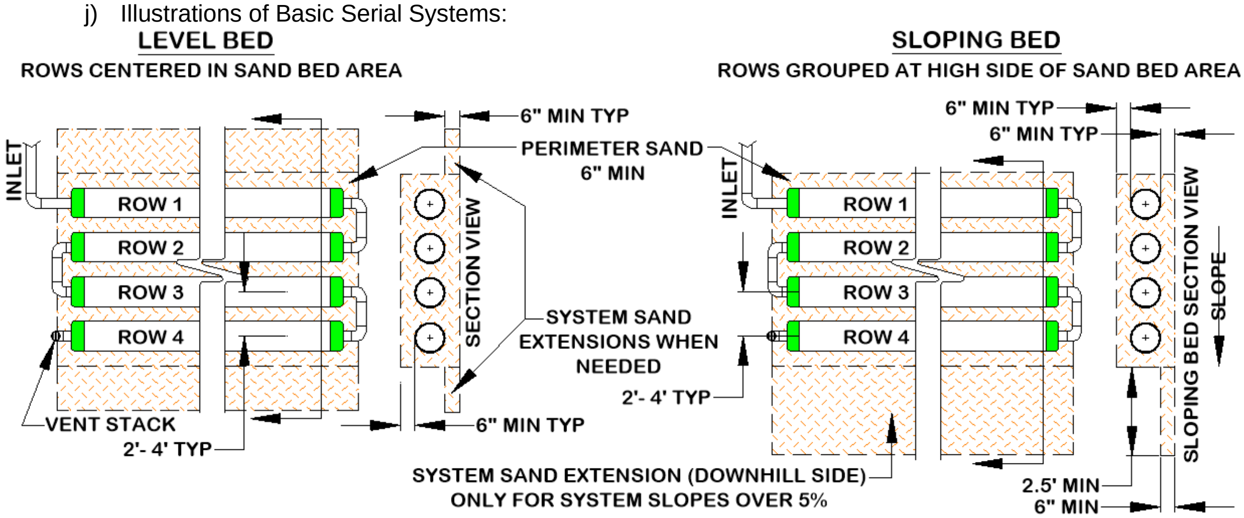
11.19 Water Purification Systems

a) Water purification systems and water softeners should **not** discharge into any Presby System. This "backwash" does not require treatment and the additional flow may overload the system.
b) If there is no alternative means of disposing of this backwash other than in the Presby System, then the system will need to be "oversized." Calculate the total amount of backwash in GPD, multiply by 3, and add this amount to the daily design flow when determining the field and septic tank sizing.
c) Water purification systems and water softeners require regular routine maintenance; consult and follow the manufacturer's maintenance recommendations.

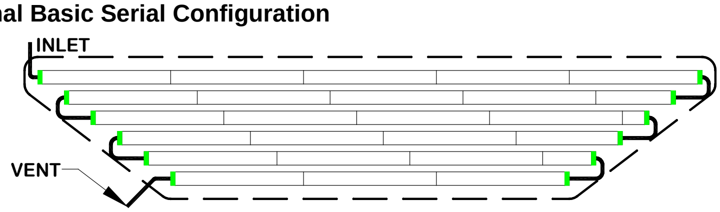
12.0 Basic Serial Distribution

Presby pipe rows are connected in series at the ends with raised connections, using offset adapters. Basic Serial distribution systems are quick to develop a strong biomat in the first row, provide a longer flow route, improved effluent treatment and ensure air will pass through all the Presby Rows. Other criteria:

a) May be used for single beds of 600 GPD or less.
b) Basic Serial distribution incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Rows to be spaced 2 ft to 4 ft center-to-center.
e) Flow Equalizers are not required for Basic Serial systems because they do not divide flow to the bed.
f) If System Sand Extension is required, it must be installed on downhill side of sloping bed.
g) For beds sloping over 5%, a System Sand Extension is placed entirely on the downhill side and must be at least 2.5 ft.
h) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
i) Pumped systems with Basic Serial distribution are limited to a maximum dose rate of 40 gallons per minute. Never pump directly into Presby Pipe.
j) Illustrations of Basic Serial Systems:

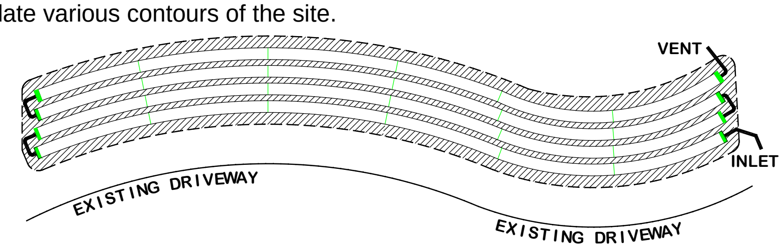


12.1 Non-Conventional Basic Serial Configuration



12.2 Curved Beds

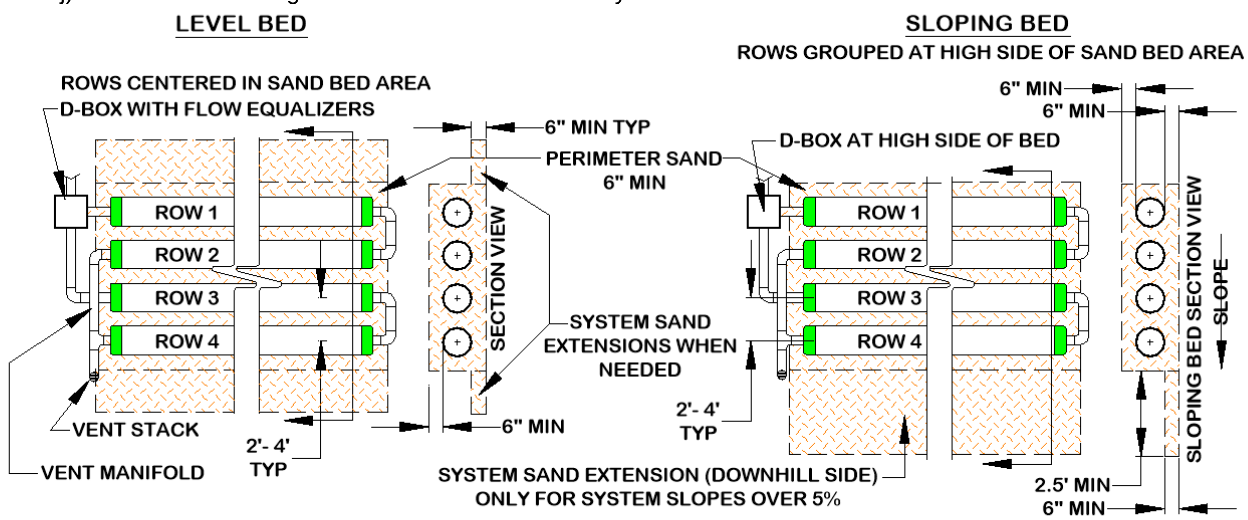
Curved configurations work well around structures, setbacks, and slopes. Multiple curves can be used within a system to accommodate various contours of the site.



