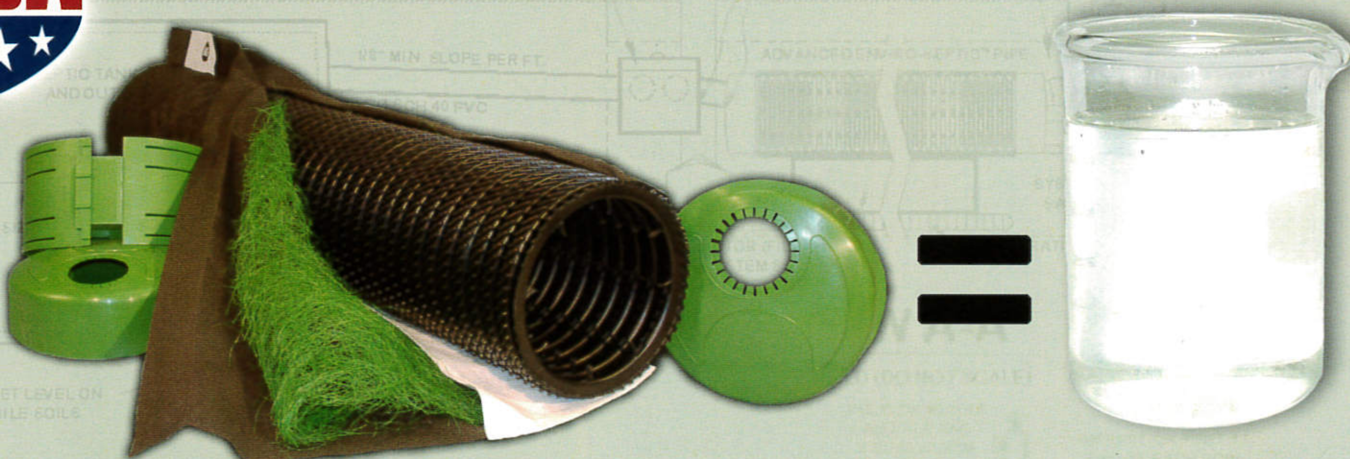
Passive Onsite Wastewater Treatment System

ADVANCED ENVIRO)SEPTIC™

COMBINED TREATMENT AND DISPERSAL

MADE IN THE USA



BNQ Certified: NQ 3680-910

NSF® The Public Health and Safety Company™

CE European Conformity

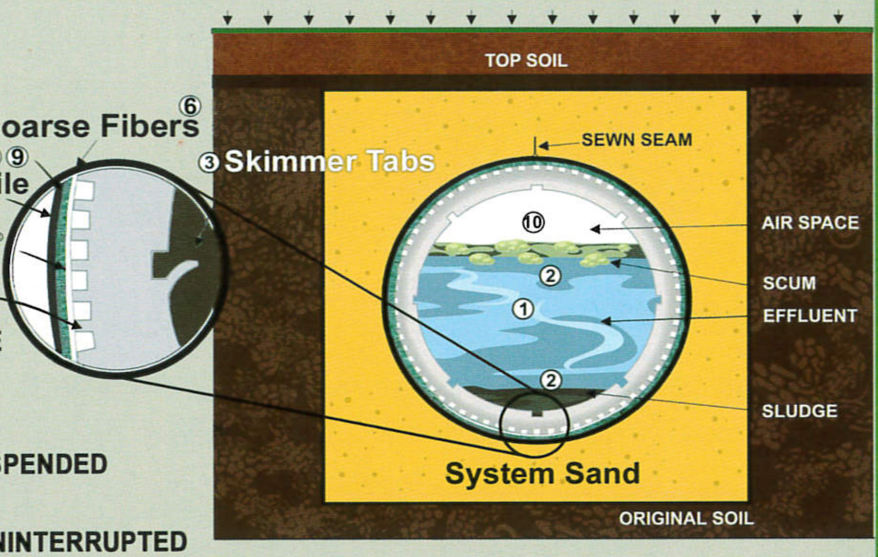
Certified Product™ Australian Standard QPW: 2013 LIC:SMK40495

www.PresbyEnvironmental.com

ADVANCED ENVIRO-SEPT

ADVANCED ENVIRO SEPTIC™

TREATMENT STAGES



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

2 Suspended solids separate from the cooled liquid effluent.

3 Skimmers further capture grease and suspended solids from the exiting effluent.

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

5 Bio-Accelerator® geo-textile fabric filters 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.

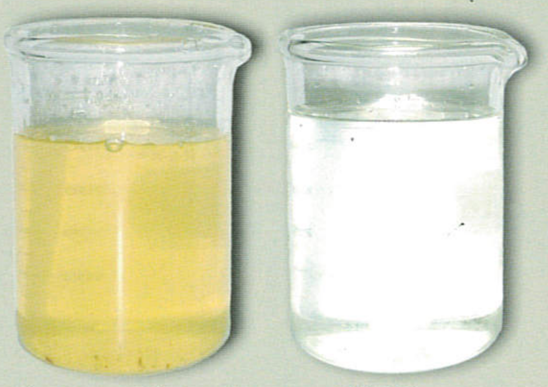
6 A mat of coarse random fibers separates more suspended solids from the effluent.

7 Effluent passes into the geo-textile fabric and grows a protected bacterial surface.

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

9 The fabric and fibers provide a large bacterial surface to break down solids.

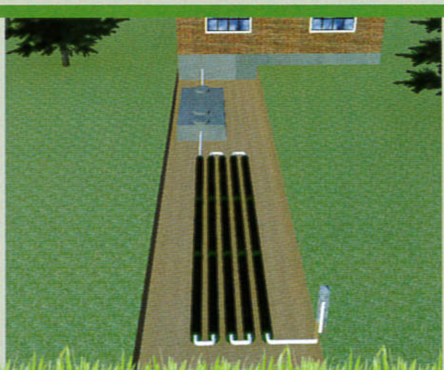
10 An ample air supply and fluctuating liquid levels increase bacterial efficiency.



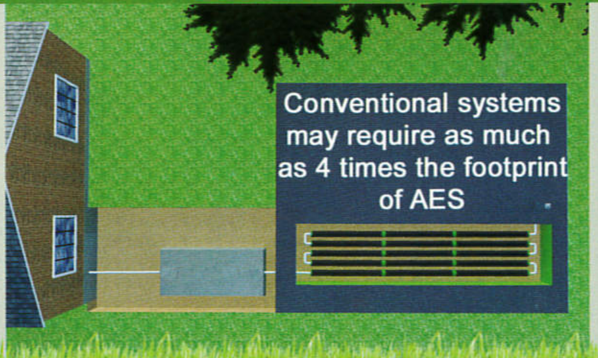
Conventional AES

Third Party Testing		Industry Standards		
BNQ Testing Parameters	Advanced Enviro-Septic® Test Results*	EPA Tertiary	NSF-40 Class I	BNQ Advanced Secondary
CBOD (mg/L)	<2	10	<25	<15
TSS (mg/L)	<2	10	<30	<15
Fecal Coliforms (CFU/100 mL)	218	1000	n/a	50,000

* (N/Ref: 30825-049-A) BNQ Test Center, Quebec



A powerful ecosystem of aerobic and anaerobic bacteria digests up to **99%** of wastewater contaminants, recycling clean water into the environment

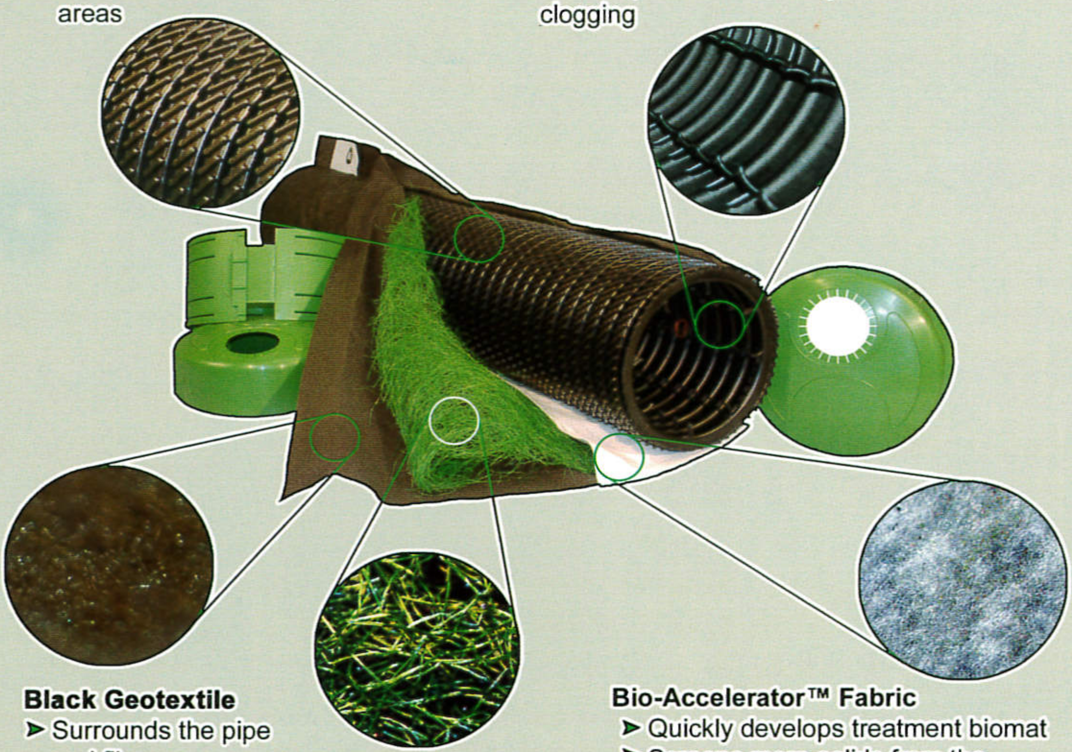


For more information on our complete line of pro

C® TREATMENT SYSTEM

Ridges
- Increase surface area and airflow
- Improve cooling
- Provide more bacterial growth areas

Skimmers at Each Perforation
- Prevent grease and suspended soilds from leaving the pipe
- Protect green fibers and geo-textiles from clogging



Black Geotextile
- Surrounds the pipe and fibers
- Provides protected bacterial treatment surface

Green Plastic Fiber Mat
- Filters more suspended solids
- Protects outer geotextile bacterial treatment surface
- Creates a massive bacterial treatment area

Bio-Accelerator™ Fabric
- Quickly develops treatment biomat
- Screens more solids from the wastewater
- Ensures distribution of wastewater along the entire length of the pipes
- Provides additional treatment surface
- Enhances and accelerates treatment
- Facilitates quick start-up
- Further protects outer layers and the receiving surfaces

NSF
The Health and Safety Company™

BNQ Certified:
NQ 3680-910

CE
European Conformity

Certified Product™
Australian Standard
QPW: 2013
LIC:SMK40495

MADE IN THE USA

The Presby Difference

- Removes up to 99% of wastewater contaminants
- Treats and disperses in the same small footprint
- Proven and reliable track record
- No electricity replacement media or expensive maintenance required

"We were so impressed with the performance in both new situations and use on repair[s] of previous system[s] that by 2008, almost all septic systems were Presby"

-Randy Raines,
Monroe County Health Department, Indiana

ucts visit **www.PresbyEnvironmental.com**

Presby Environmental

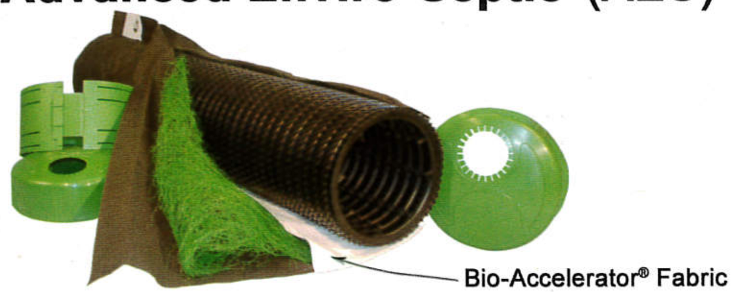
...changing the way the world approaches wastewater treatment.

Presby Environmental, Inc. (PEI), founded in 1995 by inventor and entrepreneur David Presby, is an innovative environmental organization that engineers new technology to change the way the world approaches wastewater treatment. Today, PEI is on the cutting edge of wastewater treatment technology to help protect and preserve our most precious natural resources.

Through extensive field testing and R&D, PEI has developed the world's most practical and effective wastewater treatment system, the Advanced Enviro-Septic® Wastewater Treatment System (AES). AES combines superior treatment and dispersal in the same footprint, offering design, installation, and cost advantages no other system can. This System is so effective, it is the only one of its kind to meet the stringent standards of NSF-40 Class I and BNQ Advanced Secondary.

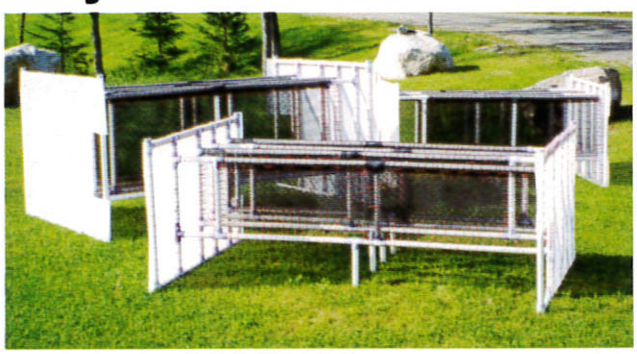
Presby Environmental combines innovation, simplicity and extensive research and development into a patented line of complimentary onsite wastewater treatment technologies, designed and manufactured at PEI's state-of-the-art facility. Mr. Presby continues to lead the industry by striving to improve the techniques and technology used in the field, always pushing to provide **the next generation of wastewater treatment technology.**

Advanced Enviro-Septic®(AES)



Enviro-Septic® (ES)

Presby Maze®



EnviroFin®(EF)

The Best Customer Service in the Industry...*for us it's personal*

- Design layouts
- User-friendly website
- Design, Installation & Operations Manuals
- Online training classes
- Technical support
- System Sand Supplier List

To contact our Customer Service Team

Presby Environmental, Inc.
143 Airport Road
Whitefield, NH 03598

Tel: 800-473-5298
Fax: 603-837-9864
Email: info@presbyeco.com

www.PresbyEnvironmental.com

Monroe County Health Department
Monroe County, Indiana

Health Department	Futures Family Planning Clinic	Public Health Clinic
119 W. 7th Street (812) 349-2543	338 S. Walnut Street (812) 349-7343	333 E. Miller Drive (812) 353-3244

Sand Lined Septic Systems in Monroe County

Prior to 2007, septic systems installed in Monroe County were like most in the State of Indiana, in-ground stone filled trench systems with a few mound septic systems on more restrictive sites. From the late 1990's to 2005, stone filled trenches were replaced by either chambers or a graveless type pipe. It appeared, to members from this department, that we were having a high rate of return visits on certain sites and we begin to question our own procedures.

With this in mind, in 2004 members of the wastewater division of Monroe County Health Department conducted a survey of septic systems installed and approved by the department within the county over the previous ten year period. This was printed and distributed in the spring of 2005. In the survey, we randomly picked 400 or 10% of the (out of 4007 new systems installed during the previous ten years) new septic system permits which had been installed and approved by this department. The permits where picked by their permit numbers only for a more indiscriminate survey. The result of the survey found that we had found 14 actual failures out of 400 systems checked or about 3.5%. Some of these were no less that two to five years old.

In the fall of 2005, our department was approached by Mike Market and Dave Presby with a new system which utilizes sand as an additional cleansing agent, such as the mound septic system does, but with a specially designed pipe. The pipe itself, with its specially designed fabric was to initially clean the effluent by tying up and breaking down any harmful bacteria contained within the septic effluent before entering the sand, and finally released to the surrounding soil. Unlike the mound which requires a slope less than 6%, the Presby septic system could be placed on most slopes up to 12-15% and did not require a pump system. The most important aspect of the systems was that if effluent would escape it should have little to no *e. coli* present *(common bacteria tested from presence of sewage)*. To ensure this, monitor wells were installed in all systems.

During the first two years all Presby septic system installed were monitored several times to ensure they were in good working condition and no problems were found. By 2008, most septic systems installed were Presby septic systems because of their ability to fit in most sites, especially for repairs of older failing septic systems. In some cases due to the lack of additional space on certain lots the Presby septic system was installed in the same location of the failing site, even on some failing mound sites. In 2012, with such great results this department required, with the Health Boards blessing, Presby septic systems to be installed on all new and repair sites. Also during this time an additional sand lined filter system appeared (Geo-flo) and was approved for use by the Monroe County Board of Health.

In 2013, the Indian State Board of Health approved a new version of Presby Environmental, Presby Advance. Presby Advance has additional material (more area for the bio mat to grow which aids in the capturing of the bad bacteria). Although the ISDH allowed a smaller sizing for Presby Advance we have reduced to a size that this department feels is adequate to continue cleansing. We still allow Presby Environmental and Geo-flo to be installed but at a greater size than Presby Advance.

Monroe County Health Department
119 West 7th Street
Bloomington IN 47404
(812) 349.2543 FAX (812) 339.6481

December 16. 2013

In 2005, the Monroe County Health Department conducted a survey of past septic system installations for the previous ten years. During that time. over 4000 septic systems had been installed, inspected and approved by this Department. These septic systems consisted of in-ground aggregate, chamber, graveless pipe, and mounds.

Letters were sent out to 400 homes randomly picked by their permit numbers. The letters consisted of an explanation for the survey, several questions dealing with the functionality of their septic system and a notification of an onsite inspection or re-visit by someone from our department. Fourteen of the 400 or about 4% of the septic systems were found to be failing. They consisted of 8 aggregate and 6 chamber type systems. We knew something had to be done to improve these results.

Monroe County consist of three major lakes, one of which is a source of water for the county. The other half of the county consist of karst features such as sink holes, caverns, and springs. We could not allow any type of pollution for either of these situations. Mound septic systems were being employed to our most severe situations since the early 90's around our lakes for the cleansing power of the sand bed. The only problem was overall cost. In the fall of 2005, our department was introduced to Presby Environmental Septic System. Here was a septic system like a mound utilizing the benefits of the sand bed but containing a pipe which creates a bio mat which further aids in cleansing the effluent.

In 2006 we began installing Presby Environmental Septic Systems, a total of 34 were installed. This increased from 165 by 2007 to 288 by 2008. We were so impressed with the performance in both new situations and use on repairs of previous system that by 2008, almost all septic systems were Presby. Today with over 900 Presby septic systems in the ground our county is exclusively only allowing sand lined septic systems.

Sincerely,

Randy Raines
Wastewater Sanitarian
Monroe County Health Department

June 9, 2015

David W. Presby, President
Presby Environmental, LLC.
143 Airport Road
Whitefield, NH 03598

Subject: Presby Environmental, Inc., Septic Star TM

Dear Mr. Presby:

Thank you for taking the time on Thursday, February 12th to demonstrate and explain, EnviroFin™ (previously known as Septic Star™), Presby Environmental, LLC.'s (Presby) new and innovative on-site wastewater treatment and disposal system. The New Hampshire Department of Environmental Services (DES) looks forward to receiving and reviewing your application for Innovative/Alternative Technology Approval (ITA) for this product. As you know, to obtain an ITA, you must first apply for approval in accordance with Env-Wq 1024 of the Subdivision and Individual Sewage Disposal System Design Rules (Rules). The requirements for approval include but are not limited to the submittal of test data demonstrating that the proposed system is "at least as protective of the environment as a conventional system". You indicated that you have already performed the required testing and, therefore, may be able to submit the application in the very near future. I assure you, once the complete ITA application is received, it will be reviewed in a very timely manner.

DES has a long history of encouraging applications for the use of technologies Env-Wq 1024 of the Rules, which has enabled the employment of alternative and innovative technologies to manage standard as well as more difficult on-site wastewater issues in NH. Since 1995, Presby has developed, manufactured and sold advanced on-site wastewater treatment technologies, including Simple-Septic®, Enviro-Septic®, Advanced Enviro-Septic®, and the Presby Maze®. All of these products have received ITA approval for use in New Hampshire under the Env-Wq 1024 Rules. Those approvals were based on third party testing which demonstrated that the treatment capabilities of the Presby systems were superior to traditional on-site (pipe and stone) systems. This allowed DES to approve the use of these systems with a smaller required separation distance from restrictive features, such as the seasonal high groundwater table and bedrock. In fact, one of these systems, the Advanced Enviro-Septic®, has the smallest required separation distance, of all systems holding ITAs in the State of New Hampshire. Taken as a whole these Presby products have been, and continue to be, used in a high percentage of on-site wastewater system designs approved by the state of New Hampshire.

Over the years, DES has observed that the Presby products are supported by a company emphasis on excellence of technical support and customer service. DES has also observed Presby's emphasis on the development of product specific design and installation manuals and its efforts to provide training, site visits and other assistance to design and installation professionals. We look forward to seeing these same emphases in your EnviroFin™ product.

DES believes that its ITA process has provided the state's residents with a wide range of innovative and cost effective wastewater treatment technologies, including the Presby products granted ITAs by DES. DES has also served as a resource to other states and entities seeking to learn from NH's positive experiences with this regulatory program.

Again, DES looks forward to reviewing an IA application for the Presby EnviroFin™ product. While I can be reached at 603-271-3449 or at thomas.burack@des.nh.gov, please direct all communications regarding IA applications to Eugene Forbes, Director, Water Division, (603-271-3308, eugene.forbes@des.nh.gov and Rob Tardif, Administrator, Subsurface Bureau (603-271-2904, robert.tardif@des.nh.gov).

Sincerely,

Thomas S. Burack

Thomas S. Burack
Commissioner

Cc: Eugene Forbes, P.E., DES Water Division Director
Rob Tardif, DES, Bureau Administrator, Subsurface Systems Bureau

Van Wert County's Enviro-Septic ® Experimental Program- the First Two Years

Jason Menchhofer, R.S.