13.0 Combination Serial Distribution

Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 600 GPD. Combination Serial distribution is quick to develop a strong biomat in the first row of each section, providing improved effluent treatment.

a) Combination Serial distribution consists of two or more serial sections installed in a single bed.
b) Each section in a Combination Serial system consists of a series of Presby Rows connected at the ends with raised connections, using offset adapters and PVC sewer and drain pipe.
c) Maximum length of any row is 100 ft.
d) Rows to be spaced 2 ft to 4 ft center-to-center.
e) Serial Section loading limit is 600 GPD.
f) There is no limit on the number of Combination Serial Sections within a bed.
g) System Sand Extension (if required) placed entirely on downhill side of bed (as shown).
h) 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 the illustration below).
i) Combination systems require the use of an adequately sized D-Box.
j) Illustrations of Single Level Combination Serial Systems:



13.1 Section Loading

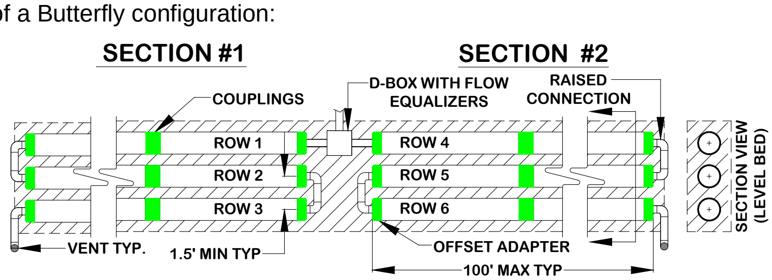
Each section in a Combination Serial system has a maximum daily design flow of 600 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 750 GPD requires (750 ÷ 600) = 1.25 (round up to nearest whole number = 2 sections). Combination systems are only required if the daily design flow exceeds 600 GPD.

13.2 Section Length Requirement

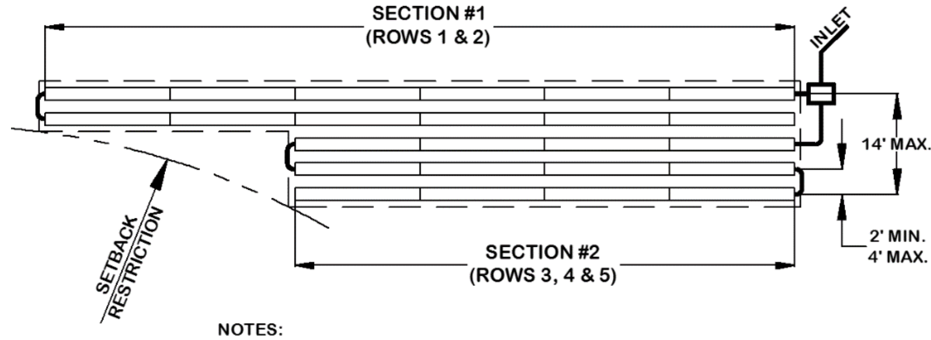
a) Each section must have the same minimum linear feet of pipe.
b) The minimum linear feet of pipe per section is determined by dividing the total linear feet required in the Presby System by the number of sections required.
c) A section may exceed the minimum linear feet required.
d) Rows within a section may vary in length to accommodate site constraints.

13.3 Butterfly Configuration

a) A "butterfly configuration," is considered a single bed system with two or more sections (can also be D-Box or Combination configurations).
b) Maximum length of any row is 100 ft.
c) Rows to be spaced 2 ft to 4 ft center-to-center.
d) Serial Section loading limit is 600 GPD.
e) Beds can contain any number of serial sections.
f) If System Sand Extension is required, it must be installed on downhill side of sloping bed.
g) Illustration of a Butterfly configuration:



13.4 Non-Conventional Combination Serial Configuration (venting not shown)

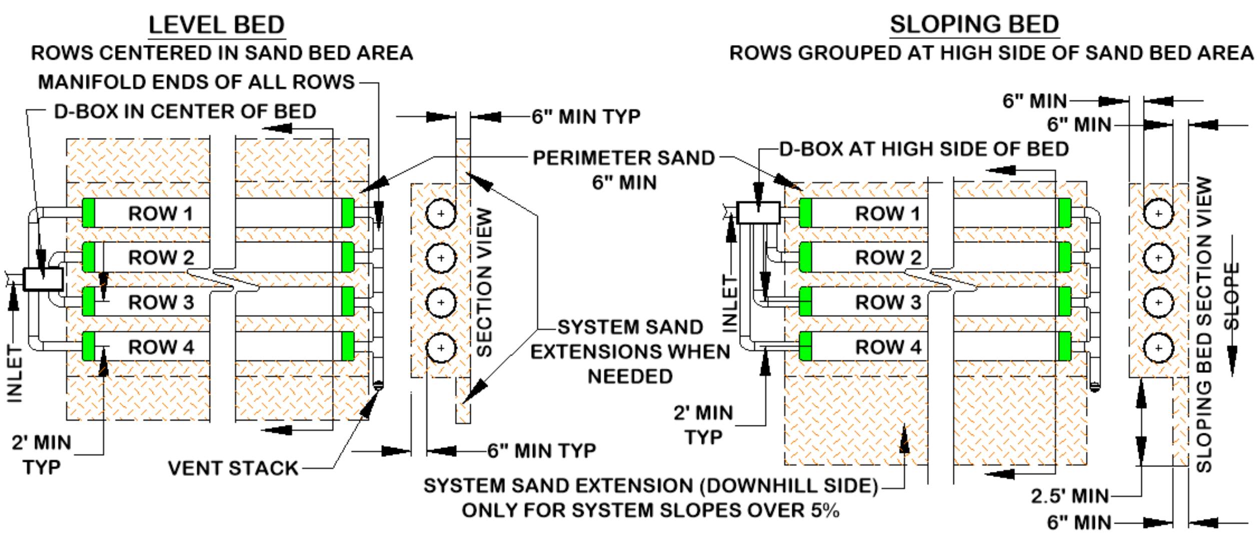


NOTES:
EACH SECTION MUST BE VENTED (NOT SHOWN).

EACH SERIAL SECTION MUST HAVE AT LEAST THE MINIMUM REQUIRED AES PIPE.

14.0 D-Box Distribution (Single Level)

a) All rows in this configuration must be the same length.
b) Flow equalizers must be used in the D-Box.
c) Use a Manifold to connect the ends of all rows. Manifold to be sloped toward Presby Pipes.
d) Maximum row length is 100 ft.
e) Rows to be spaced 2 ft to 4 ft center-to-center.
f) Place the D-box on level, firmly compacted soil.
g) All rows must be laid level end-to-end.
h) A 2 in. min. drop is required between the D-box outlets and the Presby Pipe inlets.
i) System Sand Extension (if required) placed entirely on downhill side of bed (as shown).
j) Illustrations for D-Box (Parallel) Distribution:



15.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds, each bed with Basic Serial, Combination Serial, or D-Box distribution, and each 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.

a) Each bed must 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 Presby System by the number of beds.
b) 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.
c) End-to-End configurations are preferred to Side-to-Side configurations.
d) In Side-to-Side configuration, one bed is placed beside another or one bed is place down slope of another. Bed separation distance is measured from pipe-to-pipe.

Illustration of End-to-End Multiple Beds:

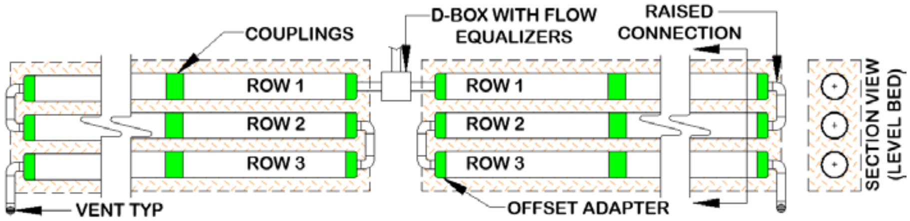
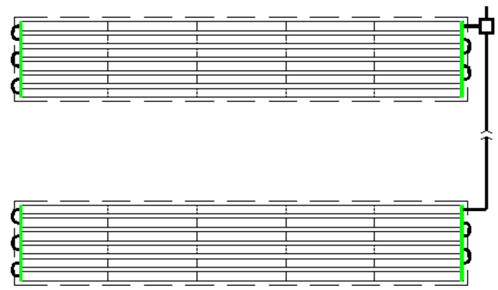
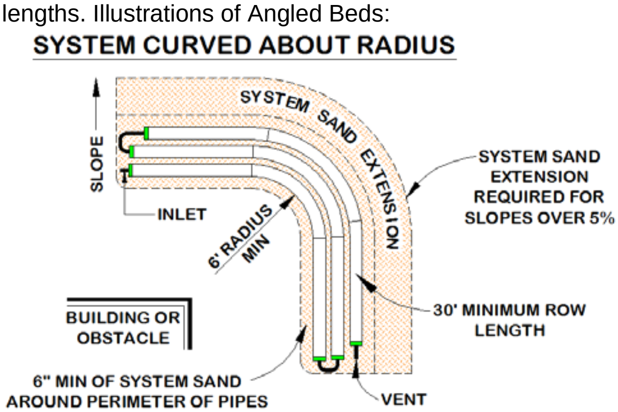


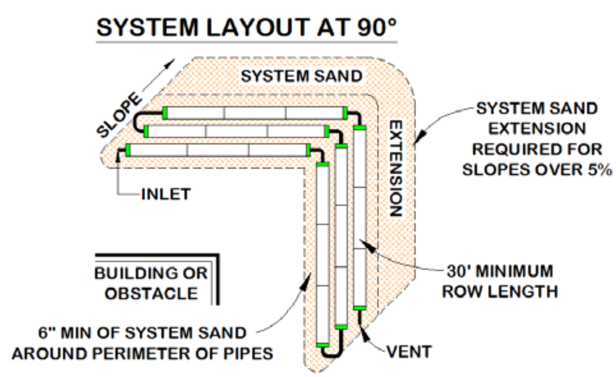
Illustration of Side-to-Side Multiple Beds:



16.0 Angled and Curving Beds

Angled configurations generally have one or more specific bends, but the rows should follow the contour of the site as much as possible. Rows are angled by bending pipes or through the use of offset adapters. A 10 ft length of Presby Pipe may be bent up to 90°. The angled system shown on the right in the illustration requires 30 ft minimum row lengths. Illustrations of Angled Beds:





17.0 Elevated Bed Systems (Mounds)

Elevated Presby Beds 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 Presby System above original grade. Elevated bed systems require 6-inch fill extensions on each side (measured from the pipe), after which side-slope tapering is to be a maximum of 2 horizontal feet for each 1 foot of vertical drop until it meets existing grade. Illustration of an elevated level bed:

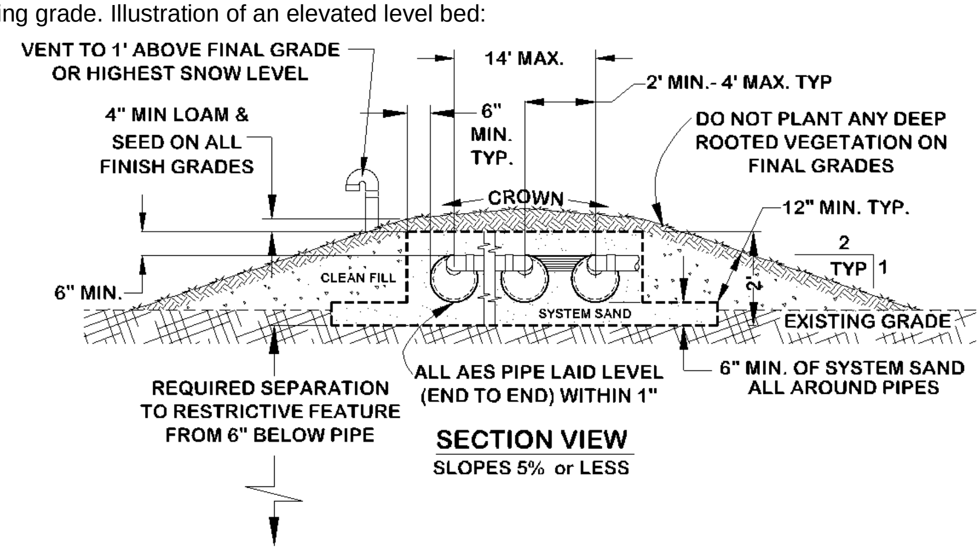
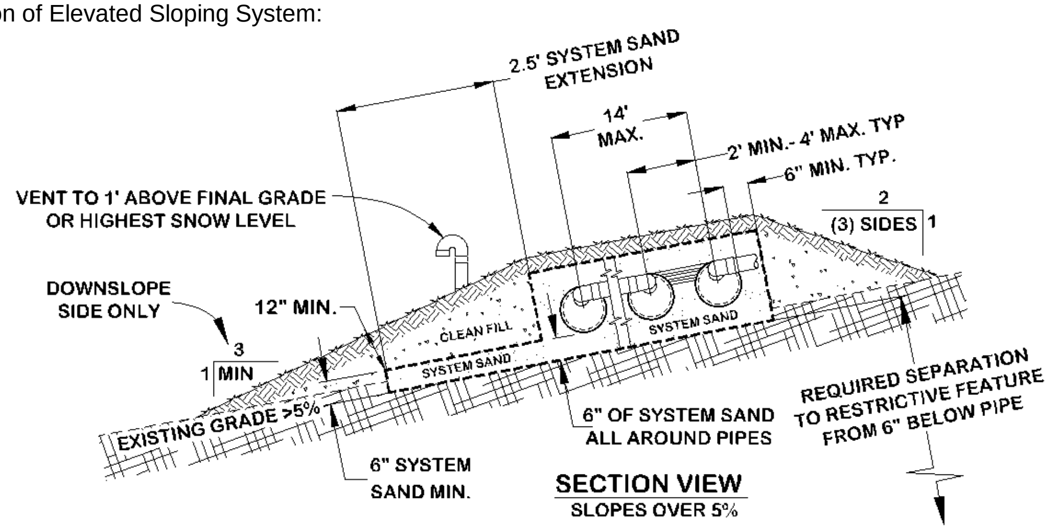
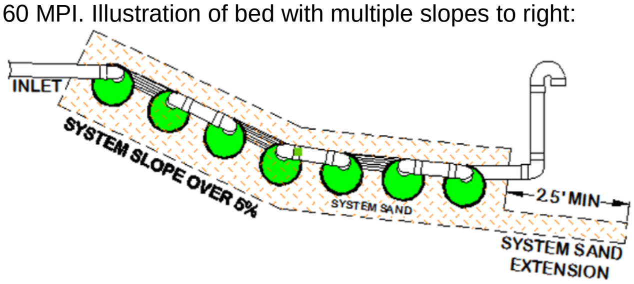