Background

On January 28, 2008 the Director of Health granted experimental concurrence allowing permitting and installation of 25 household sewage treatment systems utilizing Enviro-Septic® treatment and absorption components in Van Wert County. The main element of this system is the Enviro-Septic® pipe manufactured by Presby Environmental, Inc. This specially-designed pipe is said to provide secondary treatment of septic tank effluent in a passive manner before the effluent is dispersed into the soil.

Typical Enviro-Septic ® absorption field installation in Van Wert County.

The experimental concurrence approval allowing use of this system in Van Wert County includes several special conditions. First, all absorption systems are sized according to the sizing specifications found in the previously established Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems (Indiana Manual). Second, each system is monitored closely by the Van Wert County Health Department after it is placed into operation. Finally, because of the experimental nature of this program, the Director's approval also allows for the use of perimeter drains as close as four feet measured horizontally from the outside edge of the soil absorption area.

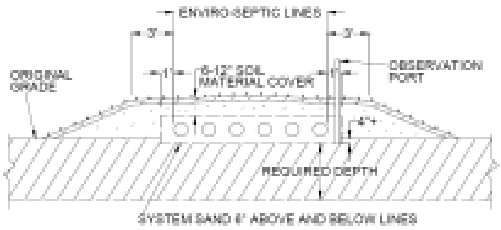
As of this writing, 14 Enviro-Septic® sewage treatment systems have been installed in Van Wert County. All of these systems are now receiving wastewater, as the last of these 15 systems was placed into operation on March 18, 2010. Eleven of these systems are installed on finely-textured silty clay or clay soils, while three systems are installed on silty clay loam or clay loam soils. One more system is currently under permit, with additional systems expected to be permitted and installed during 2010.

System Design

All Enviro-Septic® systems installed in Van Wert County are installed according to the specifications set forth in the Indiana Manual. The most significant exception to this statement is that the horizontal spacing between the soil absorption bed and perimeter drain is reduced from ten feet to four feet.

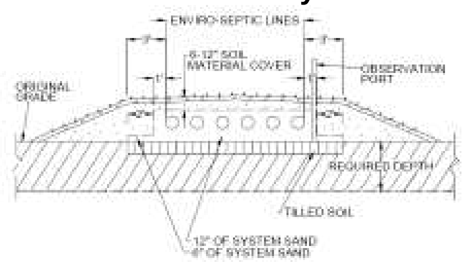
The Indiana Manual divides system installations into two basic categories. A system that is installed with its soil infiltrative surface four inches or more below original grade is categorized as a subsurface system. A system that is installed with its soil infiltrative surface less than four inches below original grade is called an elevated system. The main difference between installation of the two systems is that a subsurface system must have at least six inches of sand below the Enviro-Septic® pipe, while an elevated system must have at least twelve inches of sand below the pipe. Profile drawings of the two systems are shown below:

Subsurface Bed System



Source: Enviro-Septic® Wastewater Treatment System Indiana
Design and Installation Manual for Residential Systems

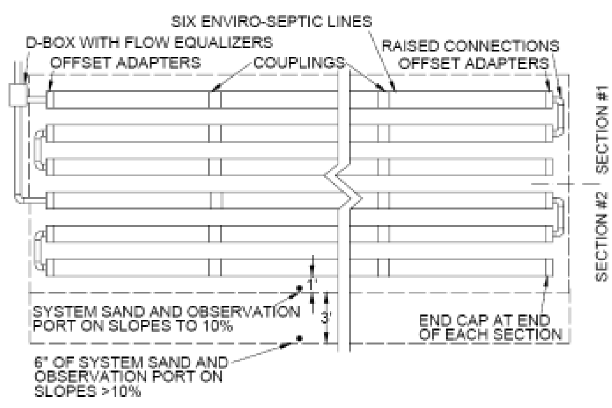
Elevated Bed System



Source: Enviro-Septic® Wastewater Treatment System Indiana
Design and Installation Manual for Residential Systems

In either system, wastewater receives primary treatment in a conventional septic tank. Effluent is then either pumped or gravity fed to the absorption system, depending upon the elevation of the system and the topography of the property. Most Van Wert County installations contain three runs of Enviro-Septic® pipe. Each run of pipe is two feet shorter than the minimum required absorption area. The pipes are connected in series, so that septic tank effluent is always fed into the first pipe, and this pipe must fill up to the level of the outlet on the opposite end of the system before any effluent enters the second pipe. The configuration of the offset adapters that connect the multiple pipes allows air space to be maintained in the top of each pipe. A vent is installed on the end of the last pipe in the series so that air can be drawn through the entire system, facilitating aerobic digestion within the pipes. Below is a diagram showing the basic serial distribution concept as described above. The typical installation for a three-bedroom home in Van Wert County contains only three runs of pipe, and the bed is 13 feet wide by 92 feet long.

Basic Serial Distribution



Source: Enviro-Septic® Wastewater Treatment System Indiana
Design and Installation Manual for Residential Systems

Absorption bed with perimeter drain installed

As mentioned previously, a perimeter drain is typically installed at a distance of four feet outside the absorption bed. This drain must be installed at least six inches below the elevation of the infiltrative surface, with the target elevation being at the depth of the glacial till or other soil layer that severely restricts vertical movement of water. The depth of an available drainage tile often dictates that the actual perimeter drain depth will be somewhere in between the minimum depth and the target depth.

Like other soil absorption systems currently in use in Ohio, sizing and location of each Enviro-Septic® system installed in Van Wert County are based on the results of a detailed site and soil evaluation. In Van Wert County, this evaluation must be conducted by a certified soil scientist. The sizing criteria found in the Indiana Manual are not completely consistent with those derived for other systems by using the Tyler loading rate table. Instead of calculating absorption system size using a specific soil loading rate and linear loading rate for each specific soil structure, texture and grade, the Indiana Manual divides soil textures and structures into seven soil classes, labeled A through G. A sizing chart then provides dimensions for each soil class, based upon the number of bedrooms in the home. While the overall square footage of an Enviro-Septic® system as specified in the Indiana manual has been found to be equal to or greater than that of a conventional system sized using the Tyler table, the length of the Enviro-Septic® system is shorter than that of a conventional system sized based on the linear loading rates found in the Tyler table. The following comparison between absorption areas of the Enviro-Septic® system, a conventional septic tank and soil absorption system, and a conventional soil absorption system preceded by a pretreatment unit is based on the results of a site and soil evaluation conducted on a Van Wert County property.

Comparison of Absorption Areas of Conventional Trenches With and Without Pre-Treatment

	Leaching Trenches or Sand Mound					
	Septic Tank Effluent		**Pre-Treated Effluent**		**Enviro-Septic®**	
Soil Texture	c		c		c	
Soil Structure	sbk		sbk		sbk	
Soil Grade	2		2		2	
Slope	0-1%		0-1%		0-1%	
Infiltration Distance	14		14		14-Jan	
# of bedrooms	3	4	3	4	3	4
design flow (gal/day)	360	480	360	480	360	480
Soil Loading Rate (gal/day/sq. ft)	0.2		0.3		90	100
Linear Loading Rate (gal/day/ft)	2.5		2.5			
Soil Class (Enviro-Septic)					G	
Absorption area length (feet)	144	192	144	192	92	102
Absorption area width (feet)	12.5	12.5	8.333333	8.333333	13	16
Total absorption area (sq. ft.)	1800	2400	1200	1600	1196	1632

System Monitoring

As a condition of the Director's approval, each Enviro-Septic® sewage treatment system installed in Van Wert County is monitored closely by Health Department staff. At a minimum, each system is inspected monthly during its first winter of operation. Specifically, monthly inspections are conducted between the months of November and April. If there are any hydraulic loading problems to be found with this system, such problems should be evident during these "wet season" months. During the remainder of the year, each system is inspected quarterly. Additional visits are made to system sites to monitor moisture conditions within the system and attempt to collect perimeter drain effluent samples for testing. The frequency of these site visits is dictated by weather and soil moisture conditions. After the first year of operation of any given system, the inspection frequency for that system is set for the following year based on the probability of finding problems or being able to collect samples on that particular system site.

At the outset of the program, routine inspections were to include not only visual inspection of the perimeter drain and the system infiltrative surface through inspection and sampling ports, but also visual inspection of septic tank and dosing tank water levels and verification of proper dosing pump and high water alarm function. As the number of systems in operation has increased, however, the focus of these routine inspections has narrowed to the absorption system and perimeter drain. This is mainly due to the fact that only one member of the Health Department's two-person environmental health division is primarily responsible for all inspections and sampling relating to this program.

Water accumulated at infiltrative surface

According to the monitoring plan established by the Van Wert County Health Department in conjunction with Ohio Department of Health Sewage Treatment Systems staff, water samples are collected from Enviro-Septic® system perimeter drains when possible. Each set of samples is then submitted to a laboratory to be tested for E. Coli, fecal coliform bacteria, biochemical oxygen demand (BOD), total dissolved solids, total suspended solids, ammonia nitrogen, nitrate and nitrite nitrogen, and total phosphorous. If sufficient water is found in either of a system's infiltrative surface inspection ports when perimeter drain samples are collected, an additional sample is collected from the infiltrative surface inspection port and analyzed for E. Coli and fecal coliform bacteria. During the 2008-2009 sampling period all bacteriological testing was performed by Alloway Laboratory in Lima, while all other testing was performed by the Ohio EPA laboratory in Reynoldsburg. During the current sampling period, all testing is being performed by Alloway Laboratory in Lima. Laboratory testing has been made possible by financial support from the Van Wert County Board of Health, Ohio Department of Health and the Van Wert County Foundation.

Observations

Post-installation site visits are divided into two categories. The required monthly or quarterly visual inspection and evaluation of performance of each system is referred to as a *routine inspection.* Any site visit which may occur between routine inspections in order to collect samples, monitor the response of a system to unusual conditions, or investigate problems with a system is referred to as an *additional site visit.* Since the beginning of the program, the Van Wert County Health Department has logged 87 routine inspections and 95 additional site visits.

Due to the lack of conformity with linear loading practices commonly accepted in Ohio, hydraulic loading is a concern associated with the use of the Enviro-Septic® system. As of this writing, no surfacing of liquid or bleeding of liquid from the toe of any system has been observed. Each system is installed with an infiltrative surface inspection port at each end of the system. Of the 15 systems currently in operation, some standing water has been observed in at least one infiltrative surface inspection port of 7 systems on at least one occasion. Only one system has been found to have standing water in both inspection ports. Water levels within the systems are normally at their highest just after major precipitation or melting events, and decrease as the soil dries out. It is worth noting that linear loading may be less of a factor in the Van Wert County installations than it would be in other locations due to the relative lack of slope on most sites where the system has been installed.

Water flowing from perimeter drain at sampling port

The use of artificial drainage around a soil absorption system is a cause for concern due to the possibility of migration of contaminants through the soil from the absorption system to the perimeter drain. Some have even suggested that a soil absorption system surrounded by a perimeter drain is no different than a discharging sewage treatment system. Perimeter drains of Enviro-Septic® systems in Van Wert County are routinely monitored for flow as soon as possible after major precipitation and melting events, as these are the only times that water has been found flowing through most of these artificial drains. Of the 15 systems currently in operation, flowing water has been visually observed in the perimeter drain sampling port of four systems. Evidence of previous perimeter drain flow has been found in most if not all systems, but the repeated inability to find water flowing through these perimeter drains suggests that they rarely carry water away from the systems for a significant period of time.

With a couple of exceptions which occurred during the 2008-2009 monitoring period, water samples are collected from flowing curtain drains by collecting water as it flows out of the drain tile, as opposed to being collected from water lying in the “sump” at the bottom of a sampling port. Samples collected from water found standing in infiltrative surface inspection ports are dipped out with as little disturbance of the soil surface as possible. Results of analysis of all samples collected as of this writing are provided below.

2008-2009 Enviro-Septic® Testing Results

		Parameters							
Date Collected	**Site Name**	**E. Coli (per 100 mL)**	**Fecal Coliform (per 100 mL)**	**BOD5(mg/L)**	**Total Dissolved Solids (mg/L)**	**Total Suspended Solids (mg/L)**	**Ammonia (mg/L)**	**Nitrate + Nitrite (mg/L)**	**Total Phosphorous (mg/L)**
3/9/2009	Pancake	<100	<100	2.7	826	31	0.94	15	0.409
3/9/2009	McOmber	<100	<100	<2.0	342	<5	0.115	13.2	0.07
3/9/2009	Amstutz	180	5100	<2.0	740	12	0.289	8.77	0.058
4/13/2009	Pancake	<20	4600	lab accident	286	214	0.097	3.44	0.341
4/13/2009	Amstutz (IP)	<20	<20						
4/13/2009	Amstutz (SP)	50	1700	lab accident	472	112	<0.05	0.1	0.01
4/13/2009	McOmber	<20	1200	lab accident	342	11	<0.05	11.9	0.01
4/20/2009	Pancake	<20	250	2	364	31	<0.05	7.27	0.449
4/20/2009	McOmber	<20	<20	<2.0	386	11	<0.05	12.5	0.066
4/20/2009	Amstutz (IP)	<20	<20						
4/20/2009	Amstutz (SP)	<20	100	<2.0	648	21	<0.05	9.11	0.017
5/14/2009	Pancake	<10	33						
5/14/2009	McOmber	180	620						
5/14/2009	Amstutz (IP)	<10	<20						
5/14/2009	Amstutz (SP)	187	1300						
5/14/2009	Miller	380	280						
6/11/2009	Pancake	41	1300						
6/11/2009	McOmber	98	>20,000						
6/11/2009	Amstutz (IP)	<10	33						
6/11/2009	Amstutz (SP)	<10	<20						

Note: IP=infiltrative surface inspection port

SP=curtain drain sampling port

All other samples collected from SP unless otherwise noted

2009-2010 Enviro-Septic® Testing Results

		Parameters							
Date Collected	**Site Name**	**E. Coli (per 100 mL)**	**Fecal Coliform (per 100 mL)**	**BOD_5(mg/L)**	**Total Dissolved Solids (mg/L)**	**Total Suspended Solids (mg/L)**	**Ammonia (mg/L)**	**Nitrate + Nitrite (mg/L)**	**Total Phosphorous (mg/L)**
12/9/2009	Pancake	1720	67	<10	615	16	0.21	24	0.39
12/9/2009	McOmber	37	1600	<10	442	11	<0.20	20.8	0.45
12/9/2009	Decker	63	1400	<10	340	6.4	<.20	5.93	0.12
12/9/2009	Amstutz	20	130	<10	1010	17	<.20	19.3	0.17
3/15/2010	Amstutz	31	<20	<10	1030	12	<.20	13.2	0.24
3/15/2010	Amstutz (IP)	<10	<20						
3/15/2010	Sidle (IP)	<10	50						
3/15/2010	Decker	610	1600	<10	954	<4.0	0.62	8.28	0.09
3/15/2010	McOmber	<10	<20	<10	475	<4.0	<.20	19.9	0.24
3/15/2010	Wright (IP)	<10	60						
4/26/2010	Amstutz (IP)	<10	<20						
4/26/2010	Decker	190	1700	<10	521	<4.0	0.43	9.38	0.15
4/26/2010	Pancake	400	1800	<10	458	14	<0.20	15.8	0.49
4/26/2010	McOmber	47	200	<10	397	29	0.29	14.5	0.63
4/26/2010	Miller*	640	1300	<10	332	16	0.45	13.9	1.09
4/26/2010	Wright*	120	800	<10	472	48	0.75	9.08	0.7
4/26/2010	Wright (IP)	10	8000						

Note: IP=infiltrative surface inspection port
SP=curtain drain sampling port
All other samples collected from SP unless otherwise noted
* Standing water in SP above curtain drain and outlet pipes (not free flowing liquid)

It is easy to see that there is a high degree of variability in the E. Coli and fecal coliform testing results. This high variability, coupled with the fact that samples collected inside the absorption system sometimes produce lower bacteria counts than those collected from the perimeter drain sampling ports, seems to indicate that some additional sources of bacteria are influencing the counts found in the perimeter drain samples. It is hoped that additional sampling will help to explain what is happening with regard to E. Coli and fecal coliform levels found in perimeter drain effluent. Also, lower suspended solids readings during the second year of operation may indicate that the initial higher readings were due to particles being easily washed down through the recently backfilled cover material above the drain trenches.

Finally, the owner of one system out of the 15 systems currently in operation has experienced problems with sewer gas inside the home, and significantly fluctuating toilet bowl water levels. Much attention was initially directed at the Enviro-Septic system as a potential cause of this problem. The theory was that the additional air drawn through the home's plumbing vent system as a result of the venting of the Enviro-Septic system had created a vacuum which emptied drain traps inside the home and lowered water levels in toilet bowls. An investigation ensued, and isolation of the absorption system's venting system from the home's plumbing vent system did not solve the problem inside the home. Eventually, the plumber was able to pinpoint two separate mistakes made in the home's plumbing vent system which seemed to be the source of the sewer gas problem. Fluctuating toilet bowl water levels have been noted once since the drain repairs were made. The cause of this fluctuation is not clear.

Conclusion

The observations outlined here appear to indicate that the Enviro-Septic® sewage treatment systems currently operating in Van Wert County are working well. This is evidenced in large part by an overall lack of serious hydraulic loading concerns. Although there is some debate among interested parties as to how much treatment occurs in the Enviro-Septic pipe as opposed to the sand surrounding the pipe, limited testing results suggest that the effluent is very clean by the time it reaches the soil infiltrative surface. Contractors who have worked with the system appreciate the system's simplicity and ease of installation and maintenance.

For more information on the use of this system in Van Wert County, contact Jason Menchhofer of the Van Wert County Health Department at 419-238-0808, extension 108, or jmenchhofer@vanwertcountyhealth.org.

References

E. Jerry Tyler and Laura Kramer Kuns. Development and Use of a Wastewater Hydraulic Linear and Infiltration Loading Rate Table. 2000 NOWRA Conference Proceedings. Grand Rapids, MI

Presby Environmental, Inc. Enviro-Septic® Wastewater Treatment System Indiana Design and Installation Manual for Residential Systems, October 2005 Edition with March 2007 Revisions.

The Presby Wastewater Treatment System

Wisconsin

Advanced Enviro-Septic®

In-Ground Component Manual

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

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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. Please contact us at: 800-473-5298

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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®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

Date of Issue: September 25, 2017

TABLE OF CONTENTS

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 has 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)

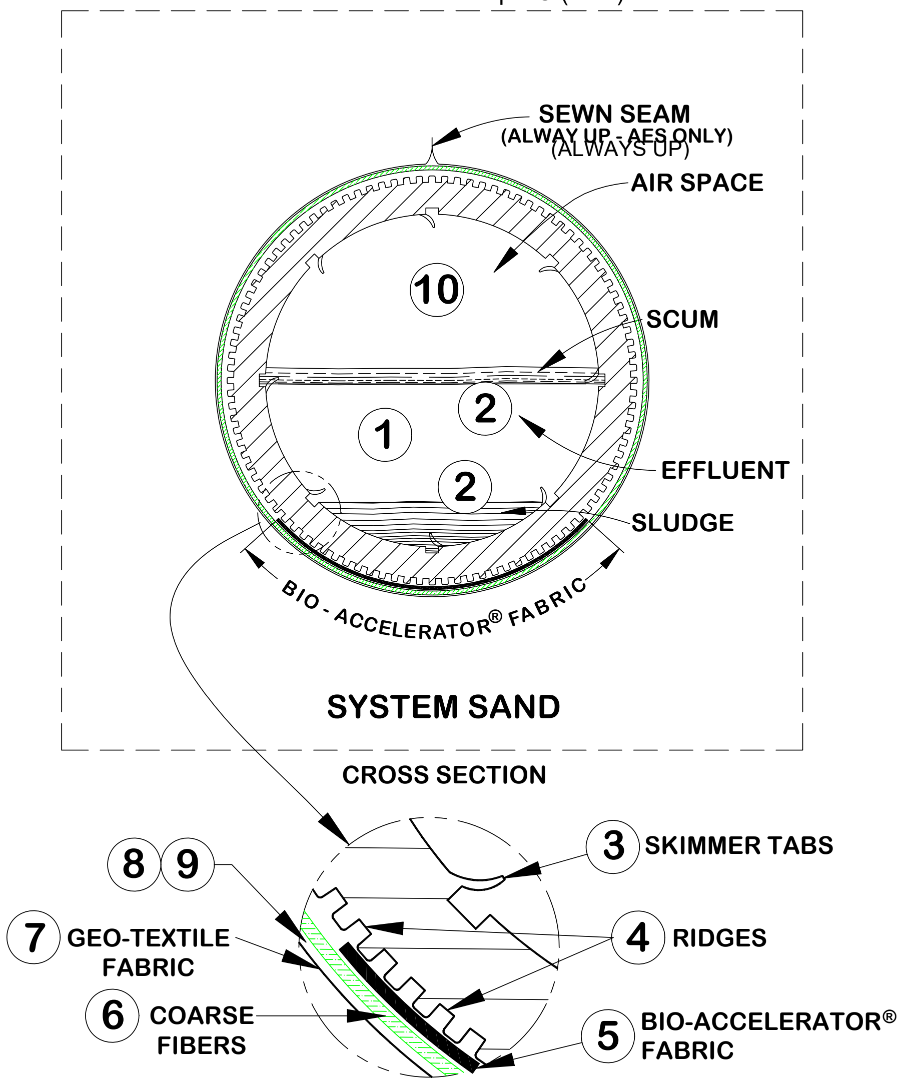
The Advanced Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I (a certification typically given to mechanical aeration devices), BNQ of Quebec, Class I, II, III and Cebedeau, Belgium standards. Advanced Enviro-Septic® 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's

10 STAGES OF TREATMENT

Advanced Enviro-Septic® (AES)



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 Presby System Components

3.1 Advanced Enviro-Septic® Pipe

a) Presby pipe required is calculated at 3 GPD/ft for both residential and commercial applications. This assumes residential strength effluent.
b) Plastic pipe made with a significant percentage of recycled material
c) 10 ft sections (can be cut to any length)
d) Ridged and perforated, with skimmer tabs on interior
e) Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
f) Surrounded by a mat of randomly-oriented plastic fibers
g) Wrapped in a non-woven geo-textile fabric stitched in place
h) Exterior diameter of 12 in.
i) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
j) A 10 ft length of AES pipe is flexible enough to bend up to 90°

3.2 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.