Illustration of Elevated Sloping System:



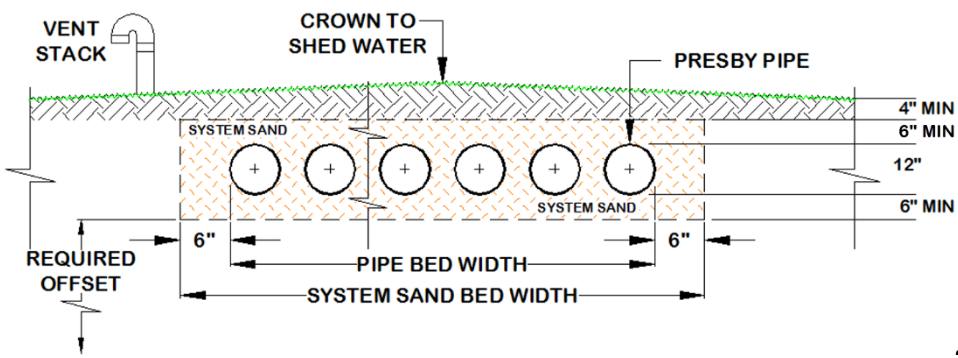
17.1 Multiple System Slopes

The System may have multiple slopes to match existing terrain. If any portion of the bed has a system slope greater than 5% a system sand extension is required on the down slope side of the field. This configuration is limited to soils with a percolation rate of 1 – 60 MPI. Illustration of bed with multiple slopes to right:



18.0 In-Ground Bed Systems

Presby Systems are installed below existing grade for sites with no soil restrictive features to limit placement. In-Ground systems that slope over 5% require a 2.5 ft system sand extension on the downhill side of the field. In-ground on level site:



19.0 Non-Conventional System Configurations

Non-conventional system configurations may have irregular shapes to accommodate site constraints. A site specific waiver from the state may be required for non-conventional configurations.

20.0 Pumped System Requirements

Pumped systems supply effluent to the Presby 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.

20.1 Alarm

All pump systems to have a high water alarm float or sensor installed inside the pump chamber per state and/or national electric code.

20.2 Differential Venting

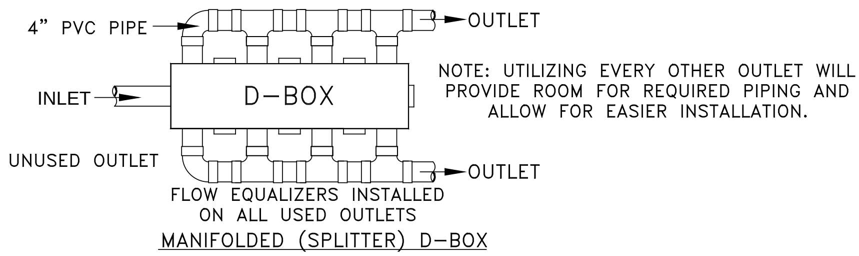
All pump systems must use differential venting (see illustration, para. 21.4, page18).

20.3 Distribution Box

All pump systems require a distribution box with some means of velocity reduction, see para. 20.5, for the effluent entering the D-Box.

20.4 Distribution Box Manifold

A distribution box manifold is utilized to evenly divide flows (like to multiple beds), all used outlets must have a flow equalizer. Manifolded D-Box:



20.5 Velocity Reduction

The rate at which effluent enters the Presby Pipe must be controlled. Excessive effluent velocity can disrupt solids that settle in the pipes.

a) Effluent must never be pumped directly into Presby Pipe.
b) A distribution box or tank must be installed between the pumping chamber and the Presby Pipe to reduce effluent velocity.
c) Force mains must discharge into a distribution box (or equivalent) with velocity reducer and a baffle, 90° bend, tee or equivalent.

20.6 Dose Volume

a) Pump volume per dose must be no greater than 1 gallon times the total linear feet of Presby Pipe.
b) Pump dosing should be designed for a minimum of 6 cycles per day.
c) If possible, the dosing cycle should provide one hour of drying time between doses.

20.7 Sand Fill

Sand fill is used to raise the elevation of the system in order to meet the required separation distance from the SHWT or other restrictive feature. No organic material or stones larger than 6 in. are allowed in the Sand Fill. System Sand may be used in place of sand fill; however, this may increase material costs.

21.0 Venting Requirements

An adequate air supply is essential to the proper functioning of Presby Systems. Venting is always required.

21.1 General Rules

a) Vent openings must be located to ensure the unobstructed flow of air through the entire Presby System.
b) The low vent inlet must be a minimum of 3 ft above final grade or anticipated snow level.
c) One 4 in. vent is required for every 1,000 ft of Presby Pipe.
d) A single 6 in. vent may be installed in place of up to three 4 in. vents.
e) If a vent manifold is used, it must be at least the same diameter as the vent(s).
f) When venting multiple beds, it is preferred that each bed be vented separately rather than manifolding bed vents together.
g) Sch. 40 PVC or equivalent should be used for all vent stacks.
h) Remote Venting may be utilized to minimize the visibility of vent stacks.

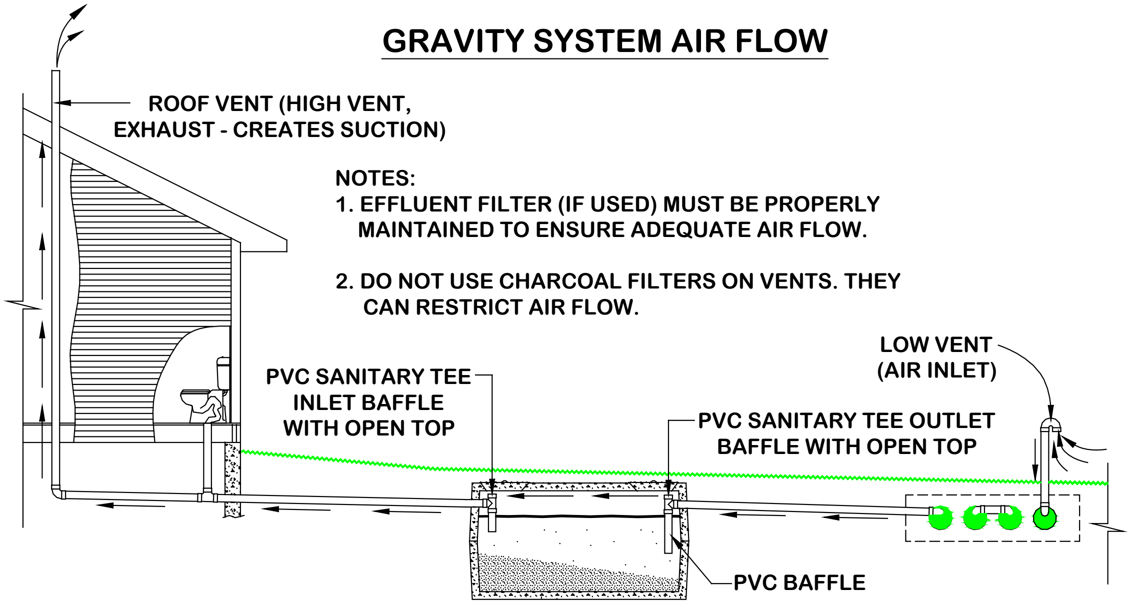
21.2 Differential Venting

a) Differential venting is the use of high and low vents in a system.
b) In a gravity system, the roof stack acts as the high vent.
c) High and low vent openings must be separated by a minimum of 10 vertical feet.
d) If possible, the high and low vents should be of the same capacity.

21.3 Vent Locations for Gravity Systems

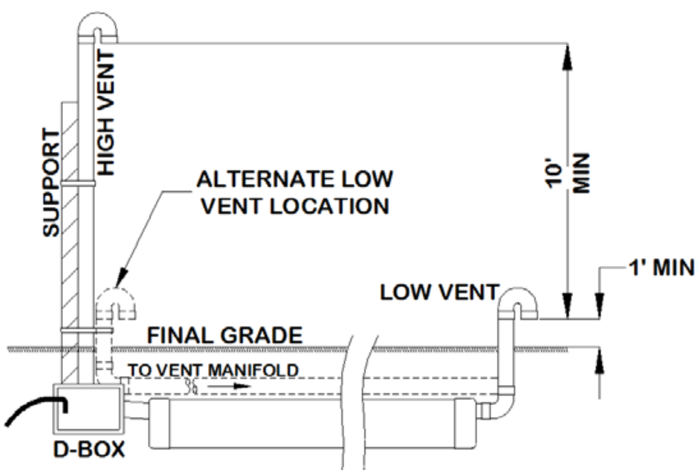
a) A low vent through an offset adapter is installed at the end of the last row of each section or the end of the last row in a Basic Serial bed, or at the end of each row in a D-Box Distribution Configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
b) The 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.
c) When the house (roof) vent functions as the high vent, there must be a minimum of a 10 ft vertical differential between the low and high (roof) vent openings.

d) Illustration of gravity system air flow:



21.4 Pump System Vent Locations

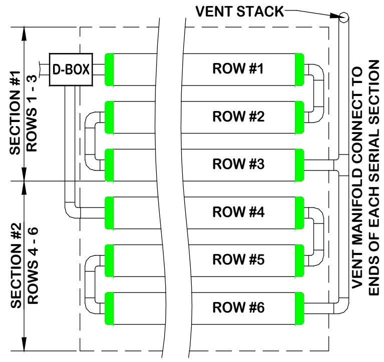
a) A low vent is installed through an offset adapter at the end of each section, Basic Serial bed or attached to a vent manifold.
b) A high vent is installed through an unused distribution box outlet.
c) A 10 ft minimum vertical differential is required between high and low vent openings.
d) When venting multiple beds, it is preferred that each bed be vented separately (have their own high and low vents) rather than manifolding bed vents together.
e) The low vent may be attached to the D-box and the high vent attached to the end of the last row (or manifold) <u>only when the D-box is insulated against freezing.</u>
f) See Remote Venting (para. 21.7, page 19) and Bypass Venting (para. 21.8, page 20) for options to relocate or eliminate the High Vent.
g) Illustration of Differential Venting:



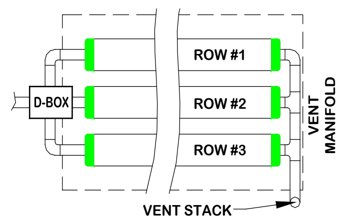
21.5 Vent Manifolds

A vent manifold may be incorporated to connect the ends of a number of sections or rows of Presby Pipe to a single vent opening. See diagrams on next page below.

Combination system:



D-Box system:



21.6 Vent Piping Slope

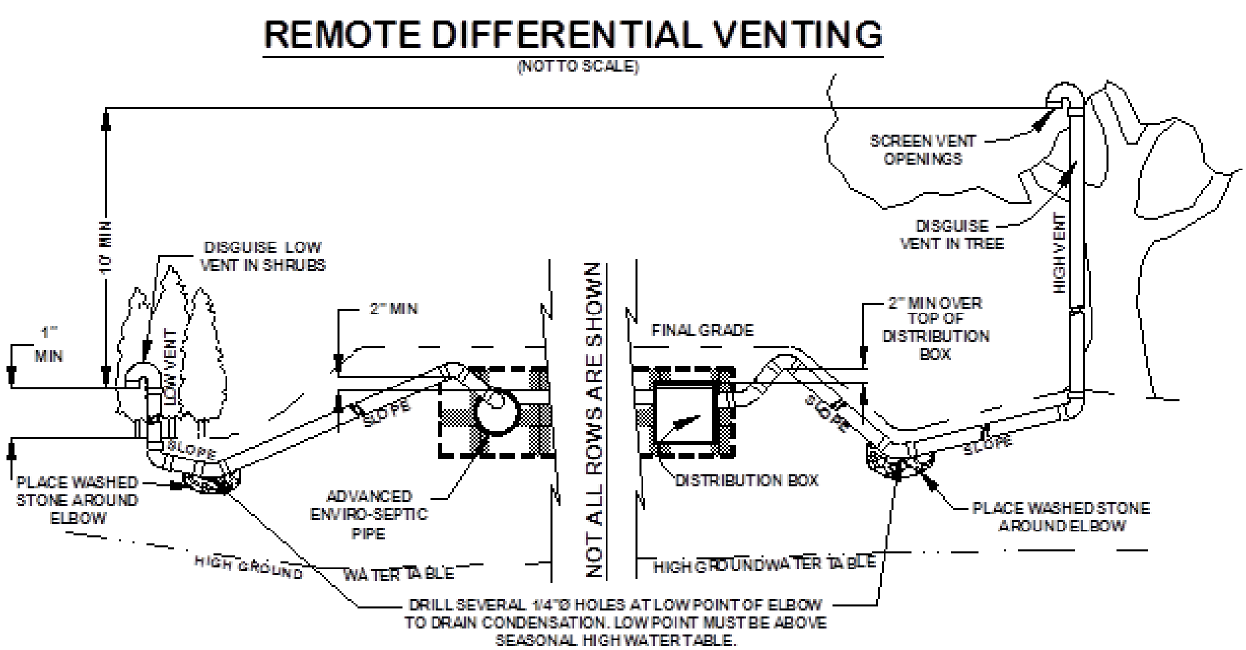
Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.