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-inch 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.

3.3 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.

3.4 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. A distribution box is only required when dividing flow to more than one section of the Presby bed.

3.5 Flow Equalizers

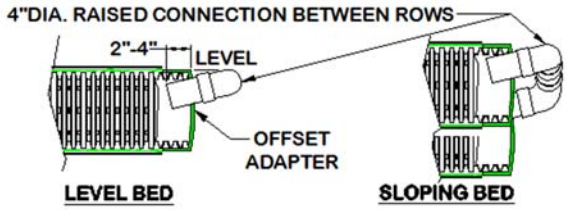
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever 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.

3.6 Manifolded Splitter Box

A manifolded splitter box joins several outlets of a D-box to help divide flow more accurately. 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.

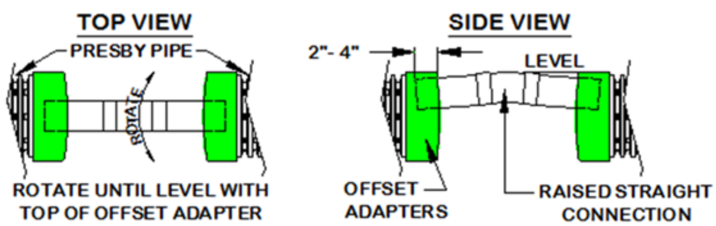
3.7 Raised Connection

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.



3.8 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.



3.9 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 is determined by state and/or local rules. Septic tanks must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Presby pipes. Effluent filters are not recommended by Presby Environmental, Inc. due to their tendency to clog, which cuts off the oxygen supply that is essential to the functioning of the Presby System. If you are required to use an effluent filter in a gravity fed system due to State or local requirements, the effluent filter selected must allow the free passage of air to ensure the proper functioning of the system.

3.10 System Sand

The System Sand that surrounds the Presby 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 12 inches below, 6 inches between and around the perimeter and 3 inches above from the Presby 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)	

3.11 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.

4.0 **Table A – Soil Application Rate by Soil Characteristics** (from Wisconsin Table SPS 383.44-1)

Soil Characteristics: Texture	Structure: Shape	Structure: Grade	Soil Application Rate (GPD/sq ft)
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	-	Structureless	1.6[a] 0.5[b]
Fine Sand, Loamy Fine Sand	-	Structureless	1.0
Very Fine Sand, Loamy Very Fine Sand	-	Structureless	0.6
Coarse Sandy Loam, Sandy Loam	-	Structureless, Massive	0.6
	Platy	Weak	0.6
		Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.7
		Moderate, Strong	1.0
Fine Sandy Loam, Very Fine Sandy Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt Loam	-	Structureless, Massive	0.2
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt	-	-	0.0
Sandy Clay Loam, Clay Loam, Silty Clay Loam	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.3
		Moderate, Strong	0.6
Sandy Clay, Clay, Silty Clay	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.0
	Prismatic, Blocky, Granular	Weak	0.0
		Moderate, Strong	0.3

a = with ≤60% rock fragments and b = with >60% to <90% rock fragments

Note: Soil application rates shown above and below assume residential strength effluent (see para. 11.7, page 12 for definition of residential strength). Contact Presby Environmental for technical assistance with high strength wastewater.

5.0 Table B – Soil Application Rate using Percolation Rate (from Wisconsin Table SPS 383.44-2)

Percolation Rate Minutes per Inch (MPI)	Soil Application Rate Gallons per Day per Sq Ft (GPD/sq ft)
0 to less than 10	1.2
10 to less than 30	0.9
30 to less than 45	0.7
45 to less than 60	0.5
60 to 120	0.3

6.0 Table C: Slope Requirements

Soil Application Rate (GPD/sq ft)	Maximum System Slope (%)	Maximum Site Slope (%)
1.6 – 0.6	25	33
0.5	15	20
0.3 – 0.2	5	5

7.0 Table D: Row Length and Pipe Layout Width (Single Level)

Row Length (ft)	Total Linear Feet of Presby Pipe													
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	195	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
# of Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.50' C/L	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
1.75' C/L	2.75	4.50	6.25	8.00	9.75	11.50	13.25	15.00	16.75	18.50	20.25	22.00	23.75	25.50
2.00 C/L	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 C/L	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 C/L	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
	*Pipe Layout Width (ft) = Outermost edge of first row to outermost edge of last row													

*Formula for single level Pipe Layout Width = [Row Spacing x (# of Rows - 1)] + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer. To use Table D: 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 until adjacent to the row spacing and find the pipe layout width.

8.0 Design Worksheet (Single Level Systems)

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

8.1 Design Example (single level)

Single family residence, (3) bedrooms (300 GPD), Application Rate for LFS (Loamy Fine Sandy), 10% sloping site, serial distribution layout, single level.

Step #1: **300** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **300** sq ft sand bed area min.

Step #2: **300** GPD ÷ 3 GPD/ft = **100** ft of Presby pipe minimum

Step #3: **300** GPD ÷ 750 GPD/section = **0.4→1** sections required.

Step #4: **100** ft Presby pipe (Step #2) ÷ **50** ft row length = 2 rows required

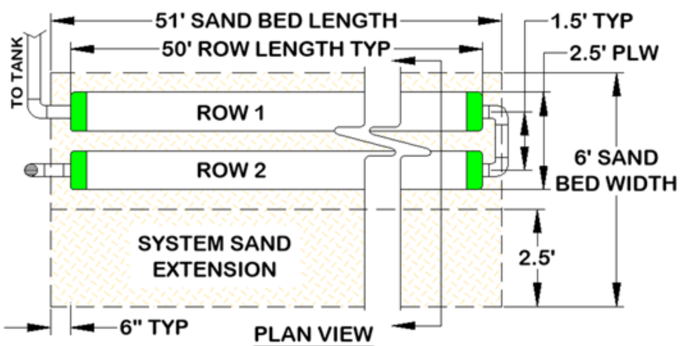
Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

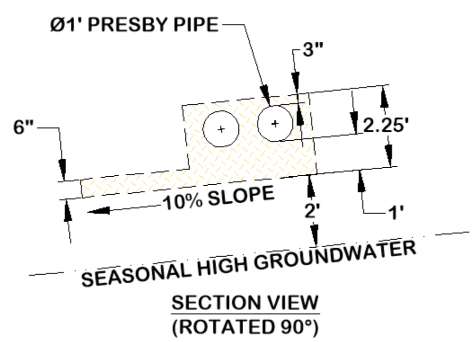
Step #6: **10**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 5.9 ft sand bed width min.
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum **(use 5.9 ft from 7a above)**

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed
b) 5.9 ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1) = less than zero (no System Sand extension required)

Illustration of Example #1, Basic Serial Distribution:





Notes: A distribution box could have been used (parallel layout) with the distribution box being placed in-line with the highest row and then connecting to all the rows individually. Whenever possible eliminate the need for a distribution box and use a serial layout. This will insure air passes equally through every foot of Presby pipe.

8.2 Design Example #2 (Single Level):

Single family residence, (4) bedrooms (400 GPD), Application Rate of 0.5 GPD/sq ft for 55 MPI soils, level site, serial distribution layout, single level.

Step #1: **400** GPD ÷ **0.5** GPD/sq ft Application Rate (Table A) = **800** sq ft sand bed area min.

Step #2: **400** GPD ÷ 3 GPD/ft = **134** ft of Presby pipe minimum

Step #3: **400** GPD ÷ 750 GPD/section = **0.54→1** sections required.

Step #4: **134** ft Presby pipe (Step #2) ÷ **70** ft row length = 1.9**→2** rows required

Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **0**% system slope (Table C allows up to 15%)

Step #7: Calculate System Sand bed width –

Beds sloping 10% or less, use the larger of (a) or (b) below:

a) **800** sq ft sand bed area (Step #1) ÷ (**70** ft row length + 1 ft) = 11.3 ft sand bed width **(<u>use this value</u>)**

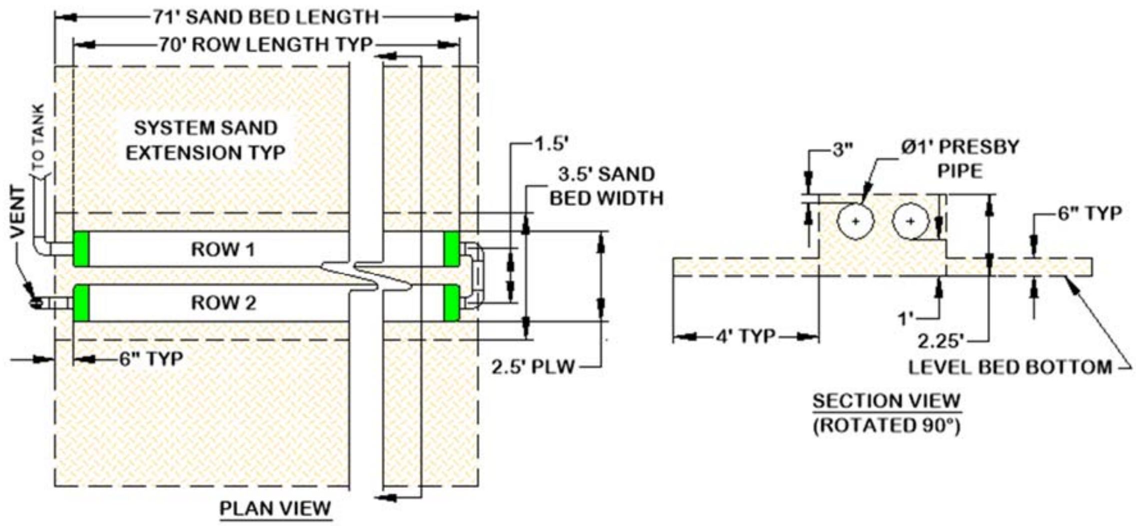
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **11.3** ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) ÷ 2 = 3.9 ft round up to **4** ft for ease of construction.

Illustration of Example #2, Basic Serial Distribution:



8.3 Design Example #3 (Single Level):

Commercial system, 770 GPD, Application Rate of 0.8 GPD/sq ft for Very Fine Sandy Loam soils, 12% sloping terrain and system, serial distribution layout.

Step #1: **770** GPD ÷ **0.8** GPD/sq ft Application Rate (Table A) = **962.5** sq ft sand bed area min.

Step #2: **770** GPD ÷ 3 GPD/ft = **257** ft of Presby pipe minimum

Step #3: **770** GPD ÷ 750 GPD/section = **1.1→2** sections required.

Step #4: **257** ft Presby pipe (Step #2) ÷ **65** ft row length = 3.9→**4** rows required

Step #5: **5.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **12**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –

Beds sloping over 10%, use the larger of (c) or (d) below:

c) **962.5** sq ft sand bed area (Step #1) ÷ (**65** ft row length + 1 ft) = **14.6** ft sand bed width **(use this value)**

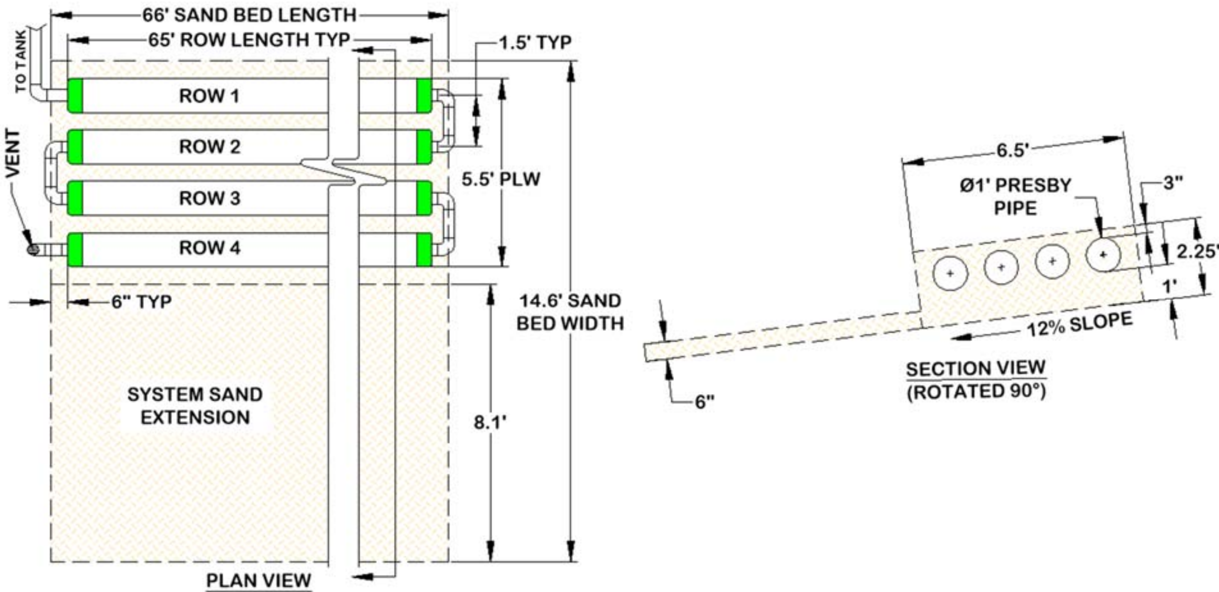
d) **5.5** ft PLW (Step #5) + 4.5 ft = **10** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **14.6** ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1 ft) = **8.1** ft

Illustration of Example #3, Commercial, Combination Serial Distribution:



9.0 Table E: Row Length and Pipe Layout Width (Multi-Level™)

		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	195	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
# of Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.5' C/L		1.75	2.50	3.25	4.00	4.75	5.50	6.25	7.00	7.75	8.50	9.25	10.00	10.75	11.50
2.0' C/L		2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
2.50' C/L		2.25	3.50	4.75	6.00	7.25	8.50	9.75	11.00	12.25	13.50	14.75	16.00	17.25	18.50
2.75' C/L		2.38	3.75	5.13	6.50	7.88	9.25	10.63	12.00	13.38	14.75	16.13	17.50	18.88	20.25

*Pipe Layout Width (ft) = Outermost edge of Upper Level to Outermost edge of Lower Level

Formula for Multi-Level™ Pipe Layout Width (3 rows or more) = { [Row Spacing x (# of Rows - 1)] / 2 } + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer.

10.0 Design Worksheet for Multi-Level™ Systems

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table E (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

10.1 Design Example #4 (Multi-Level™)

Single family residence, (6) bedrooms (600 GPD), Application Rate for LFS (Loamy Fine Sandy), level site, serial distribution layout.

Step #1: **600** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **600** sq ft sand bed area min.

Step #2: 6**00** GPD ÷ 3 GPD/ft = **200** ft of Presby pipe minimum

Step #3: 6**00** GPD ÷ 750 GPD/section = **0.8→1** sections required.

Step #4: **200** ft Presby pipe (Step #2) ÷ **50** ft row length = 4 rows required

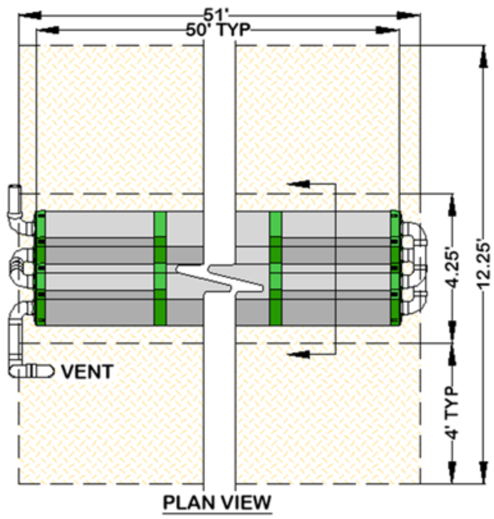
Step #5: **3.25** ft PLW from Table D (at 1.5 ft spacing)

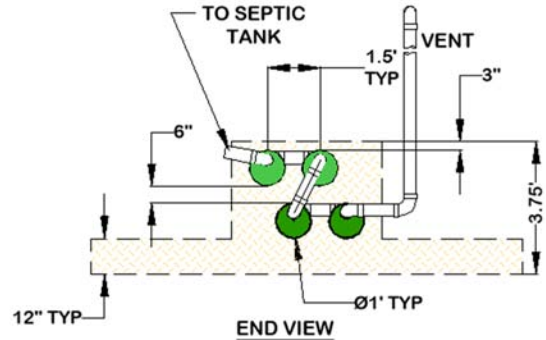
Step #6: **0**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **600** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 11.8 ft sand bed width min. **(<u>use this value</u>)**
b) **3.25** ft PLW (Step #5) + 1 ft = **4.25** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):
b) [**11.8** ft SSBW (Step #7) – (**3.25** ft PLW Step #5 + 1)] ÷ 2= 3.775 ft (round up to 4 ft for ease of construction).

Illustration of Example #4, Basic Serial Distribution, Multi-Level™





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 22.0, page 19.

11.3 Certification Requirements

Any designers and installers who have not previously attended a Presby Environmental, Inc. Certification Course are required to obtain Presby Certification. 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 through regular mail. All professionals involved in the inspection, review or certification of AES systems should also become Presby Certified. Professionals involved in the design or installation of Multi-Level™ systems must be Presby Certified.

11.4 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.

11.5 Daily Design Flow

Residential daily design flow for Presby Systems is calculated in accordance with State rules. The minimum daily design flow for any single-family residential system is two bedrooms and 200 GPD for any commercial system.

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 for commercial systems, refer to the State Rules.

d) PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of 2 to 3 times.
e) 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.

11.6 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. 18.0, page 18).

11.7 Effluent (Wastewater) Strength

The Presby pipe requirement for Bed or Trench systems is based on residential strength effluent, which has received primary treatment in a septic tank. Residential strength effluent (measured after the septic tank) cannot exceed a concentration of 240 mg/L, when adding together the values for the 5-day biochemical oxygen demand (BOD5) and the total suspended solids (TSS). Typically, this corresponds to an influent strength of 300 mg/L BOD5 and 350 mg/L TSS prior to the septic tank. Designing a system that will treat higher strength wastes requires additional Presby pipe. In these situations, consult our Technical Advisors at (800) 473-5298 for recommendations.

11.8 Filters, Alarms & Baffles

a) Effluent Filters are **not** recommended for use with Presby Systems.
b) If used, 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. Please consult PEI for the most compatible filter recommendations.
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.
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.

11.9 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.

11.10 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.

11.11 Presby Pipe Requirement (Single & Multi-Level™)

See Section 11.1, on page 11 for additional Advanced Enviro-Septic® requirements. Presby Pipe requirements are as follows and require a 1.5 ft minimum row spacing:

a) Residential systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
b) Commercial systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
c) Contact Presby Environmental, Inc. when treating high strength effluent.

11.12 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. This Manual is to be used in conjunction with the State Department of Safety and Professional Services Administrative Rules. In the event of contradictions between this Manual and State regulations, Presby Environmental, Inc. should be contacted for technical assistance at (800) 473-5298. Exceptions to any State rules other than those specifically discussed in this Manual require a State waiver.

11.13 Pressure Distribution

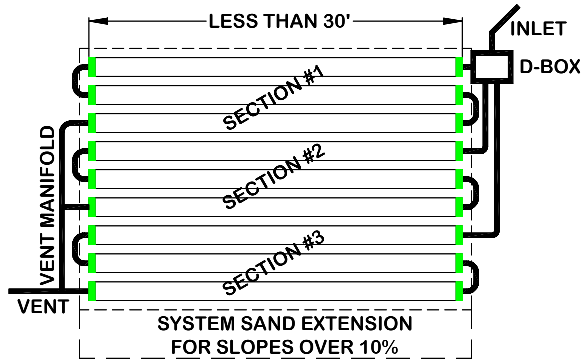
The use of pressure distribution lines in Presby Systems is **prohibited**. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the Presby Field.

11.14 Row Requirements

a) All beds must have at least 2 rows.
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 1.5 ft min. for all systems. Row spacing may be increased to accommodate greater basal area spacing requirements if desired.
f) For level beds: the Presby Rows are centered in the middle of the System Sand bed area and any System Sand extensions divided evenly on both sides.
g) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing. All rows to be grouped at the high side of the System Sand bed area with any System Sand extensions placed entirely on the downslope side.
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.