21.7 Remote Venting

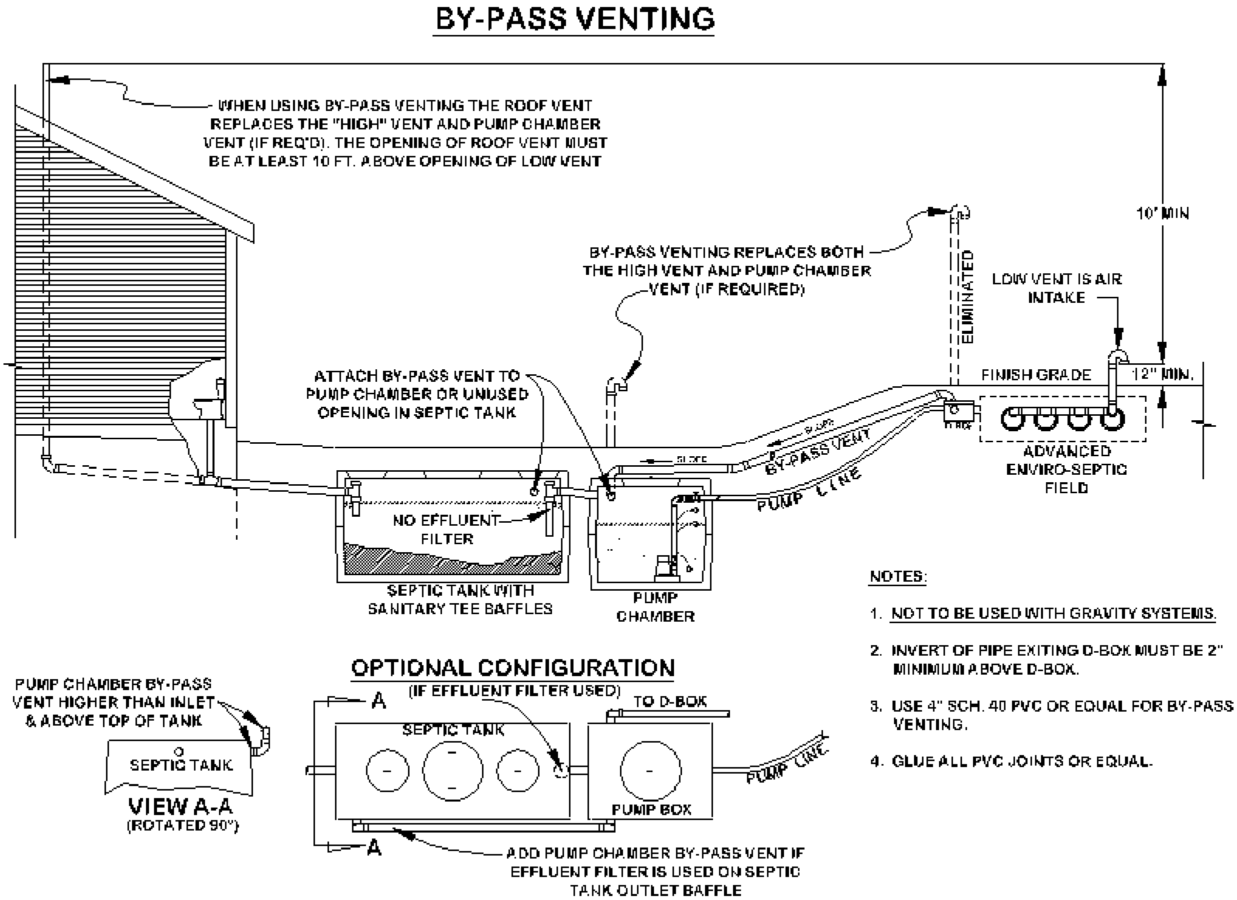
If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in. holes to allow drainage of condensation.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

a) A **high point** that is above the highest point of all Presby Pipes or the Distribution Box; and,
b) A **low point** opened for drainage which is above the SHWT. (See diagram on next page.)

Illustration of Remote Venting:



21.8 By-Pass Venting



22.0 Site Selection

22.1 Determining Site Suitability
Refer to Montana Rules regarding site suitability requirements.

22.2 Topography
Locate systems on convex, hill, slope or level locations that do not concentrate surface flows. Avoid swales, low areas, or toe-of-slope areas that may not provide sufficient drainage away from the system.

22.3 Surface Water Diversions
Surface water runoff must be diverted away from the system. Diversions must be provided up-slope of the system and designed to avoid ponding. Systems must not be located in areas where surface or groundwater flows are concentrated.

22.4 Containment
Systems should not be located where structures such as curbs, walls or foundations might adversely restrict the soil's ability to transport water away from the system.

22.5 Hydraulic loading
Systems should not be located where lawn irrigation, roof drains, or natural flows increase water loading to the soils around the system.

22.6 Access
Systems should be located to allow access for septic tank maintenance and to at least one end of all Presby Rows. Planning for future access will facilitate rejuvenation in the unlikely event the system malfunctions.

22.7 Rocky or Wooded Areas
Avoid locating systems in rocky or wooded areas that require additional site work, since this may alter the soil's ability to accept water. No trees or shrubs should be located within 10 ft of the system to prevent root infiltration.

22.8 Replacement System Reserve Area
In the event of system malfunction, contact PEI for technical assistance prior to attempting Rejuvenation procedures. An undisturbed reserve area must be set aside for the construction of a replacement system if needed, which will accommodate a full sized conventional leach bed.

23.0 Installation Requirements, Component Handling and Site Preparation

23.1 Component Handling

a) Keep mud, grease, oil, etc. away from all components.
b) Avoid dragging pipe through wet or muddy areas.
c) Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
d) The outer fabric of the Presby 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.

23.2 Critical Reminder 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.

23.3 Site Preparation Prior to Excavation

a) Locate and stake out the System Sand bed, extension areas and soil material cover extensions on the site according to the approved plan.
b) Install sediment/erosion control barriers prior to beginning excavation to protect the system from surface water flows during construction.
c) Do not travel across or locate excavation equipment within the portion of the site receiving System Sand.
d) Do not stockpile materials or equipment within the portion of the site receiving System Sand.
e) It is especially important to avoid using construction equipment down slope of the system to prevent soil compaction.

23.4 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.

23.5 Tree Stumps

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.

a) Do not locate equipment within the limits of the System Sand bed.
b) Avoid soil disturbance, relocation, or compaction.
c) Avoid mechanical leveling or tamping of dislodged soil.
d) Fill all voids created by stump or root removal with System Sand.

23.6 Organic Material Removal

Before tilling, remove all grass, leaves, sticks, brush and other organic matter or debris from the excavated system site. It is not necessary for the soil of the system site to be smooth when the site is prepared.