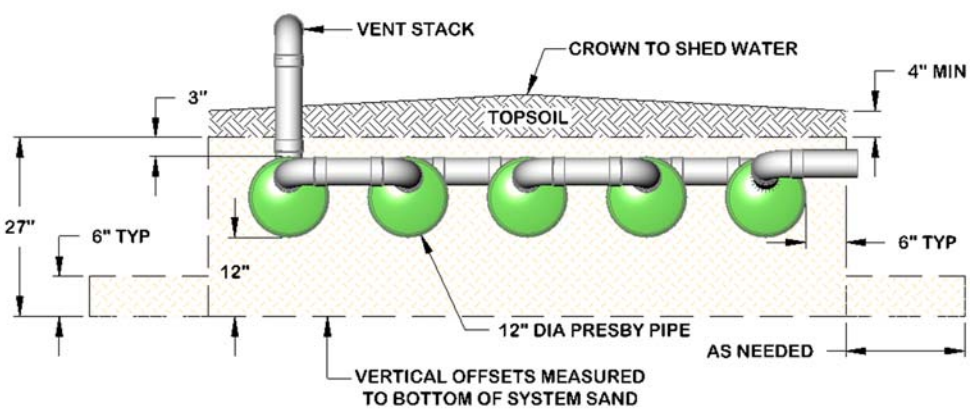
Illustration of row lengths less than 30ft:



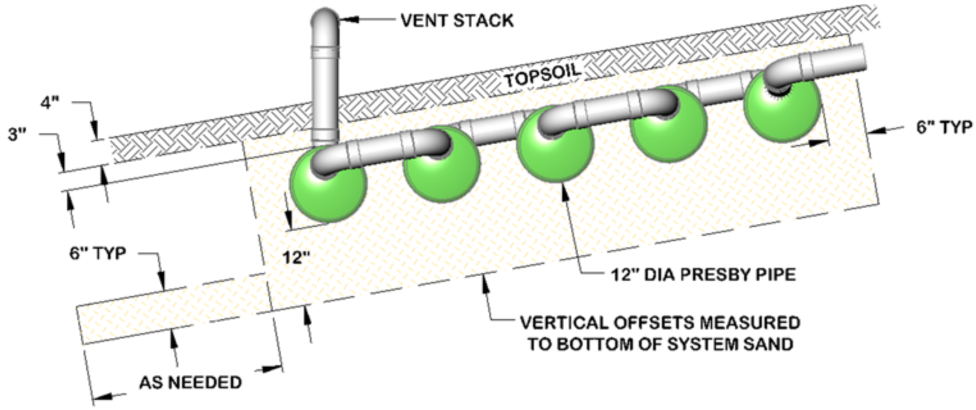
11.15 Separation Distances (Horizontal and Vertical)
Separation distances to the seasonal high water table (SHWT) or other restrictive features are measured from the outermost edge of the System Sand.

11.16 Sloping Sites and Sloping Systems
a) The percentage of slope in all system drawings refers to the slope of the Presby System, not 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 illustration in para.18.2, page 19).
c) Maximum site slope is 33% and maximum system slope is 25% (without a State waiver).

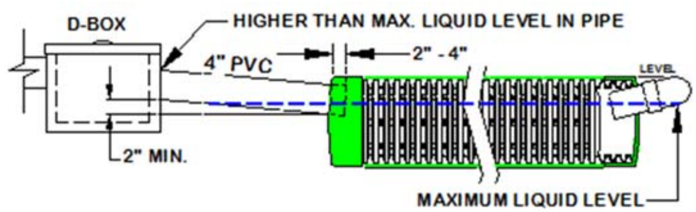
11.17 System Sand Bed Height Dimensions
The height of a Presby Sand Bed measures 27 in. minimum (not including cover material):
a) 12 in. minimum of System Sand below the Presby Pipe;
b) 12 in. diameter of the pipe; and
c) 3 inches minimum of System Sand above the Presby Pipe; also
d) When System Sand Extensions are required, they must be a minimum of 6 inches thick.



e) Sloping systems require any System Sand extension to be placed on the down slope side of the field. If the system slope is over 10% the sand extension must be at least 2.5 ft.



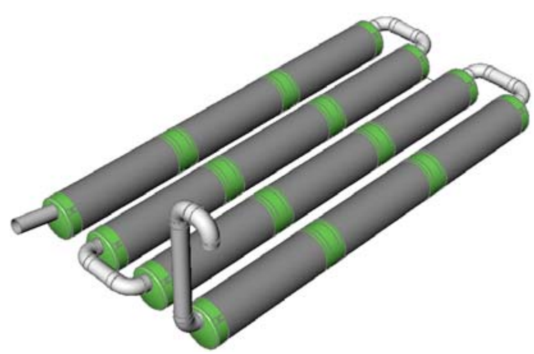
11.18 Two Inch Rule
The outlet of a septic tank or distribution box (if used) must be set at least 2 inches above the highest inlet of the Presby Row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.) See illustration of 2 in. rule below:



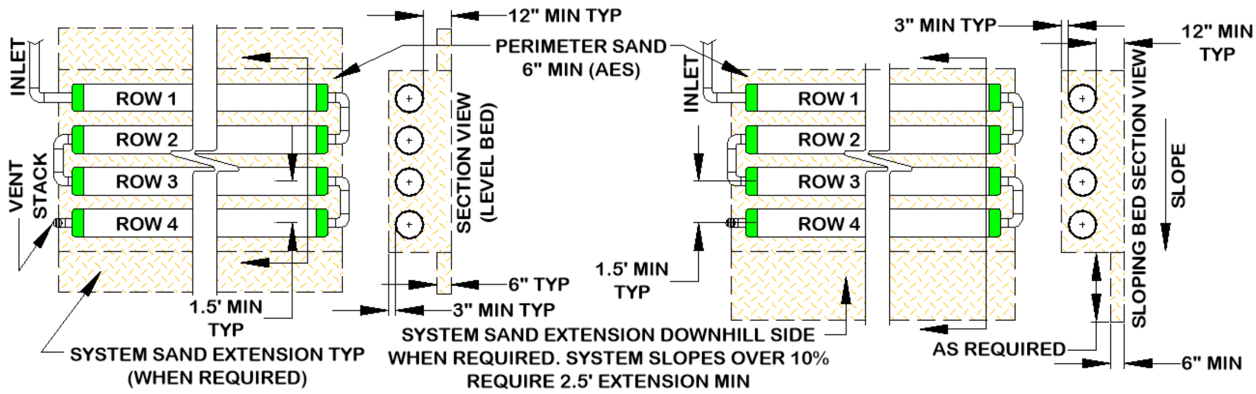
11.19 Topographic Position Requirement
The system location must be located in an area that does not concentrate water, both surface and subsurface. If allowed by State and local authorities, altering the terrain upslope of a system may alleviate this requirement if the waters are sufficiently altered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

11.20 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 (Single Level)
AES 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 750 GPD or less.
b) Incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Flow Equalizers are not required for Basic Serial systems.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
h) Illustrations of Basic Serial Systems:



Level Beds   Sloping Beds

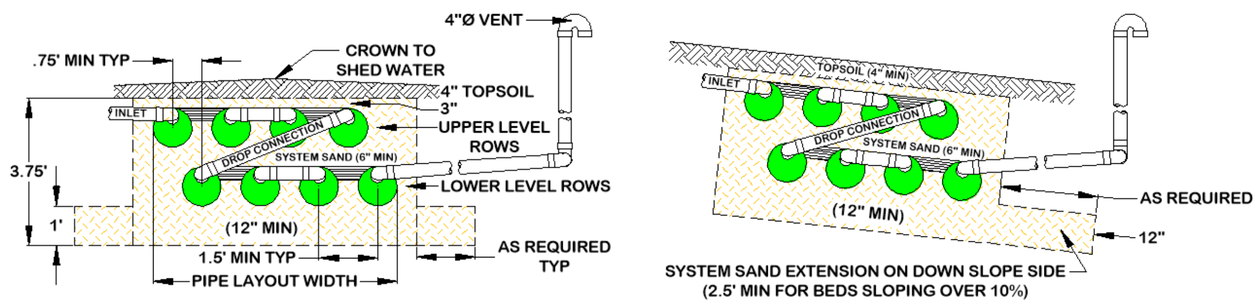


13.0 Basic Serial Distribution (Multi-Level™)

Basic Serial Multi-Level™ systems must conform to the requirements for single level basic serial systems except:

a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) When a System Sand Extension is required, it must be 12 inches thick.
d) A minimum of 6 inches of System Sand separates the Upper and Lower Level Rows.
e) Effluent is delivered first to the Upper Rows, which then connects to the Lower Level Rows by way of a Drop Connection.
f) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
g) Multi-Level™ systems are not allowed in H-20 applications.
h) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
i) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
j) System Sand extensions for Multi-Level™ systems must be 12 inches thick.
k) Illustrations of Multi-Level™ Basic Serial Systems:

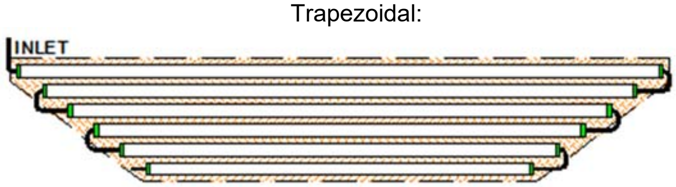
Level Beds   Sloping Beds



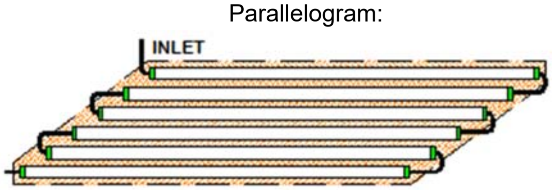
13.1 Basic Serial Configuration with Unusual Shapes:

Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

Trapezoidal:

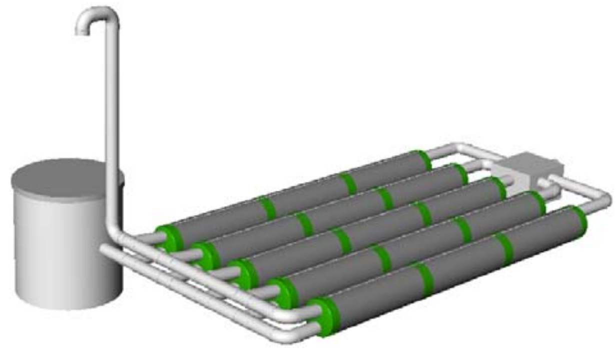


Parallelogram:



14.0 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-box Distribution or Combination Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation. There must be 18 inches from the bottom of the sump to the bottom of the drain. The sump should be brought above the final grade and have a locking or mechanically fastened cover.



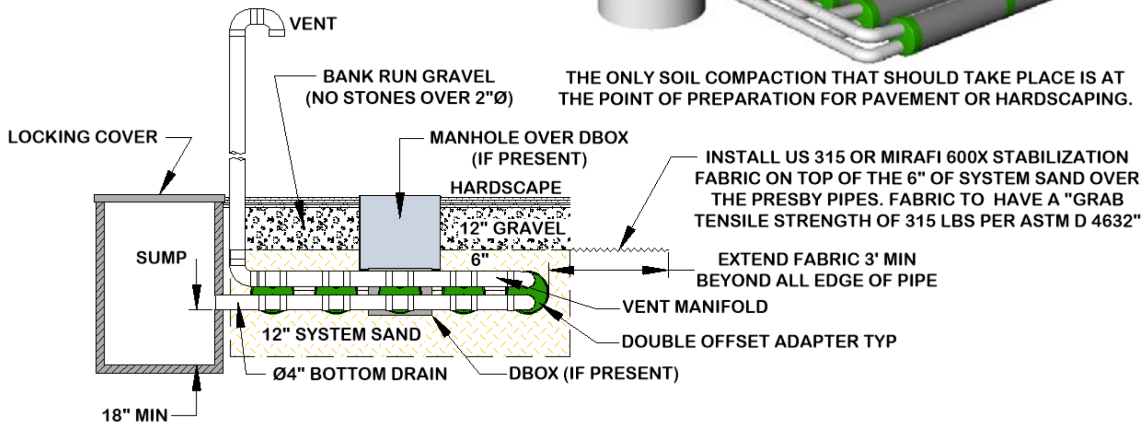
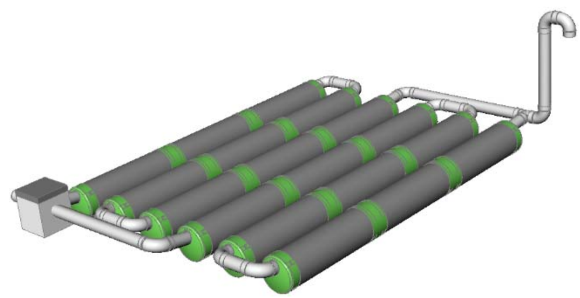


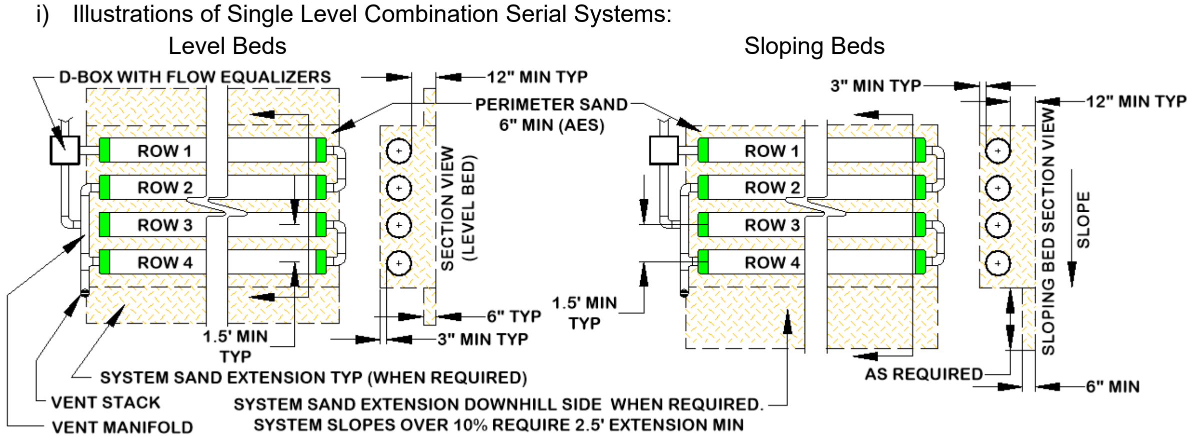
Illustration of a bottom drain used for H-20 system (End View):

15.0 Combination Serial Distribution (Single Level)

Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 GPD. Combination Serial distribution is quick to develop a strong biomat in the first row of each section, providing improved effluent treatment. Each Combination Serial section is limited to a maximum loading of 750 gallons/day.

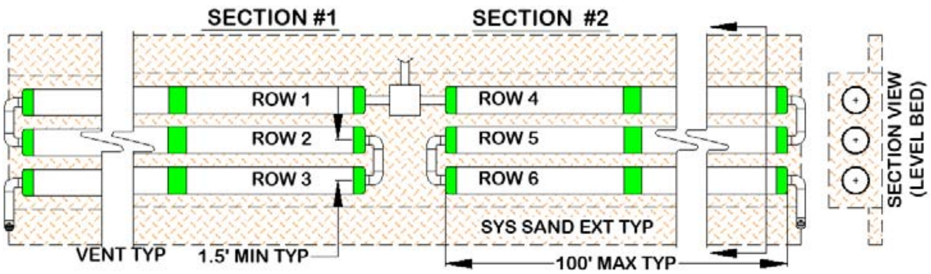


a) Combination Serial distribution consists of two or more serial sections installed in a single bed.
b) Each section in a Combination Serial system consists of a series of Presby Rows connected at the ends with raised connections, using offset adapters and PVC sewer and drain pipe.
c) Maximum length of any row is 100 ft.
d) There is no limit on the number of Combination Serial Sections within a bed.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) 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 below).
h) Combination systems require the use of an adequately sized D-Box.
i) Illustrations of Single Level Combination Serial Systems:



15.1 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) Serial Section loading limit is 750 GPD.
d) Beds can contain any number of serial sections.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Illustration of a level bed Butterfly configuration (plan view):



15.2 Section Loading

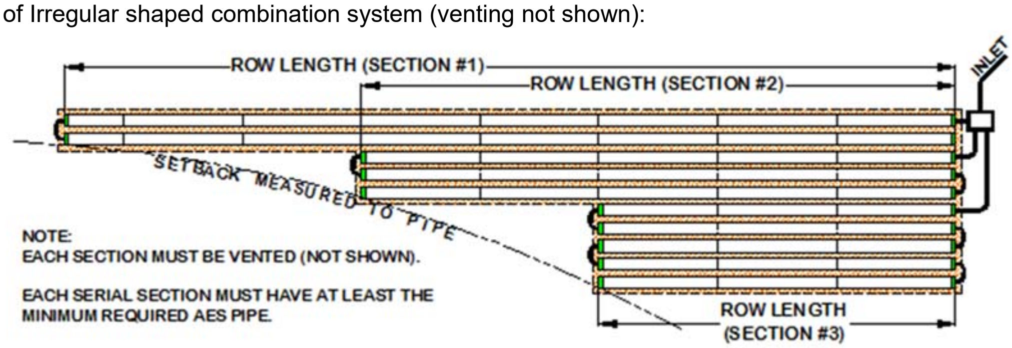
Each section in a Combination Serial system has a maximum daily design flow of 750 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 1,000 GPD requires (1,000 ÷ 750) = 1.4, use 2 sections minimum. Combination systems are only required if the daily design flow exceeds 750 GPD.

15.3 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.

15.4 Irregular Shaped Combination Serial Configuration

Illustration of Irregular shaped combination system (venting not shown):



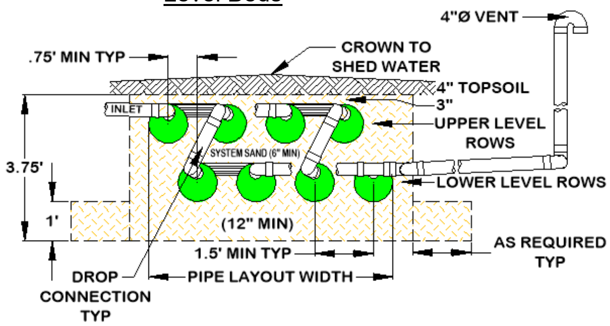
16.0 Combination Serial Distribution (Multi-Level™)

Combination Multi-Level™ systems must conform to the requirements for single level combination systems except:

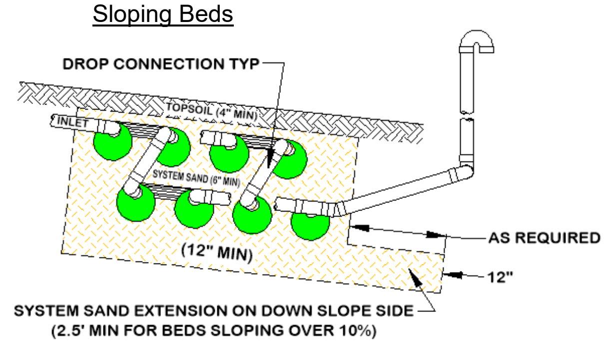
a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) If a System Sand Extension is required, it must be 12 in. thick
d) Effluent must be delivered to the Upper Level Rows from the D-Box. A Drop Connection delivers effluent from the Upper Level rows to the Lower Level rows.
e) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
f) Multi-Level™ systems are not allowed in H-20 applications.
g) The ends of all serial sections on the Lower Level are manifolded and taken to a vent stack. Each serial section may be vented separately.
h) A minimum of 6 in. of System Sand separates the Upper Level Rows from the Lower Level Rows.
i) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
j) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
k) System Sand extensions for Multi-Level™ systems must be 12 inches thick.

l) Illustrations of Multi-Level™ Combination Serial Systems:

Level Beds

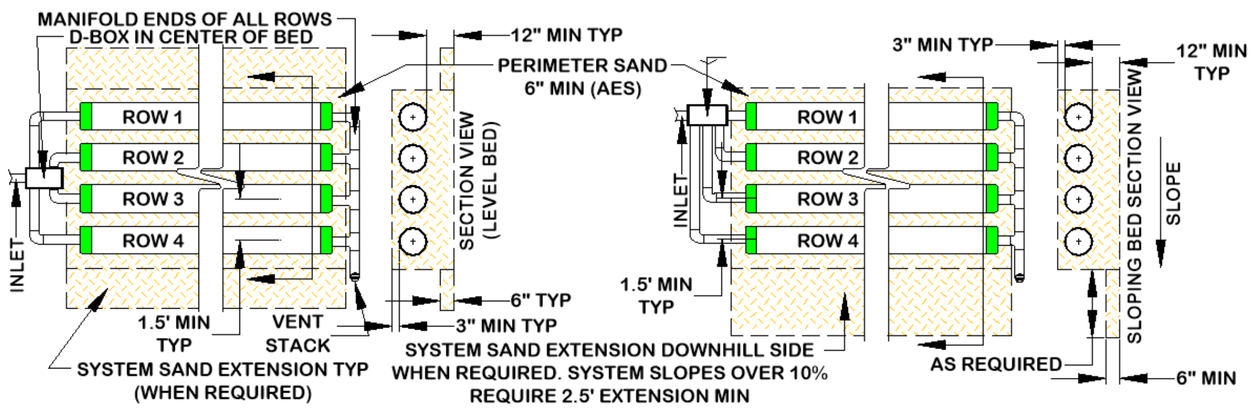


Sloping Beds



17.0 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) Place the D-Box on level, firmly compacted soil.
f) All rows must be laid level end-to-end.
g) A 2-inch min. drop is required between the D-box outlets and the Presby Pipe inlets.
i) D-Box systems are not recommended for use in Multi-Level™ beds.
j) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
k) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
h) Illustrations for D-Box (Parallel) Distribution:



18.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds (Single Level or Multi-Level™), 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.

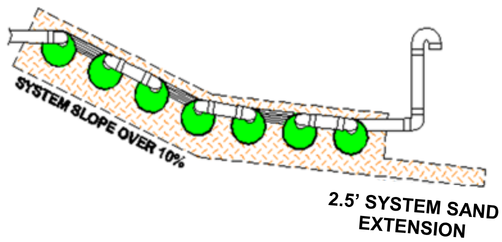
a) Each bed must have the same minimum linear feet of pipe. The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the Presby System by the number of beds.
b) Rows within a bed may vary in length to accommodate site constraints, except with D-Box configuration 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 placed down slope of another. Bed separation distance is measured from pipe-to-pipe and is dependent on soil hydrology and State requirements.
e) Multi-Level™ may be used in multiple bed systems.

18.1 System Sand Extension

In systems where SSBA is greater the PLW + 1’ (see para. 8.0, page 9, step #9). In systems sloping more than 10%, a 3 ft minimum System Sand extension is required. The System Sand extension area is placed on the down slope side of all sloping systems. For level systems, the System Sand Extension is divided equally and placed on both sides. The System Sand extension area is a minimum of 6 inches deep (12 inches for Multi-Level™ beds). For beds with multiple slopes, if any portion of the bed has a system slope greater than 10% a system sand extension is required. Illustration of bed with multiple slopes below.

18.2 Total Linear Feet Requirement

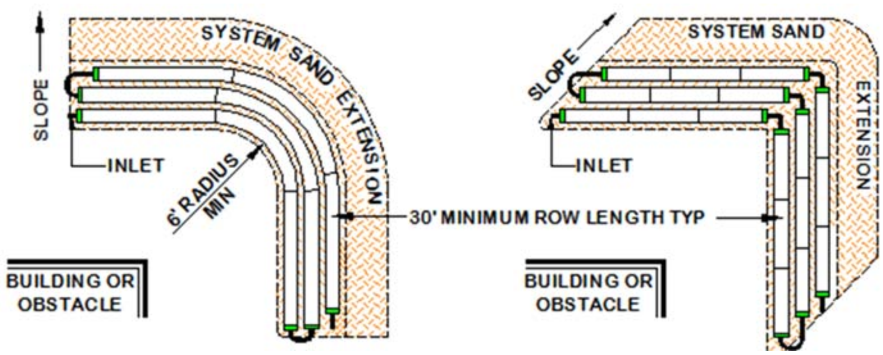
a) Maximum row length is 100 ft.
b) Each section or bed must have at least the minimum linear feet of pipe (total feet of pipe required divided by number of sections equals the minimum number of feet required for each section or bed).
c) A section or bed may exceed the minimum linear length.
d) Rows within a section or bed may vary in length (except D-Box configurations) to accommodate site constraints.



19.0 Angled and Curving Beds

Angled configurations are used to avoid obstacles.

a) Rows should follow the contour of the site as much as possible
b) Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters
c) Row lengths are required to be a minimum of 30 ft
d) Multi-Level™ systems may take advantage of angled bed configurations.
e) Illustrations of Angled Beds:

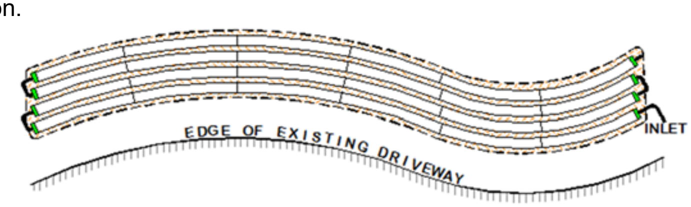


19.1 Trench Systems

Presby pipe may be installed in trench configurations on level or sloping terrain and may utilize serial, combination or parallel distribution. Trench systems may incorporate one or two rows of Presby pipe. A minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above of System Sand are required for all Presby pipes. Consult regulatory rules for required trench separation.

20.0 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.



21.0 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.

22.0 H-20 Loading

If a system is to be installed below an area that will be subjected to vehicular traffic, it must be designed and constructed as depicted below in order to protect the system from compaction and/or damage. Note that a layer of stabilization fabric is added between the System Sand and the cover material. All H-20 systems require venting. See para. 14.0 on page 16 for illustration of H-20 loading requirements.

23.0 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.

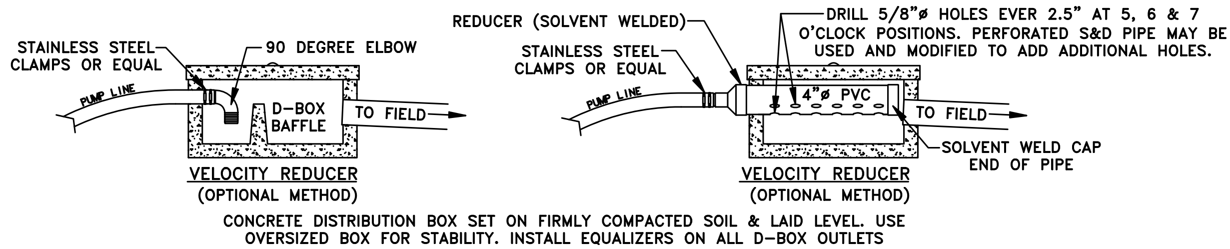
23.1 Alarm
States require all pump systems to have a high-water alarm float or sensor installed inside the pump chamber.

23.2 Differential Venting
All pump systems must use differential venting (see illustration, para.25.2, page 21).

23.3 Distribution Box
All pump systems require a distribution box with some means of velocity reduction for the effluent entering the D-Box.

23.4 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 (see illustrations on next page).
Two methods of velocity reduction:



23.5 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.

23.6 Basic Serial Distribution Limit
Pumped systems with Basic Serial distribution are limited to a maximum dose rate of 40 gallons per minute and do not require the use of a flow equalizer on the D-Box outlet. Never pump directly into Presby Pipe.

23.7 Combination and Multiple-Bed Distribution Limit
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. 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.

24.0 System Sand and Sand Fill Requirements for All Beds
It is critical to the proper functioning of Presby Systems that the proper amount and type of System Sand be installed.

24.1 Quantity of System Sand
System Sand is placed a minimum of 12 in. below, 3 in. above and 6 in. between the Presby Rows and a minimum of 6 in. horizontally around the perimeter of the Advanced Enviro-Septic® rows.

24.2 Sand Fill
Sand fill meeting state and local requirements 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.

25.0 Venting Requirements
An adequate air supply is essential to the proper functioning of Presby Systems. Venting is always required. Including the following requirements:

a) Pump systems must utilize Differential Venting.

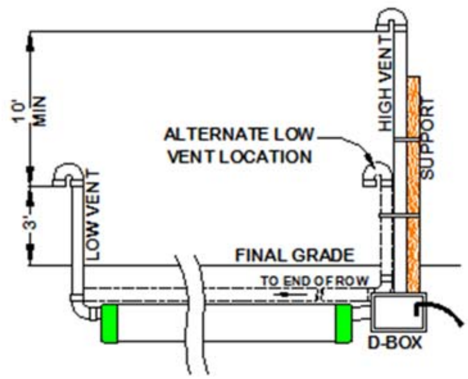
b) Vents for Multi-Level™ beds must connect to the lower level rows.

25.1 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 1 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.

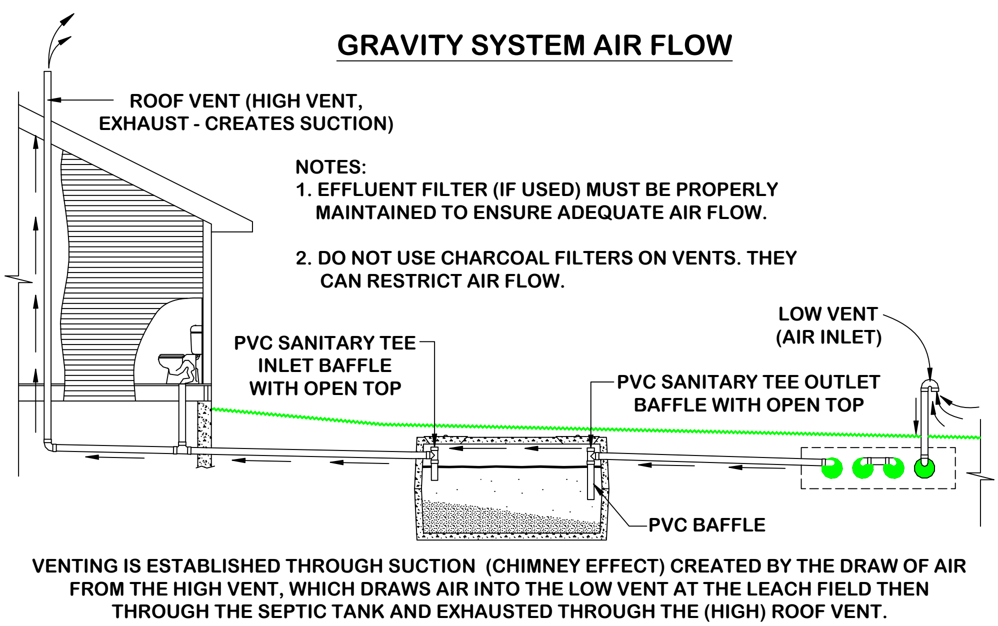
25.2 Differential Venting

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.



25.3 Vent Locations for Gravity Systems

a) 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.
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:



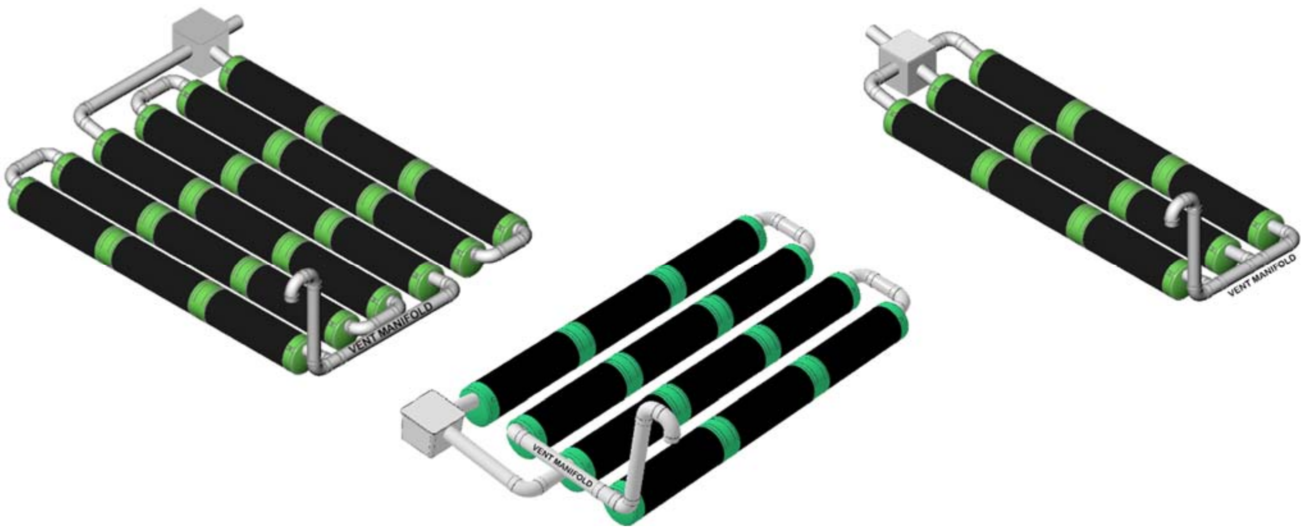
25.4 Pump System Vent Locations

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 attached to 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 and High vents may be swapped proved the distribution box is insulated against freezing in cold climates.
f) See Remote Venting (para. 25.7, page 22) and Bypass Venting (para. 25.8, page 23) for options to relocate or eliminate the High Vent.

25.5 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. Slope the lines connecting the manifold to the Presby pipes to drain condensation. See diagrams below:



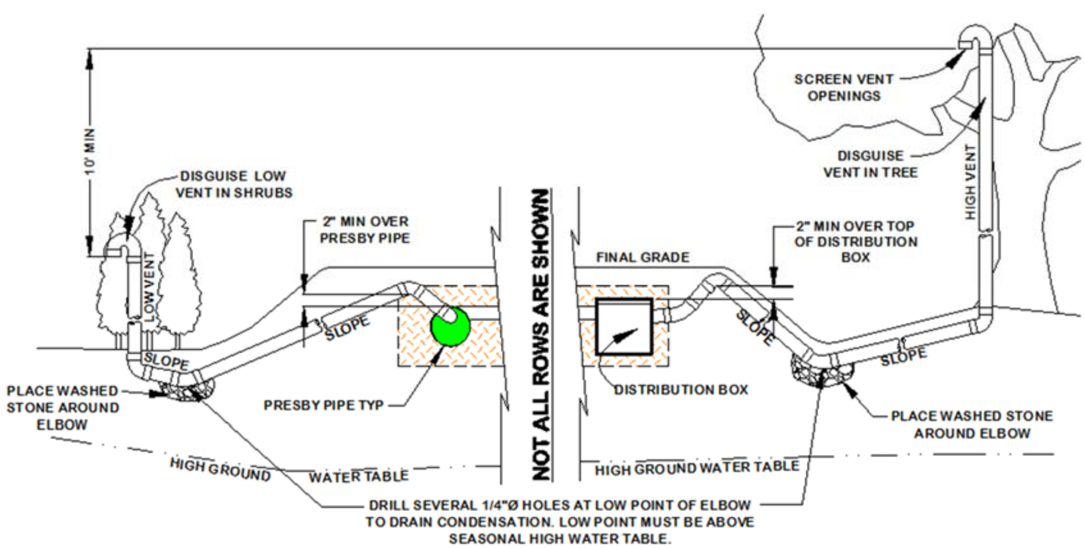
25.6 Vent Piping Slope

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

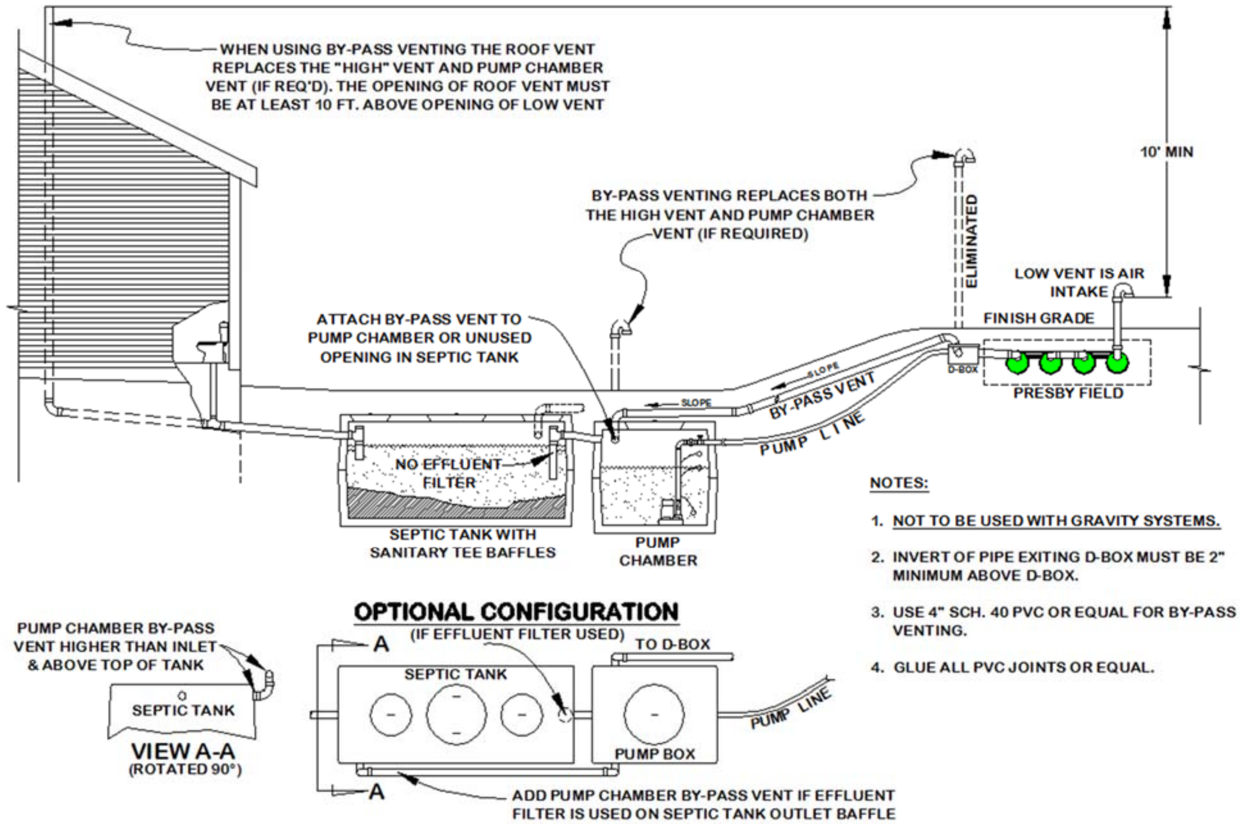
25.7 Remote Venting

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 below.)



25.8 By-Pass Venting



26.0 Site Selection

26.1 Determining Site Suitability
Refer to State or local rules regarding site suitability requirements.

26.2 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.

26.3 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.

26.4 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.

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

26.6 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.

26.7 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.

26.8 Replacement System
In the event of system malfunction, contact PEI for technical assistance prior to attempting Rejuvenation procedures. In the unlikely event that a Presby System needs to be replaced …

a) It can be reinstalled in the same location, eliminating the need for a replacement field reserve area.

b) All unsuitable material must be removed prior to replacement system construction.
c) Disposal of hazardous materials to be in accordance with State and local requirements.
d) Permits may be required for system replacement; contact the appropriate local or state agency.

27.0 Installation Requirements, Component Handling and Site Preparation

27.1 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.

27.2 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.

27.3 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.

27.4 When to Excavate

a) 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.
b) Do not excavate the system area immediately after, during or before precipitation.

27.5 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.

27.6 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.

27.7 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. 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”).

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

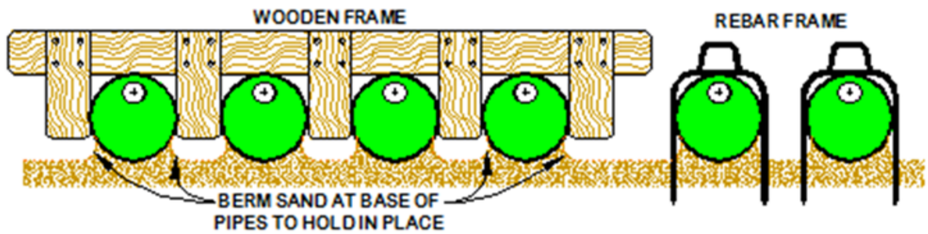
a) To protect the tilled area (System Sand bed area and System Sand extension area) from damage by precipitation, System Sand should be installed immediately after tilling.
b) Work off either end or the uphill side of the system to avoid compacting soil.
c) Keep at least 6 in. of sand between the vehicle 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.

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

27.10 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.

27.11 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).

27.12 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. Caution: Remove all tools used as row spacers before final covering.



27.13 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. 3.7 page 4). Glue or mechanically fasten all pipe connections.

27.14 Backfilling Rows
a) Spread System Sand between the rows.
b) 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 and leave them exposed for inspection purposes.

27.15 Backfilling and Final Grading
Spread System Sand to a minimum of 3 inches over the pipe and a minimum of 6 inches beyond Presby Pipes on all four sides beyond the Presby Pipes. Spread soil material free of organics, stones over 4 inches 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 inches of cover material is placed over the Presby Pipes (H-10 Loading). 18 inches of cover material over the Presby System is required for H-20 loading (see para. 22.0, page 19).

27.16 System Soil Cover Material
A minimum of 4 inches 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.

27.17 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.

27.18 Trees and Shrubs
It is recommended that no trees or shrubs be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

28.0 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.

28.1 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 Presby System is its ability to be rejuvenated in place.

28.2 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 Presby 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.

29.0 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.

29.1 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.

30.0 Operation & Maintenance

30.1 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.

30.2 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) Antibiotics and 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

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

30.3 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.

30.4 Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation, 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.

31.0 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.

31.1 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. Each unit 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.

31.2 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 14).

31.3 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®.

31.4 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-Box Distribution Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation (see illustration in para. 14.0, page 16).

31.5 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. 15.1, page 17).

31.6 Center-to-Center Row Spacing

The distance from the center of one Presby Row to the center of the adjacent row.

31.7 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).

31.8 Combination Serial Distribution

Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 750 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 750 GPD or less. See Combination Serial Distribution, para. 15.0, on page 16.

31.9 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).

31.10 Coupling

A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.3.3, page 3).

31.11 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 the State Rules. In general, actual daily use is expected to be one-half to two-thirds less than "daily design flow."

31.12 Differential Venting

A method of venting a Presby System utilizing high and low vents (see para. 25.2, page 21).

31.13 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. 23.4, page 20.

31.14 Drop Connection (Multi-Level™ Systems)
A drop connection is a PVC Sewer & Drain pipe configuration which is used to connect upper level rows to lower level rows in a Multi-Level™ bed. Drop connections extend 2 in. to 4 in. into the pipe and are installed with at least 2 in. of drop from the upper level row to the lower level row. All PVC joints should be glued or mechanically fastened.

31.15 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. 17.0, page 18.

31.16 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. 18.0, page 18 and illustration on page 16.

31.17 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet.

31.18 GPD and GPM
An acronym for Gallons per Day and Gallons per Minute respectively.

31.19 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 25.0, page 20.

31.20 High Strength Effluent
High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (BOD5) and total suspended solids (TSS) in excess of two-hundred and forty (240) mg/L.

31.21 Manifolded Splitter Box
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 3.6, on page 3.

31.22 Multi-Level™
A Multi-Level™ System is a patented process using Presby Pipe; it consists of essentially two Presby Systems installed in the same bed with one system on top of another with 6 in. of System Sand between the two levels. Multi-Level Systems are limited to soils with a Soil Application rate of 0.6 GDP/ft² and greater.

31.23 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 para. 18.0, page 18).

31.24 Non-Conventional Configurations
Have irregular shapes or row lengths shorter than 30 ft to accommodate site constraints (see para. 13.1, page 15).

31.25 Offset Adapter
A plastic fitting with a 4-inch hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 3.2, page 3).

31.26 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.

31.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 23.0, page 20).

31.28 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.3.8, page 4.

31.29 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. 27.7, page 24.

31.30 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. 11.14, page 12).

31.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 24.2, page 20. 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.

31.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 750 GPD daily design flow maximum.

31.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in sections 12.0 on page 14. Combination Serial distribution is described in detail in paragraphs 15.0 and 16.0, pages 16 and 17.

31.34 Skimmer Tabs
Projections into the AES pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

31.35 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another.

31.36 Slope (3:1)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. Example: A slope with a grade of (3:1) is the difference in horizontal distance of two (3) horizontal feet (run) over an elevation difference of one (1) ft (rise).