23.7 Raking and Tilling Procedures

All areas receiving System Sand, sand fill and fill extensions **must** 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 must remain outside of the proposed System Sand area and extensions.

a) 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 in.- 6 in. deep into the bottom of the entire area receiving System Sand or sand fill (“receiving area”).
b) For elevated bed systems with a percolation rate of 1 to 60 MPI: remove the topsoil (“A” horizon); for percolation rates of 61 – 120 MPI, the topsoil may be left in-place. Next, use an excavator or backhoe to rake furrows 2 in. – 6 in. deep into the receiving area.

23.8 Install System Sand and/or Sand Fill Immediately After Excavation

a) To protect the tilled area (System Sand bed area and System Sand extension area) from damage by precipitation, System Sand should be installed immediately after tilling.
b) Work off either end or the uphill side of the system to avoid compacting soil.
c) 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.

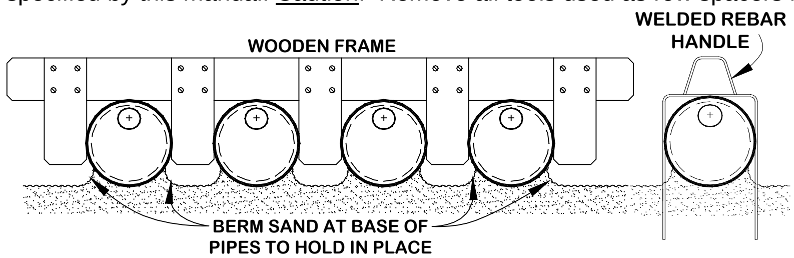
d) Track construction equipment should not travel over the installed system area until at least 12 in. of cover material is placed over the Presby Pipes.
e) Heavy equipment with tires must never enter the receiving area due to likely wheel compaction of underlying soil structures.

23.9 Distribution Box Installation
To prevent movement, be sure D-boxes are placed level on compacted soil, sand, pea gravel base, or concrete pad.

23.10 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.

23.11 Correct Alignment of Advanced Enviro-Septic® 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).

23.12 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. Center-to-center row spacing may be larger than specified by this manual. <u>Caution</u>: Remove all tools used as row spacers before final covering.



23.13 Connect Rows Using Raised Connections
Raised connections consist of offset adapters, 4 in. PVC sewer and drain pipe, and 90° elbows. They enable greater liquid storage capacity and increase the bacterial surfaces being developed. Use raised connections to connect the rows of the Presby System (see para.4.9, page 5). Glue or mechanically fasten all pipe connections.

23.14 Backfilling Rows
a) Spread System Sand between the rows.
b) If using AES, confirm pipe rows are positioned with Bio-Accelerator® along the bottom (sewn seam up).
c) Straddle each row of pipe and walk heel-to-toe its entire length, ensuring that System Sand fills all void spaces beneath the Presby Pipe.
d) Finish spreading System Sand to the top of the rows.

23.15 Backfilling and Final Grading
Spread System Sand to a minimum of 3 in. over the pipe and a minimum of 6 in. beyond Presby Pipes on all four sides beyond the Presby Pipes. Spread soil material free of organics, stones over 4 in. and building debris, having a texture similar to the soil at the site, without causing compaction. Construction equipment should not travel over the installed system area until at least 12 in. of cover material is placed over the Presby Pipes (H-10 Loading). 18 in. of cover material over the Presby System is required for H-20 loading.

23.16 Fill Extensions Requirements
All Presby Systems with any portion of the System Sand bed above original grade require 6-inch fill extensions on each side beyond the outside edge of all Presby Pipes and then tapering to meet existing grade at a maximum slope of 2:1 (see illustration in para. 3.0, page 3).

23.17 System Soil Cover Material
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, must be placed above the installed system.

23.18 Erosion Control
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.

23.19 Trees and Shrubs
No trees or shrubs should be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

24.0 System Bacteria Rejuvenation and Expansion

This section covers procedures for bacteria rejuvenation and explains how to expand existing systems.
Note: Presby Environmental, Inc. must be contacted for technical assistance prior to attempting rejuvenation procedures.

24.1 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.

24.2 How to Rejuvenate Advanced Enviro-Septic® 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.

1. Contact Presby Environmental before attempting Rejuvenation for technical assistance.
2. Determine and rectify the problem(s) causing the bacteria conversion.
3. Drain the system by excavating one end of all the rows and removing the offset adapters.
4. If foreign matter has entered the system, flush the pipes.
5. Safeguard the open excavation.
6. Guarantee a passage of air through the system.
7. Allow all rows to dry for 72 hours minimum. The System Sand should return to its natural color.
8. Re-assemble the system to its original design configuration. As long as there is no physical damage to the Presby components, the original components may be reused.

25.0 System Expansion

Presby 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 must comply with State and local regulations. Permits may be required prior to system expansion.

25.1 Reusable Components

Presby 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.

26.0 Operation & Maintenance

26.1 Proper Use

Presby Systems require minimal maintenance, 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.PresbyEnvironmental.com or via mail upon request to (800) 473-5298 or info@presbyeco.com.

26.2 System Abuse Conditions

The following conditions constitute system abuse:

a) 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).
b) 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)
c) Antibiotic medicines in high concentrations
d) Cleaning products in high concentrations
e) Fertilizers or other caustic chemicals in any amount
f) Petroleum products in any amount
g) Latex and oil paints
h) System suffocation (compacted soils, barrier materials, etc.) without proper venting

<u>Note</u>: PEI and most regulatory agencies do not recommend the use of septic system additives.

26.3 System Maintenance/Pumping of the Septic Tank

a) Inspect the septic tank at least once every two years under normal usage.
b) Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
c) If a garbage disposal is used, the septic tank will likely require more frequent pumping.
d) 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.

e) Inspect the system to ensure that vents are in place and free of obstructions.
f) 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.

26.4 Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation to within a minimum of 10 ft of the system, including the entire System Sand bed area, 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.

27.0 Glossary

This Manual contains terminology which is common to the industry and terms that are unique to Presby Systems. While alternative definitions may exist, this section defines how these terms are used in this Manual.

27.1 Bio-Accelerator®

Bio-Accelerator® fabric screens additional solids from the effluent, enhances and accelerates treatment, facilitates quick start-up after periods of non-use, provides additional surface area for bacterial growth, promotes even distribution, and further protects outer layers and the receiving surfaces so they remain permeable. Bio-Accelerator® is only available with Advanced Enviro-Septic®.

27.2 Advanced Enviro-Septic® (AES) Pipe

A single unit comprised of corrugated plastic pipe, Bio-Accelerator® fabric along its bottom which is surrounded by a layer of randomized plastic fibers and a sewn geo-textile fabric, is 10 ft in length, with an outside diameter of 12 in. and a storage capacity of approximately 58 gallons. Each foot of Advanced Enviro-Septic® provides over 40 sq ft of total surface area for bacterial activity. The sewn seam is always oriented up (12 o'clock position) within the bed. A white tag is sewn into the seam indicating the product is Advanced Enviro-Septic® pipe. Pipes are joined together with couplings to form rows. Advanced Enviro-Septic® is a combined wastewater treatment and dispersal system.

27.3 Basic Serial Distribution

Basic Serial distribution incorporates Presby Rows in serial distribution in a single bed (see Basic Serial Distribution in para. 12.0, page 12).

27.4 Butterfly Configuration

A variation of a standard, single bed system with the D-box located in the center, with rows oriented symmetrically on either side, and with each side or section receiving an equal volume of flow from the D-Box. See Butterfly Configuration (see para. 13.3, page 13).

27.5 Center-to-Center Row Spacing

The distance from the center of one Presby Row to the center of the adjacent row and must never be less than 2 ft or more than 4 ft.

27.6 Coarse Randomized Fiber

A mat of coarse, randomly-oriented fibers which separates more suspended solids from the effluent protecting the bacterial surface in the geo-textile fabric (see illustration in para. 2.0, page 2).

27.7 Combination Serial Distribution

Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 600 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 600 GPD or less. See Combination Serial Distribution, para. 13.0, on page 13.

27.8 Cooling Ridges

Pipe ridges that allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling (see illustration in para. 2.0, page 2).

27.9 Coupling

A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.4.3, page 4).

27.10 Daily Design Flow

The peak daily flow of wastewater to a system, expressed in gallons per day (GPD); systems are typically sized based on the daily design flow. Design flow calculations are set forth in state rules. In general, actual daily use is expected to be one-half to two-thirds less than "daily design flow."

27.11 Differential Venting

A method of venting a Presby System utilizing high and low vents (see para. 21.2, page 17).

27.12 Distribution Box or "D-Box"
A device designed to divide and distribute effluent from the septic tank equally to each of the outlet pipes that carry effluent into the Presby System. D-Boxes are also used for velocity reduction, see Velocity Reduction, para. 20.5, page 17.

27.13 D-Box Distribution Configuration
A design in which each Presby Row receives effluent from a distribution box outlet. Such a system is also called a "parallel system" or a "finger system." See D-Box (Parallel) Distribution, para. 14.0, page 14.

27.14 Distribution Box Manifold
A PVC configuration which connects several distribution box outlets together in order to evenly divide effluent flow. It is often utilized as a splitter box when dividing flow to multiple beds. Refer to drawing in para. 20.4, on page 17.

27.15 End-to-End Configuration
Consists of two or more beds constructed in a line (i.e., aligned along the width of the beds). See para. 15.0, page 14 and illustration on page 14.

27.16 Fill Extension
Utilized in constructing Elevated (mound) Systems and blend the raised portion of the system with side slope tapering to meet existing grade. The fill extension is measured from the Presby pipe and must be at least 6 inches (see para. 3.0, page 3).

27.17 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet (see para. 4.6 on page 4.

27.18 GPD and GPM
An acronym for Gallons Per Day and Gallons Per Minute respectively.

27.19 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 21.0, page 17).

27.20 High Strength Effluent
High strength wastewater is septic tank effluent quality higher than standard residential wastewater.

27.21 MPI
An acronym for Minutes Per Inch and is the numerical value by which percolation rates (also called "perc rates") are expressed.

27.22 Multiple Bed Distribution
Incorporates two or more beds, each bed with Basic Serial, Combination Serial, or D-Box distribution and receiving effluent from a distribution box (see section 15.0, page 14).

27.23 Non-Conventional Configurations
Have irregular shapes or row lengths shorter than 30 ft to accommodate site constraints (see para. 12.1, page 12).

27.24 Offset Adapter
A plastic fitting with a 4 in. hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 4.7, page 4).

27.25 Percolation Rate
Also known as Perc Rate, is a numerical indication of a soil's hydraulic capacity, expressed in minutes per inch (MPI.)

27.26 Pressure Distribution
A pressurized, small-diameter pipe system used to deliver effluent to an absorption field. Pressure Distribution is not permitted to be used with the Presby System. Presby Systems are designed to promote even distribution without the need for pressure distribution.

27.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 20.0, page 16).

27.28 Raised Connection
A U-shaped, 4” diameter, PVC pipe configuration which is used to connect rows oriented in a serial configuration and to maintain the proper liquid level inside each row. See drawing in para. 4.9, page 5.

27.29 Raking and Tilling
Refers to methods of preparing the native soil that will be covered with System Sand or Sand Fill, creating a transitional layer between the sand and the soil. See Installation Requirements para. 23.7, page 21.

27.30 Row
Consists of a number of Presby Pipe sections connected by couplings with an Offset Adapter on the inlet end and an Offset Adapter or End Cap on the opposite end. Rows are typically between 30 ft and 100 ft long (see Row Requirements in para. 11.11, page 11).

27.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 20.7, page 17. Sand fill is used to raise the elevation of the system to meet required separation distance or in side slope tapers. System Sand may be used in place of Sand Fill.

27.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 600 GPD daily design flow maximum.

27.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in section, 12.0 on page 12. Combination Serial distribution is described in detail in sections 13.0 and, pages 13.

27.34 SHWT
An acronym for <u>**S**</u>easonal <u>**H**</u>igh <u>**W**</u>ater <u>**T**</u>able.

27.35 Skimmer Tabs
Projections into the Advanced Enviro-Septic® pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

27.36 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another (See para. 15.0, page 14 and illustration on page 14).

27.37 Slope (2:1)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. <u>Example</u>: A slope with a grade of (2:1) is the difference in horizontal distance of two (2) horizontal feet (run) over an elevation difference of one (1) ft (rise).

27.38 Slope (%)
Expressed as a **percent**, is the difference in elevation divided by the difference in horizontal distance between two points on the surface of a landform. <u>Example</u>: A site slope of one (1) percent is the difference in elevation of one (1) foot (rise) over a horizontal distance of one hundred (100) feet (run).

27.39 Smearing
The mechanical sealing of soil air spaces along an excavated, tilled or compressed surface. This is also referred to as “compacting.” In all installations, it is critical to avoid smearing or compacting the soils under and around the field.

27.40 Surface Diversion
A natural or manmade barrier that changes the course of water flow around an onsite system’s soil absorption field.

27.41 System Sand Bed
System Sand area required/used in Presby Systems. The System Sand bed extends a minimum of 6 in. below, 6 in. above and 6 in. horizontally from the outside edges of the Presby Pipes.

27.42 System Sand
System Sand must be clean, granular sand free of organic matter and must adhere to the Presby System Specification with no more than 3% passing the #200 sieve (see complete details in para.4.12).

27.43 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep (see illustration in para. 3.0, page 3). A System Sand extension area is required on the down slope side of systems sloping more than 5% and extends a minimum of 2.5 ft beyond the edge of the System Sand.

27.44 Topsoil (a.k.a. Loam or Soil Cover Material)
Topsoil, also known as Loam, is soil material cover capable of sustaining plant growth which forms the topmost layer of cover material above the system.

27.45 Velocity Reducer
Velocity reducer refers to any of the various components whose purpose is to reduce the velocity of effluent flow into the Presby Pipes. A distribution box with a baffle or inlet tee is sufficient for velocity reduction in most systems (see illustration in para. 20.5, page 17).