31.37 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. Example: 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).

31.38 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.

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

31.40 System Sand Bed
System Sand area required/used in Presby Systems. The System Sand bed extends a minimum of 12 in. below, 3 in. above and 6 in. horizontally from the outside edges of the Presby Pipes.

31.41 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. 3.10, page 4).

31.42 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep for Single Level systems and 12 in. deep for Multi-Level systems. The System Sand extension is placed on the down slope side of sloping systems. System sloping more than 10% require a 3 ft minimum extension. The System Sand extension is measured from the tall portion of the System Sand bed (see illustration in para. 18.1, page 19).

31.43 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.

31.44 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. 23.4, page 20).

The Presby Wastewater Treatment System

Wisconsin

Advanced Enviro-Septic®

Mound Component Manual

✔ 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. Please contact us at: 800-473-5298

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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®. Substitution of any other large diameter gravelless pipe will result in compromised treatment of wastewater and other adverse effects.

Date of Issue: September 25, 2017

TABLE OF CONTENTS

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 has 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)

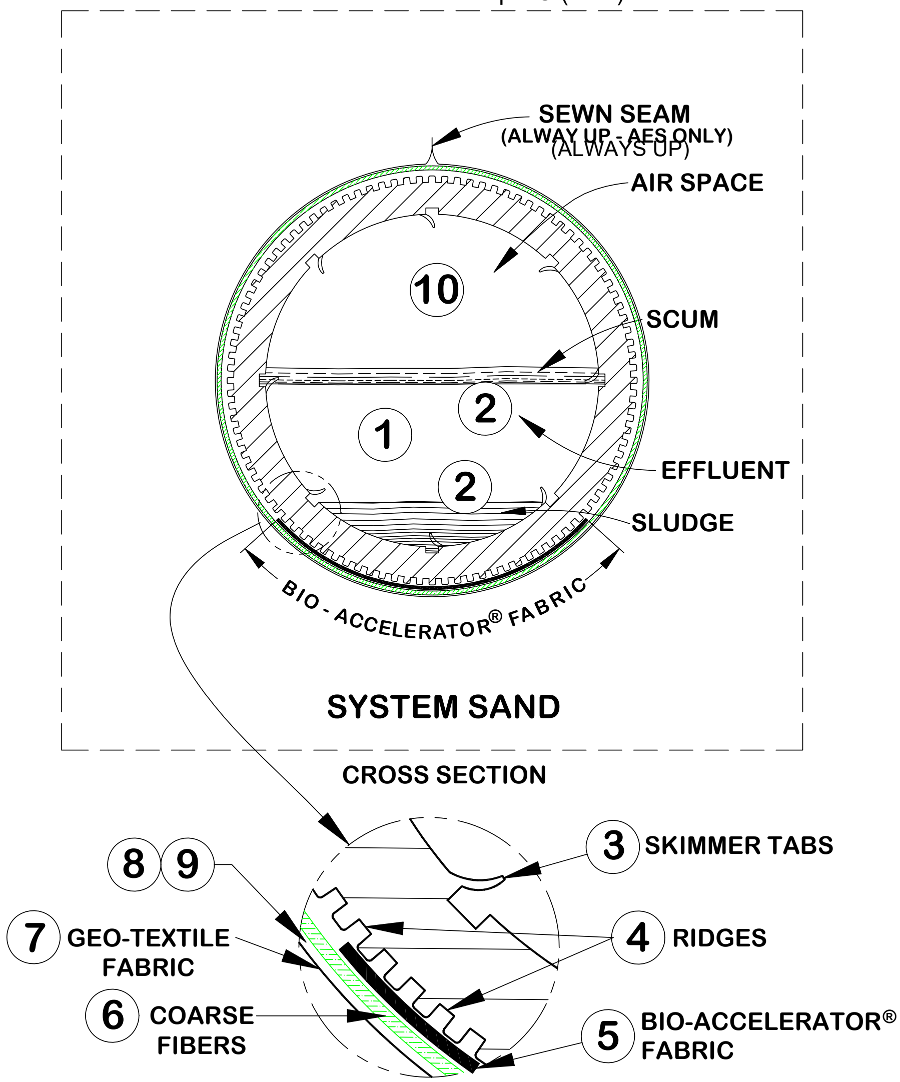
The Advanced Enviro-Septic® pipe is assembled into an onsite wastewater treatment system that has been successfully tested and certified to NSF 40, Class I (a certification typically given to mechanical aeration devices), BNQ of Quebec, Class I, II, III and Cebedeau, Belgium standards. Advanced Enviro-Septic® 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's

10 STAGES OF TREATMENT

Advanced Enviro-Septic® (AES)



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 Presby System Components

3.1 Advanced Enviro-Septic® Pipe

a) Presby pipe required is calculated at 3 GPD/ft for both residential and commercial applications. This assumes residential strength effluent.
b) Plastic pipe made with a significant percentage of recycled material
c) 10 ft sections (can be cut to any length)
d) Ridged and perforated, with skimmer tabs on interior
e) Bio-Accelerator® along bottom of pipe (sewn seam always placed up).
f) Surrounded by a mat of randomly-oriented plastic fibers
g) Wrapped in a non-woven geo-textile fabric stitched in place
h) Exterior diameter of 12 in.
i) Each 10 ft section has a liquid holding capacity of approx. 58 gallons
j) A 10 ft length of AES pipe is flexible enough to bend up to 90°

3.2 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.

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 inch 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.

3.3 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.

3.4 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. A distribution box is only required when dividing flow to more than one section of the Presby bed.

3.5 Flow Equalizers

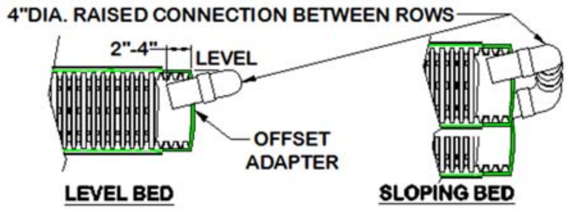
All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a distribution box to equalize effluent distribution to each outlet whenever 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.

3.6 Manifolded Splitter Box

A manifolded splitter box joins several outlets of a D-box to help divide flow more accurately. 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.

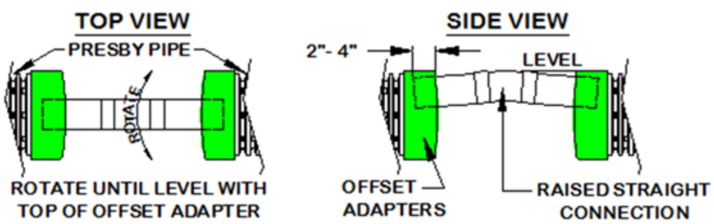
3.7 Raised Connection

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.



3.8 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 inches to 4 inches 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.



3.9 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 is determined by state and/or local rules. Septic tanks must be fitted with inlet and outlet baffles in order to retain solids in the septic tank and to prevent them from entering the Presby pipes. Effluent filters are not recommended by Presby Environmental, Inc. due to their tendency to clog, which cuts off the oxygen supply that is essential to the functioning of the Presby System. If you are required to use an effluent filter in a gravity fed system due to State or local requirements, the effluent filter selected must allow the free passage of air to ensure the proper functioning of the system.

3.10 System Sand

The System Sand that surrounds the Presby 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 12 inches below, 6 inches between and around the perimeter and 3 inches above from the Presby 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)	

3.11 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.

4.0 **Table A – Soil Application Rate by Soil Characteristics** (from Wisconsin Table SPS 383.44-1)

Soil Characteristics			Soil Application Rate (GPD/sq ft)
Texture	Structure: Shape	Structure: Grade	
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	-	Structureless	1.6[a] / 0.5[b]
Fine Sand, Loamy Fine Sand	-	Structureless	1.0
Very Fine Sand, Loamy Very Fine Sand	-	Structureless	0.6
Coarse Sandy Loam, Sandy Loam	-	Structureless, Massive	0.6
	Platy	Weak	0.6
		Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.7
		Moderate, Strong	1.0
Fine Sandy Loam, Very Fine Sandy Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Loam	-	Structureless, Massive	0.5
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt Loam	-	Structureless, Massive	0.2
	Platy	Moderate, Strong	0.2
	Platy, Prismatic, Blocky, Granular	Weak	0.6
	Prismatic, Blocky, Granular	Moderate, Strong	0.8
Silt	-	-	0.0
Sandy Clay Loam, Clay Loam, Silty Clay Loam	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.2
	Prismatic, Blocky, Granular	Weak	0.3
		Moderate, Strong	0.6
Sandy Clay, Clay, Silty Clay	-	Structureless, Massive	0.0
	Platy	Weak, Moderate, Strong	0.0
	Prismatic, Blocky, Granular	Weak	0.0
		Moderate, Strong	0.3

a = with ≤60% rock fragments and b = with >60% to <90% rock fragments

Note: Soil application rates shown above and below assume residential strength effluent (see para. 11.7, page 12 for definition of residential strength). Contact Presby Environmental for technical assistance with high strength wastewater.

5.0 Table B – Soil Application Rate using Percolation Rate (from Wisconsin Table SPS 383.44-2)

Percolation Rate Minutes per Inch (MPI)	Soil Application Rate Gallons per Day per Sq Ft (GPD/sq ft)
0 to less than 10	1.2
10 to less than 30	0.9
30 to less than 45	0.7
45 to less than 60	0.5
60 to 120	0.3

6.0 Table C: Slope Requirements

Soil Application Rate (GPD/sq ft)	Maximum System Slope (%)	Maximum Site Slope (%)
1.6 – 0.6	25	33
0.5	15	20
0.3 – 0.2	5	5

7.0 Table D: Row Length and Pipe Layout Width (Single Level)

Row Length (ft)	Total Linear Feet of Presby Pipe													
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	195	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
# of Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.50' C/L	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
1.75' C/L	2.75	4.50	6.25	8.00	9.75	11.50	13.25	15.00	16.75	18.50	20.25	22.00	23.75	25.50
2.00 C/L	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 C/L	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 C/L	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
	*Pipe Layout Width (ft) = Outermost edge of first row to outermost edge of last row													

*Formula for single level Pipe Layout Width = [Row Spacing x (# of Rows - 1)] + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer. To use Table D: 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 until adjacent to the row spacing and find the pipe layout width.

8.0 Design Worksheet (Single Level Systems)

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

8.1 Design Example (single level)

Single family residence, (3) bedrooms (300 GPD), Application Rate for LFS (Loamy Fine Sandy), 10% sloping site, serial distribution layout, seasonal high groundwater at 30 inches.

Step #1: **300** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = **300** sq ft sand bed area min.

Step #2: **300** GPD ÷ 3 GPD/ft = **100** ft of Presby pipe minimum

Step #3: **300** GPD ÷ 750 GPD/section = **0.4→1** sections required.

Step #4: **100** ft Presby pipe (Step #2) ÷ **50** ft row length = **2** rows required

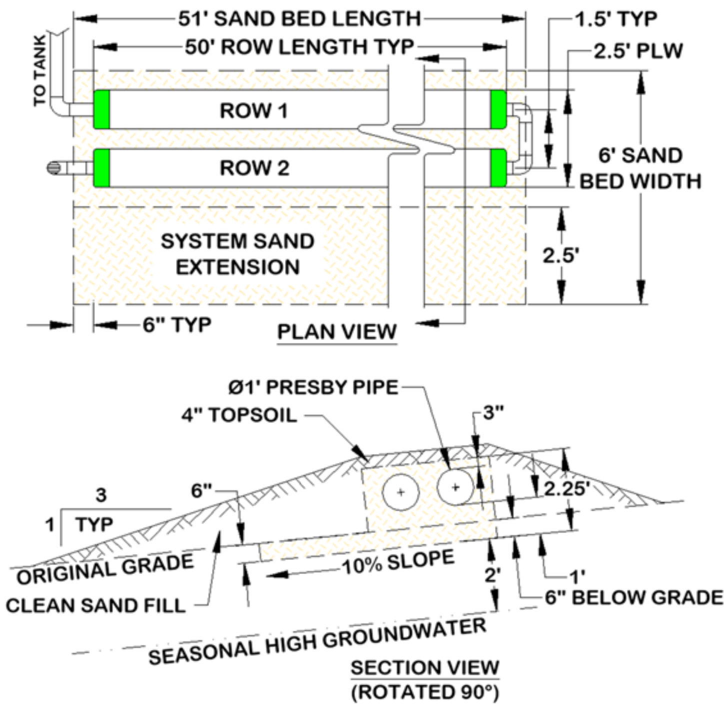
Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **10**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 5.9 ft sand bed width min.
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum **(use 5.9 ft from 7a above)**

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Sloping beds: SSE placed entirely on the down slope side of the bed when present
b) 5.9 ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) = 2.4 (use 2.5 ft System Sand extension for ease of construction)

Illustration of Example #1, Basic Serial Distribution:



Notes: A distribution box could have been used (parallel layout) with the distribution box being placed in-line with the highest row and then connecting to all the rows individually. Whenever possible eliminate the need for a distribution box and use a serial layout. This will insure air passes equally through every foot of Presby pipe.

8.2 Design Example #2 (Single Level):

Single family residence, (4) bedrooms (400 GPD), Application Rate of 0.5 GPD/sq ft for 55 MPI soils, level site, serial distribution layout, seasonal high groundwater at 18 inches.

Step #1: **400** GPD ÷ **0.5** GPD/sq ft Application Rate (Table A) = **800** sq ft sand bed area min.

Step #2: **400** GPD ÷ 3 GPD/ft = **134** ft of Presby pipe minimum

Step #3: **400** GPD ÷ 750 GPD/section = **0.54→1** sections required.

Step #4: **134** ft Presby pipe (Step #2) ÷ **70** ft row length = 1.9**→2** rows required

Step #5: **2.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **0**% system slope (Table C allows up to 15%)

Step #7: Calculate System Sand bed width –

Beds sloping 10% or less, use the larger of (a) or (b) below:

a) **800** sq ft sand bed area (Step #1) ÷ (**70** ft row length + 1 ft) = 11.3 ft sand bed width **(use this value)**

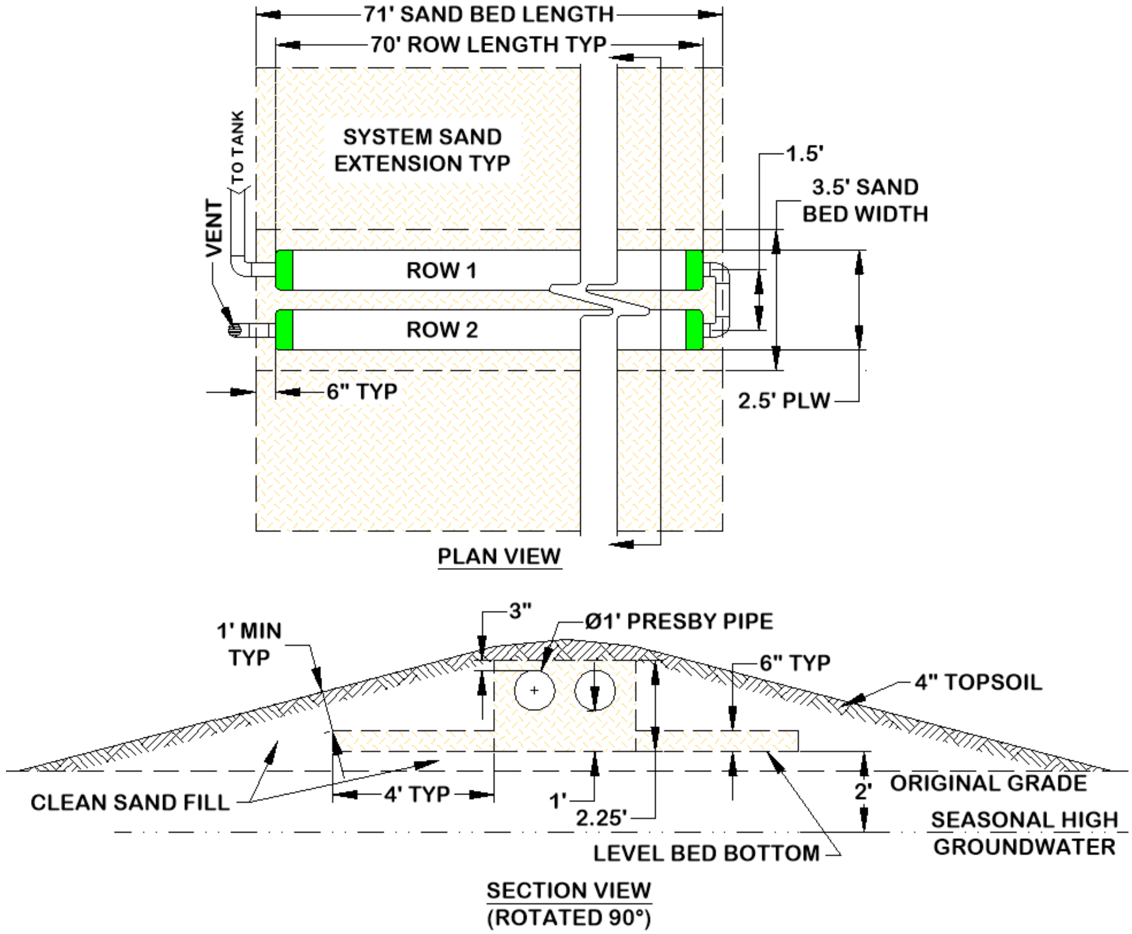
b) **2.5** ft PLW (Step #5) + 1 ft = **3.5** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **11.3** ft SSBW (Step #7) – (**2.5** ft PLW Step #5 + 1) ÷ 2 = 3.9 ft round up to **4** ft for ease of construction.

Illustration of Example #2, Basic Serial Distribution:



8.3 Design Example #3 (Single Level):

Commercial system, 770 GPD, Application Rate of 0.8 GPD/sq ft for Very Fine Sandy Loam soils, 12% sloping terrain and system, serial distribution layout, season high ground water at 24 inches.

Step #1: **770** GPD ÷ **0.8** GPD/sq ft Application Rate (Table A) = **962.5** sq ft sand bed area min.

Step #2: **770** GPD ÷ 3 GPD/ft = **257** ft of Presby pipe minimum

Step #3: **770** GPD ÷ 750 GPD/section = **1.1→2** sections required.

Step #4: **257** ft Presby pipe (Step #2) ÷ **65** ft row length = 3.9→**4** rows required

Step #5: **5.5** ft PLW from Table D (or calculated manually for larger row spacing)

Step #6: **12**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –

Beds sloping over 10%, use the larger of (c) or (d) below:

c) **962.5** sq ft sand bed area (Step #1) ÷ (**65** ft row length + 1 ft) = **14.6** ft sand bed width **(use this value)**

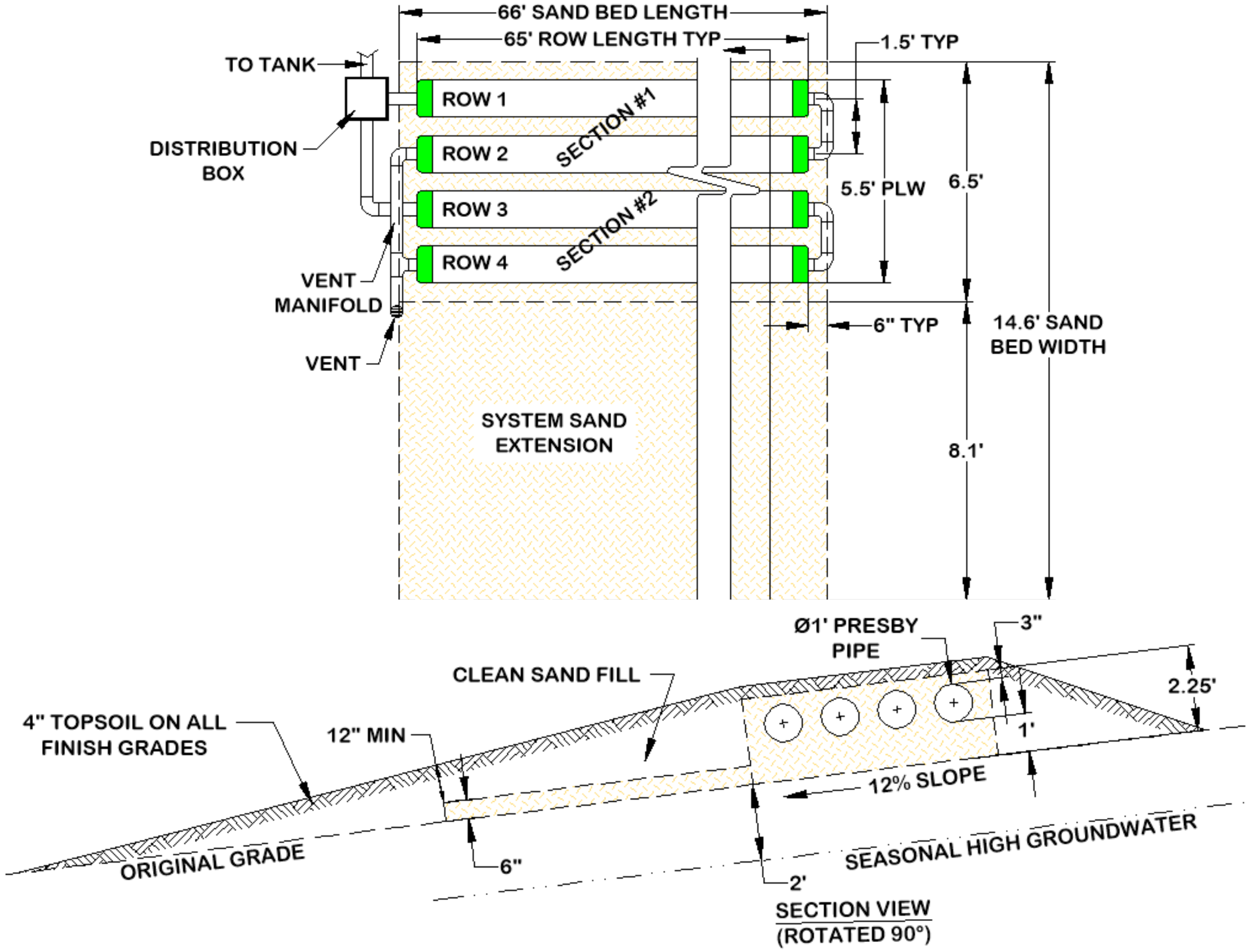
d) **5.5** ft PLW (Step #5) + 4.5 ft = **10** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:

Sloping beds: SSE placed entirely on the down slope side of the bed

a) **14.6** ft SSBW (Step #7) – (**5.5** ft PLW Step #5 + 1 ft) = **8.1** ft

Illustration of Example #3, Commercial, Combination Serial Distribution:



9.0 Table E: Row Length and Pipe Layout Width (Multi-Level™)

		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	195	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
# of Rows		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.5' C/L		1.75	2.50	3.25	4.00	4.75	5.50	6.25	7.00	7.75	8.50	9.25	10.00	10.75	11.50
2.0' C/L		2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
2.50' C/L		2.25	3.50	4.75	6.00	7.25	8.50	9.75	11.00	12.25	13.50	14.75	16.00	17.25	18.50
2.75' C/L		2.38	3.75	5.13	6.50	7.88	9.25	10.63	12.00	13.38	14.75	16.13	17.50	18.88	20.25
		*Pipe Layout Width (ft) = Outermost edge of Upper Level to Outermost edge of Lower Level													

Formula for Multi-Level™ Pipe Layout Width (3 rows or more) = { [Row Spacing x (# of Rows - 1)] / 2 } + 1. Row spacing is 1.5 ft minimum; larger row spacing is allowed and at the discretion of the designer.

10.0 Design Worksheet for Multi-Level™ Systems

Step #1: ___________ GPD ÷ ________ GPD/sq ft Application Rate (Table A) = _________ sq ft sand bed area min.

Step #2: ___________ GPD ÷ 3 GPD/ft = _________ ft of Presby pipe minimum (assumes residential strength)

Step #3: ___________ GPD ÷ 750 GPD/section = _______ sections required. Notes: round fractions up to whole number. This step does not apply to parallel distribution systems.

Step #4: ___________ ft Presby pipe (Step #2) ÷ _________ ft row length = ________ number of rows. Notes: number of rows must be evenly divided by number of serial sections from Step #3, add rows if necessary (does not apply to parallel distribution systems). Longer rows preferred to shorter length rows.

Step #5: ___________ ft PLW from Table E (or calculated manually for larger row spacing)

Step #6: ___________% system slope (cannot exceed Table C allowances)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:

a) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum
Note: 1 ft is added to row length to allow 6 inches of sand beyond the ends of each row.

b) ___________ ft PLW (Step #5) + 1 ft = _____________ ft sand bed width minimum

Beds sloping over 10%, use the larger of (c) or (d) below:

c) ___________ sq ft sand bed area (Step #1) ÷ (______ ft row length + 1 ft) = ________ ft sand bed width minimum

d) ___________ ft PLW (Step #5) + 4.5 ft = _______ ft sand bed width minimum Note: 4.5 ft is added to the PLW to allow 6 inches of sand above the first row and 3.5 ft beyond the edge of the lower row.

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):

a) (__________ ft SSBW (Step #7) – ________ ft PLW Step #5 + 1) ÷ 2 = ________ ft

Sloping beds: SSE placed entirely on the down slope side of the bed

b) __________ ft SSBW (Step #7) – ________ ft PLW (Step #5) + 1 = ________ ft

10.1 Design Example #4 (Multi-Level™)

Single family residence, (6) bedrooms (600 GPD), Application Rate for LFS (Loamy Fine Sandy), level site, serial distribution layout, seasonal high ground water 36 inches.

Step #1: **600** GPD ÷ **1.0** GPD/sq ft Application Rate (Table A) = 6**00** sq ft sand bed area min.

Step #2: **600** GPD ÷ 3 GPD/ft = 2**00** ft of Presby pipe minimum

Step #3: **600** GPD ÷ 750 GPD/section = **0.8→1** sections required.

Step #4: **200** ft Presby pipe (Step #2) ÷ **50** ft row length = **4** rows required

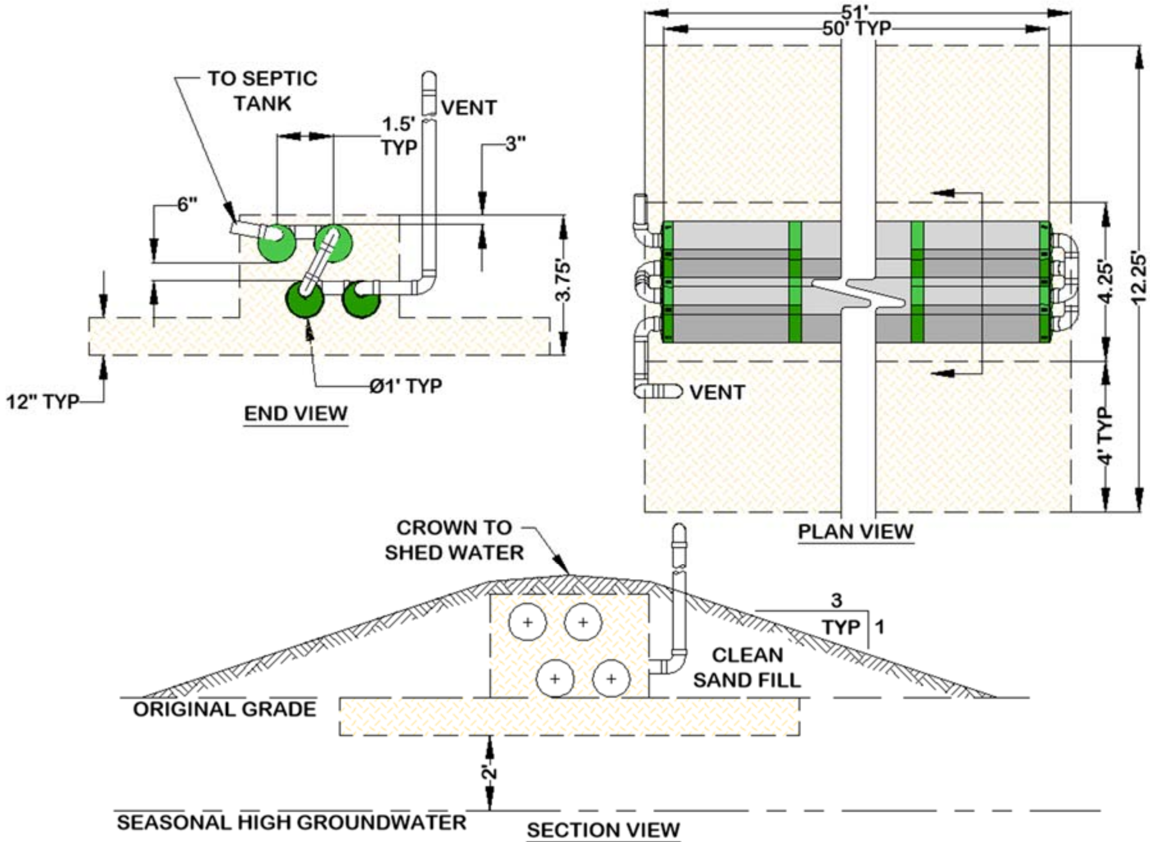
Step #5: **3.25** ft PLW from Table D (at 1.5 ft spacing)

Step #6: **0**% system slope (Table C allows up to 25%)

Step #7: Calculate System Sand bed width –
Beds sloping 10% or less, use the larger of (a) or (b) below:
a) **300** sq ft sand bed area (Step #1) ÷ (**50** ft row length + 1 ft) = 11.8 ft sand bed width min.**(<u>use this value</u>)**
b) **3.25** ft PLW (Step #5) + 1 ft = **4.25** ft sand bed width minimum

Step #8: Calculate System Sand Extension(s) choose (a) or (b) below:
Level beds (System Sand Extensions (SSE) are placed on each side of Presby Pipes):
b) [11.8 ft SSBW (Step #7) – (**3.25** ft PLW Step #5 + 1)] ÷ 2= 3.775 ft (round up to 4 ft for ease of construction).

Illustration of Example #4, Basic Serial Distribution, Multi-Level™



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 22.0, page 19.

11.3 Certification Requirements

Any designers and installers who have not previously attended a Presby Environmental, Inc. Certification Course are required to obtain Presby Certification. 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 through regular mail. All professionals involved in the inspection, review or certification of AES systems should also become Presby Certified. Professionals involved in the design or installation of Multi-Level™ systems must be Presby Certified.

11.4 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.

11.5 Daily Design Flow

Residential daily design flow for Presby Systems is calculated in accordance with State rules. The minimum daily design flow for any single-family residential system is two bedrooms and 200 GPD for any commercial system.

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 for commercial systems, refer to the State Rules.

d) PEI recommends taking the average daily use from a peak month and multiply it by a peaking factor of 2 to 3 times.
e) 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.

11.6 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. 18.0, page 18).

11.7 Effluent (Wastewater) Strength

The Presby pipe requirement for Bed or Trench systems is based on residential strength effluent, which has received primary treatment in a septic tank. Residential strength effluent (measured after the septic tank) cannot exceed a concentration of 240 mg/L, when adding together the values for the 5-day biochemical oxygen demand (BOD5) and the total suspended solids (TSS). Typically, this corresponds to an influent strength of 300 mg/L BOD5 and 350 mg/L TSS prior to the septic tank. Designing a system that will treat higher strength wastes requires additional Presby pipe. In these situations, consult our Technical Advisors at (800) 473-5298 for recommendations.

11.8 Filters, Alarms & Baffles

a) Effluent Filters are **not** recommended for use with Presby Systems.
b) If used, 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. Please consult PEI for the most compatible filter recommendations.
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.
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.

11.9 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.

11.10 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.

11.11 Presby Pipe Requirement (Single & Multi-Level™)

See Section 11.1, on page 11 for additional Advanced Enviro-Septic® requirements. Presby Pipe requirements are as follows and require a 1.5 ft minimum row spacing:

a) Residential systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
b) Commercial systems: 3 GPD/ft assuming effluent strength of 300 mg/L BOD5 and 350 mg/L TSS
c) Contact Presby Environmental, Inc. when treating high strength effluent.

11.12 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. This Manual is to be used in conjunction with the State Department of Safety and Professional Services Administrative Rules. In the event of contradictions between this Manual and State regulations, Presby Environmental, Inc. should be contacted for technical assistance at (800) 473-5298. Exceptions to any State rules other than those specifically discussed in this Manual require a State waiver.

11.13 Pressure Distribution

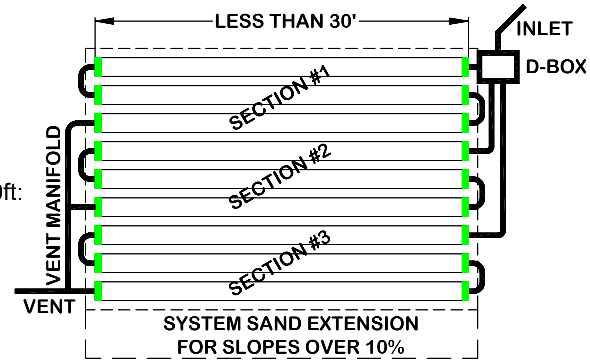
The use of pressure distribution lines in Presby Systems is **prohibited**. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the Presby Field.

11.14 Row Requirements

a) All beds must have at least 2 rows.
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 1.5 ft min. for all systems. Row spacing may be increased to accommodate greater basal area spacing requirements if desired.
f) For level beds: the Presby Rows are centered in the middle of the System Sand bed area and any System Sand extensions divided evenly on both sides.
g) For Sloping Beds: the elevations for each Presby Row must be provided on the drawing. All rows to be grouped at the high side of the System Sand bed area with any System Sand extensions placed entirely on the downslope side.
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 30ft:



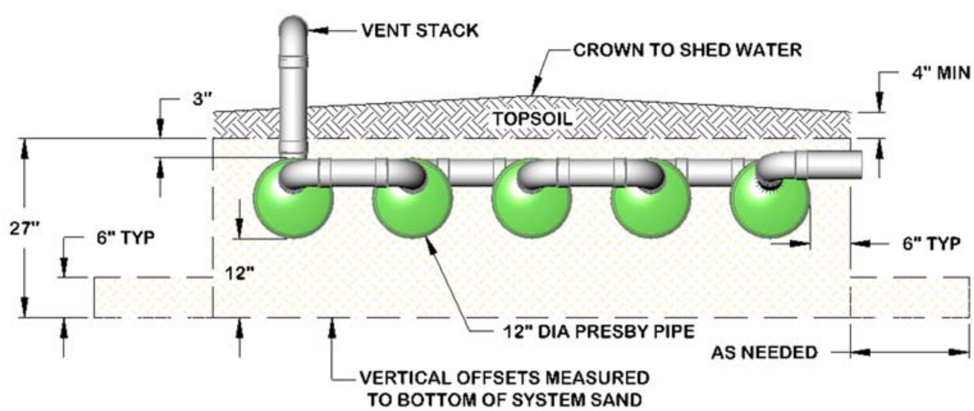
11.15 Separation Distances (Horizontal and Vertical)
Separation distances to the seasonal high water table (SHWT) or other restrictive features are measured from the outermost edge of the System Sand.

11.16 Sloping Sites and Sloping Systems

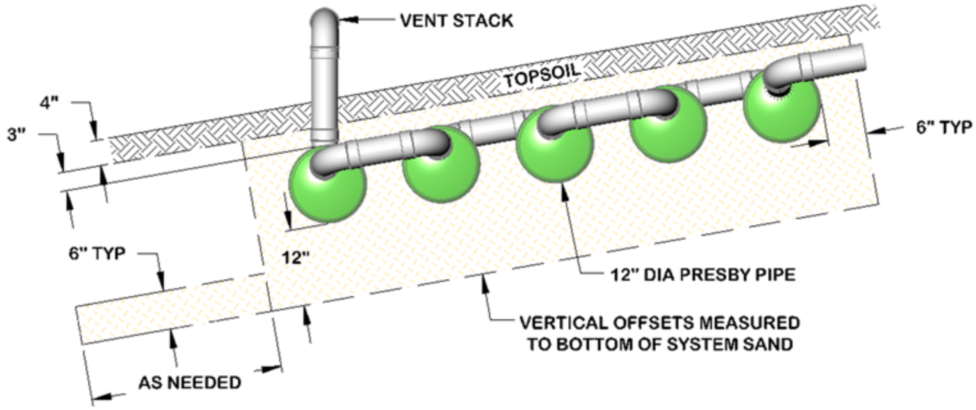
a) The percentage of slope in all system drawings refers to the slope of the Presby System, not the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
b) The system slope and the site slope do not have to be the same (see illustration in para. 18.218.1 , page 19).
c) Maximum site slope is 33% and maximum system slope is 25% (without a State waiver).

11.17 System Sand Bed Height Dimensions
The height of a Presby Sand Bed measures 27 in. minimum (not including cover material):

a) 12 in. minimum of System Sand below the Presby Pipe;
b) 12 in. diameter of the pipe; and
c) 3 inches minimum of System Sand above the Presby Pipe; also
d) When System Sand Extensions are required, they must be a minimum of 6 inches thick.

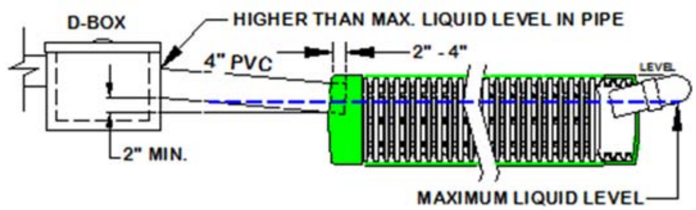


e) Sloping systems require any System Sand extension to be placed on the down slope side of the field. If the system slope is over 10% the sand extension must be at least 2.5 ft.



11.18 Two Inch Rule

The outlet of a septic tank or distribution box (if used) must be set at least 2 inches above the highest inlet of the Presby Row, with the connecting pipe slope not less than 1% (approximately 1/8 in. per foot.) See illustration of 2 in. rule below:



11.19 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.

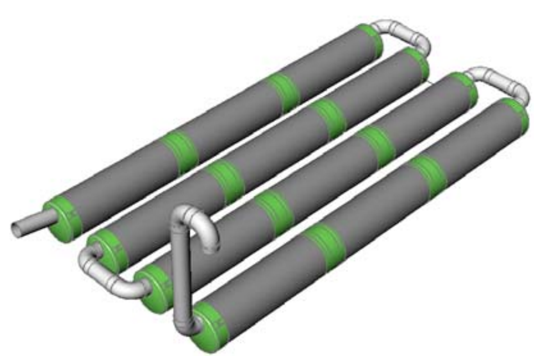
11.20 Water Purification Systems

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.

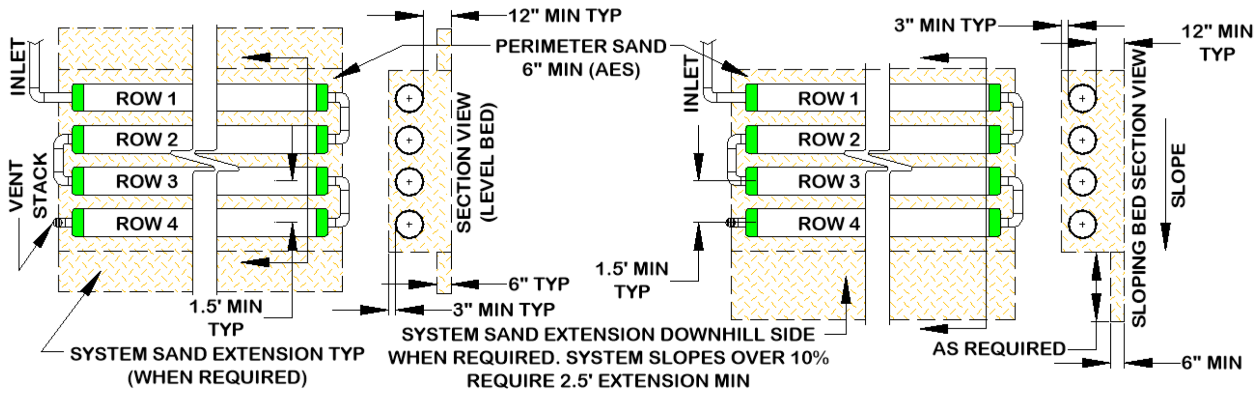
12.0 Basic Serial Distribution (Single Level)

AES 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 750 GPD or less.
b) Incorporates rows in serial distribution in a single bed.
c) Maximum length of any row is 100 ft.
d) Flow Equalizers are not required for Basic Serial systems.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Gravity fed Basic Serial systems do not require the use of a D-Box (fed directly from the septic tank).
h) Illustrations of Basic Serial Systems:



Level Beds   Sloping Beds

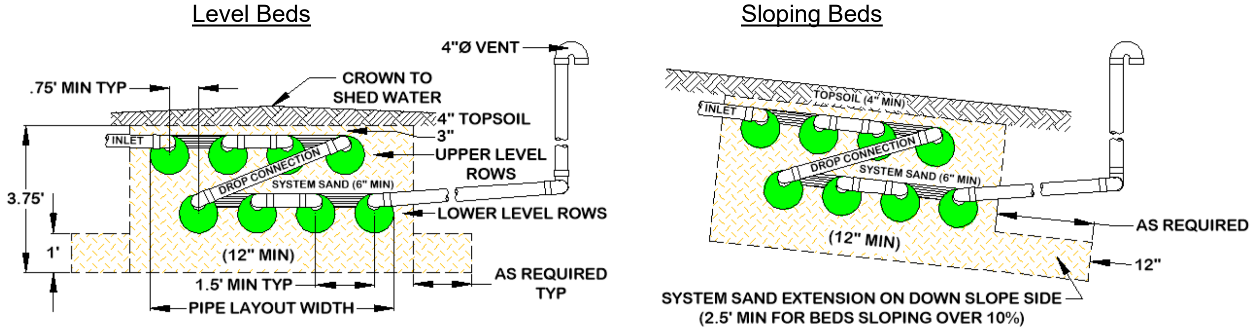


13.0 Basic Serial Distribution (Multi-Level™)

Basic Serial Multi-Level™ systems must conform to the requirements for single level basic serial systems except:

a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) When a System Sand Extension is required, it must be 12 inches thick.
d) A minimum of 6 inches of System Sand separates the Upper and Lower Level Rows.
e) Effluent is delivered first to the Upper Rows, which then connects to the Lower Level Rows by way of a Drop Connection.
f) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
g) Multi-Level™ systems are not allowed in H-20 applications.
h) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
i) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
j) System Sand extensions for Multi-Level™ systems must be 12 inches thick.
k) Illustrations of Multi-Level™ Basic Serial Systems:

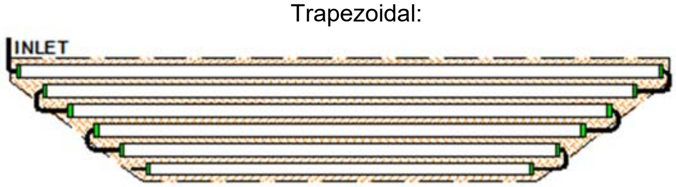
Level Beds   Sloping Beds



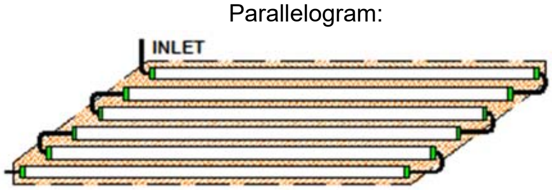
13.1 Basic Serial Configuration with Unusual Shapes:

Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

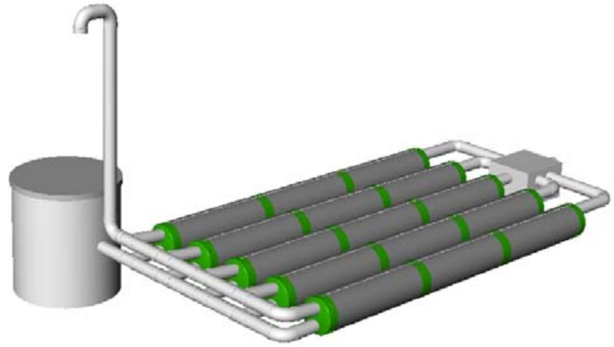
Trapezoidal:



Parallelogram:



14.0 Bottom Drain



A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-box Distribution or Combination Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation. There must be 18 inches from the bottom of the sump to the bottom of the drain. The sump should be brought above the final grade and have a locking or mechanically fastened cover.

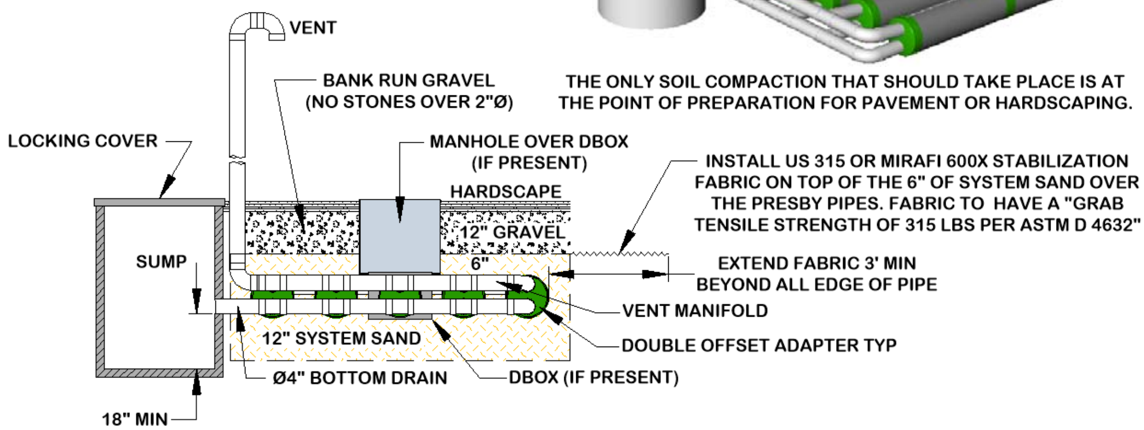
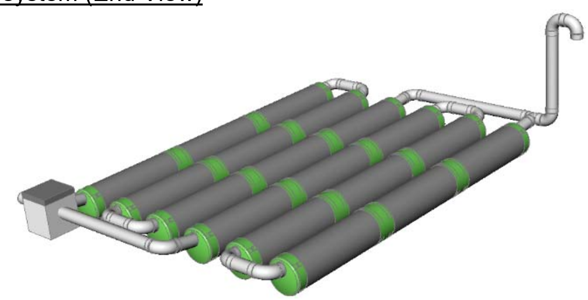


Illustration of a bottom drain used for H-20 system (End View)

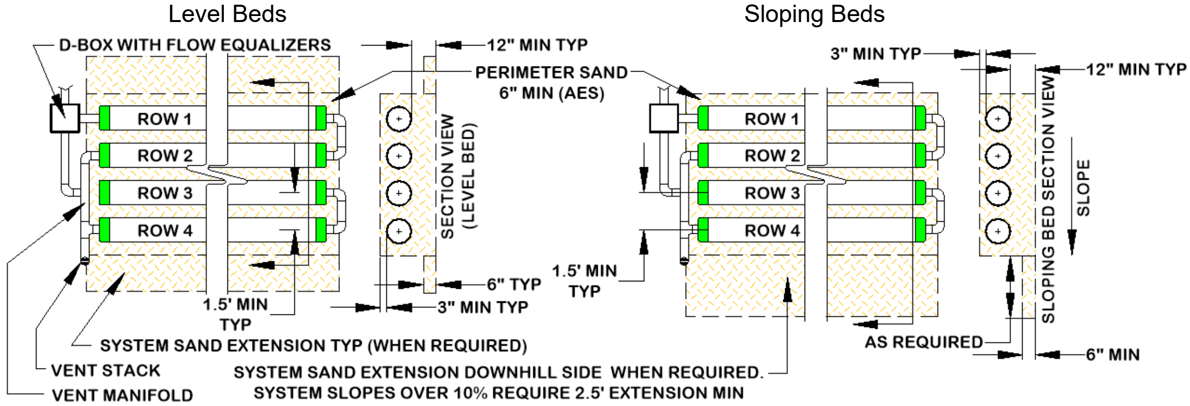
15.0 Combination Serial Distribution (Single Level)



Combination Serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 GPD. Combination Serial distribution is quick to develop a strong biomat in the first row of each section, providing improved effluent treatment. Each Combination Serial section is limited to a maximum loading of 750 gallons/day.

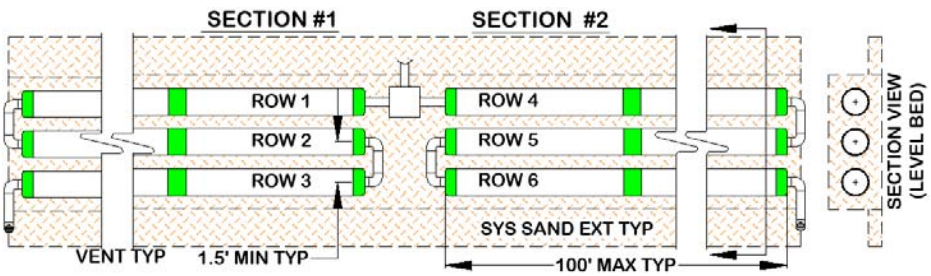
a) Combination Serial distribution consists of two or more serial sections installed in a single bed.
b) Each section in a Combination Serial system consists of a series of Presby Rows connected at the ends with raised connections, using offset adapters and PVC sewer and drain pipe.
c) Maximum length of any row is 100 ft.
d) There is no limit on the number of Combination Serial Sections within a bed.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) 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 below).
h) Combination systems require the use of an adequately sized D-Box.
i) Illustrations of Single Level Combination Serial Systems:

Level Beds | Sloping Beds



15.1 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) Serial Section loading limit is 750 GPD.
d) Beds can contain any number of serial sections.
e) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
f) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
g) Illustration of a level bed Butterfly configuration (plan view):



15.2 Section Loading

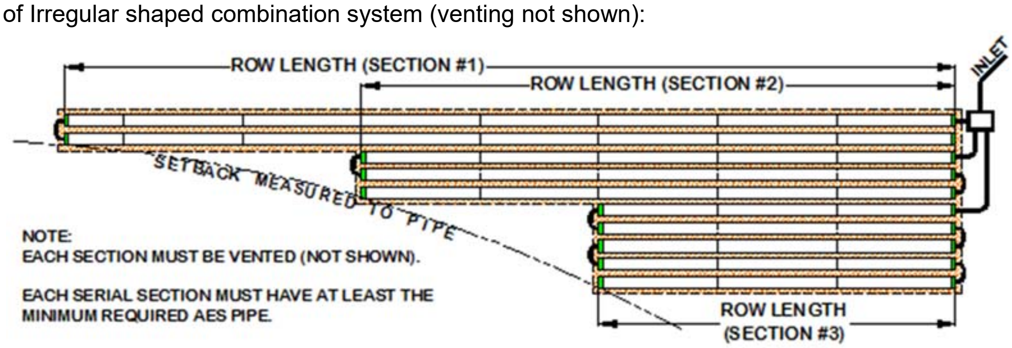
Each section in a Combination Serial system has a maximum daily design flow of 750 GPD. More than the minimum number of sections may be used. Ex: Daily design flow = 1,000 GPD requires (1,000 ÷ 750) = 1.4, use 2 sections minimum. Combination systems are only required if the daily design flow exceeds 750 GPD.

15.3 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.

15.4 Irregular Shaped Combination Serial Configuration

Illustration of Irregular shaped combination system (venting not shown):



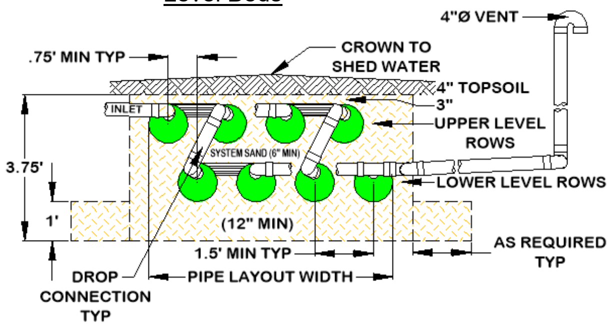
16.0 Combination Serial Distribution (Multi-Level™)

Combination Multi-Level™ systems must conform to the requirements for single level combination systems except:

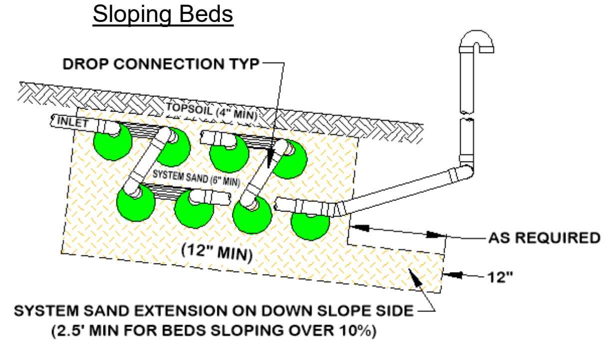
a) Row spacing 1.5 ft minimum.
b) The vent must be connected to the last row in the series on the Lower Level.
c) If a System Sand Extension is required, it must be 12 in. thick
d) Effluent must be delivered to the Upper Level Rows from the D-Box. A Drop Connection delivers effluent from the Upper Level rows to the Lower Level rows.
e) The Drop Connection must pitch downward toward the Lower Level at least 2 inches.
f) Multi-Level™ systems are not allowed in H-20 applications.
g) The ends of all serial sections on the Lower Level are manifolded and taken to a vent stack. Each serial section may be vented separately.
h) A minimum of 6 in. of System Sand separates the Upper Level Rows from the Lower Level Rows.
i) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
j) For sloping beds, any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
k) System Sand extensions for Multi-Level™ systems must be 12 inches thick.

l) Illustrations of Multi-Level™ Combination Serial Systems:

Level Beds

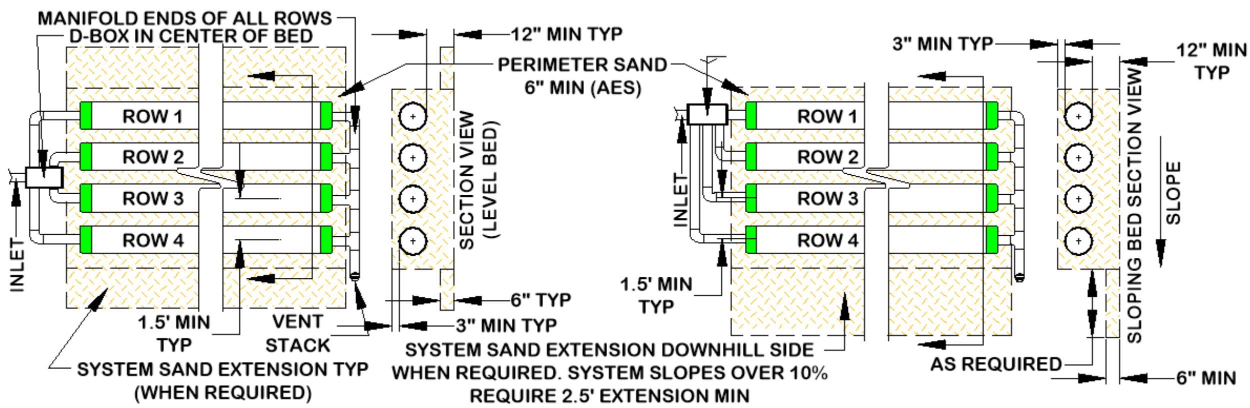


Sloping Beds



17.0 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) Place the D-Box on level, firmly compacted soil.
f) All rows must be laid level end-to-end.
g) A 2-inch minimum drop is required between the D-box outlets and the Presby Pipe inlets.
i) D-Box systems are not recommended for use in Multi-Level™ beds.
j) For level beds: any required System Sand extension is to be evenly divided and placed on both sides of the Presby pipes.
k) For sloping beds: any required System Sand extension is placed entirely on the downhill (low) side of the field. If the bed slopes over 10%, the System Sand extension must be at least 2.5 ft.
h) Illustrations for D-Box (Parallel) Distribution:



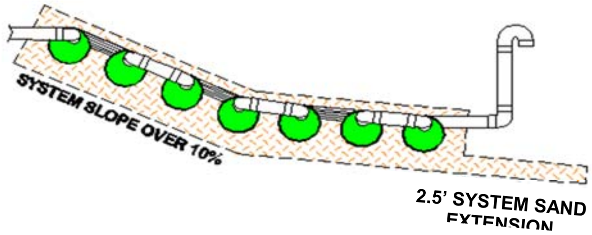
18.0 Multiple Bed Distribution

Multiple Bed distribution incorporates two or more beds (Single Level or Multi-Level™), 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 placed down slope of another. Bed separation distance is measured from pipe-to-pipe and is dependent on soil hydrology and State requirements.
e) Multi-Level™ may be used in multiple bed systems.

18.1 System Sand Extension

In systems where SSBA is greater the PLW + 1' (see para. 8.0, page 6, step #9). In systems sloping more than 10%, a 2.5 ft minimum System Sand extension is required. The System Sand extension area is placed on the down slope side of all sloping systems. For level systems, the System Sand Extension is divided equally and placed on both sides. The System Sand extension area is a minimum of 6 inches deep (12 inches for Multi-Level™ beds). For beds with multiple slopes, if any portion of the bed has a system slope greater than 10% a system sand extension is required. Illustration of bed with multiple slopes below.



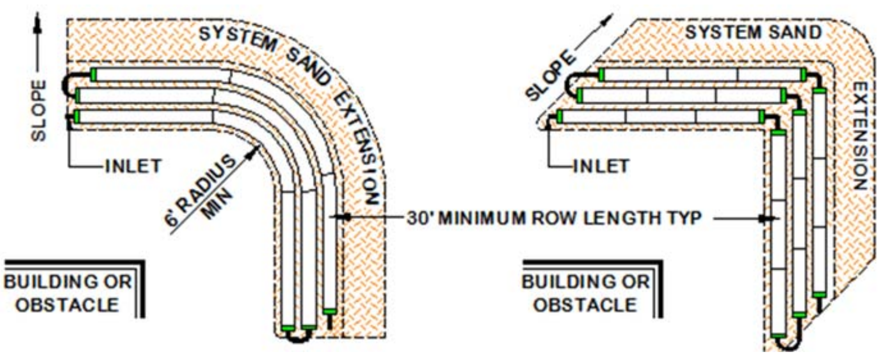
18.2 Total Linear Feet Requirement

a) Maximum row length is 100 ft.
b) Each section or bed must have at least the minimum linear feet of pipe (total feet of pipe required divided by number of sections equals the minimum number of feet required for each section or bed).
c) A section or bed may exceed the minimum linear length.
d) Rows within a section or bed may vary in length (except D-Box configurations) to accommodate site constraints.

19.0 Angled and Curving Beds

Angled configurations are used to avoid obstacles.

a) Rows should follow the contour of the site as much as possible
b) Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters
c) Row lengths are required to be a minimum of 30 ft
d) Multi-Level™ systems may take advantage of angled bed configurations.
e) Illustrations of Angled Beds:

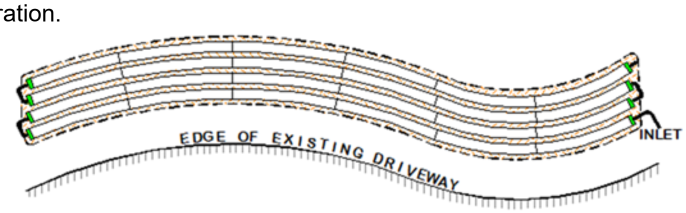


19.1 Trench Systems

Presby pipe may be installed in trench configurations on level or sloping terrain and may utilize serial, combination or parallel distribution. Trench systems may incorporate one or two rows of Presby pipe. A minimum of 12 inches below, 6 inches between and around the perimeter and 3 inches above of System Sand are required for all Presby pipes. Consult regulatory rules for required trench separation.

20.0 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.



21.0 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.

22.0 H-20 Loading

If a system is to be installed below an area that will be subjected to vehicular traffic, it must be designed and constructed as depicted below in order to protect the system from compaction and/or damage. Note that a layer of stabilization fabric is added between the System Sand and the cover material. All H-20 systems require venting. See para. 14.0 on page 16 for illustration of H-20 loading requirements.

23.0 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.

23.1 Alarm

States require all pump systems to have a high-water alarm float or sensor installed inside the pump chamber.

23.2 Differential Venting

All pump systems must use differential venting (see illustration, para. 25.2, page 21).

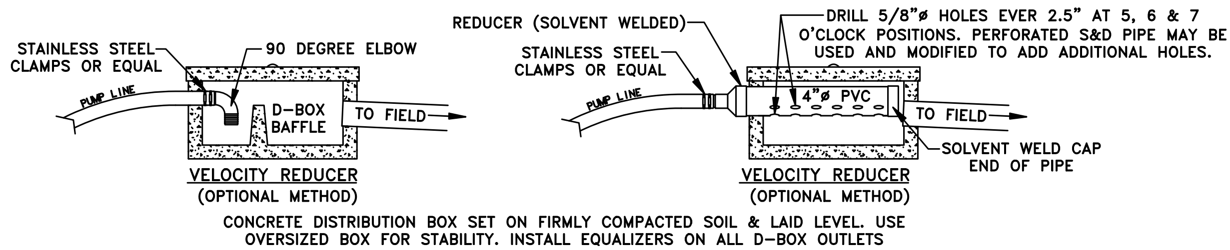
23.3 Distribution Box

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

23.4 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 (see illustrations on next page).
   Two methods of velocity reduction:



23.5 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.

23.6 Basic Serial Distribution Limit

Pumped systems with Basic Serial distribution are limited to a maximum dose rate of 40 gallons per minute and do not require the use of a flow equalizer on the D-Box outlet. Never pump directly into Presby Pipe.

23.7 Combination and Multiple-Bed Distribution Limit

All Presby Systems with Combination Serial distribution or Multiple Bed distribution must use Flow Equalizers in each distribution box outlet. 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.

24.0 System Sand and Sand Fill Requirements for All Beds

It is critical to the proper functioning of Presby Systems that the proper amount and type of System Sand be installed.

24.1 Quantity of System Sand

System Sand is placed a minimum of 12 in. below, 3 in. above and 6 in. between the Presby Rows and a minimum of 6 in. horizontally around the perimeter of the Advanced Enviro-Septic® rows.

24.2 Sand Fill

Sand fill meeting state and local requirements 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.

25.0 Venting Requirements

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

a) Pump systems must utilize Differential Venting.

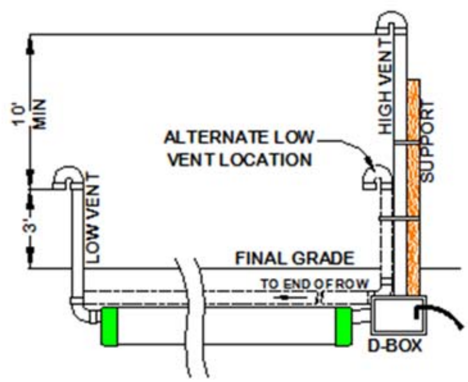
b) Vents for Multi-Level™ beds must connect to the lower level rows.

25.1 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 1 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.

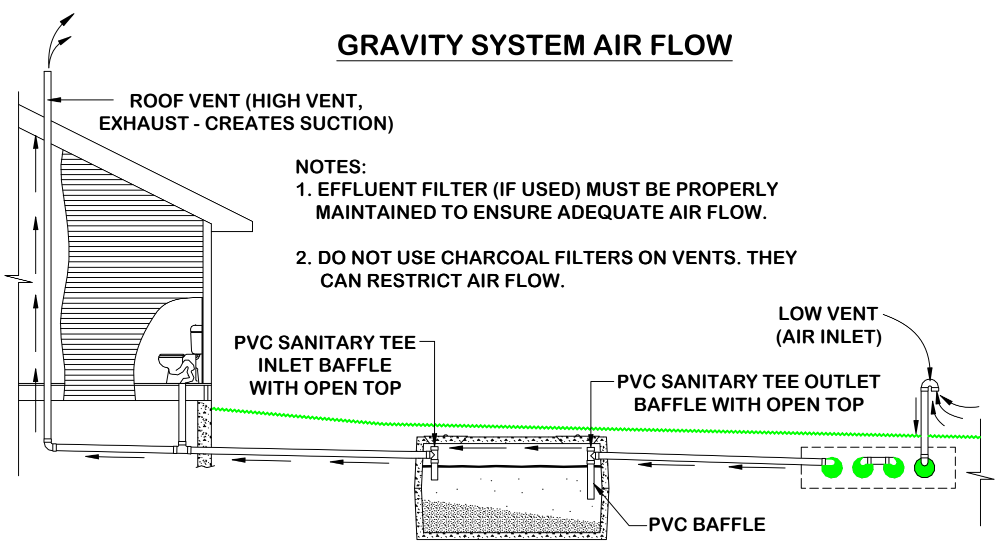
25.2 Differential Venting

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.



25.3 Vent Locations for Gravity Systems

a) 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.
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:



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

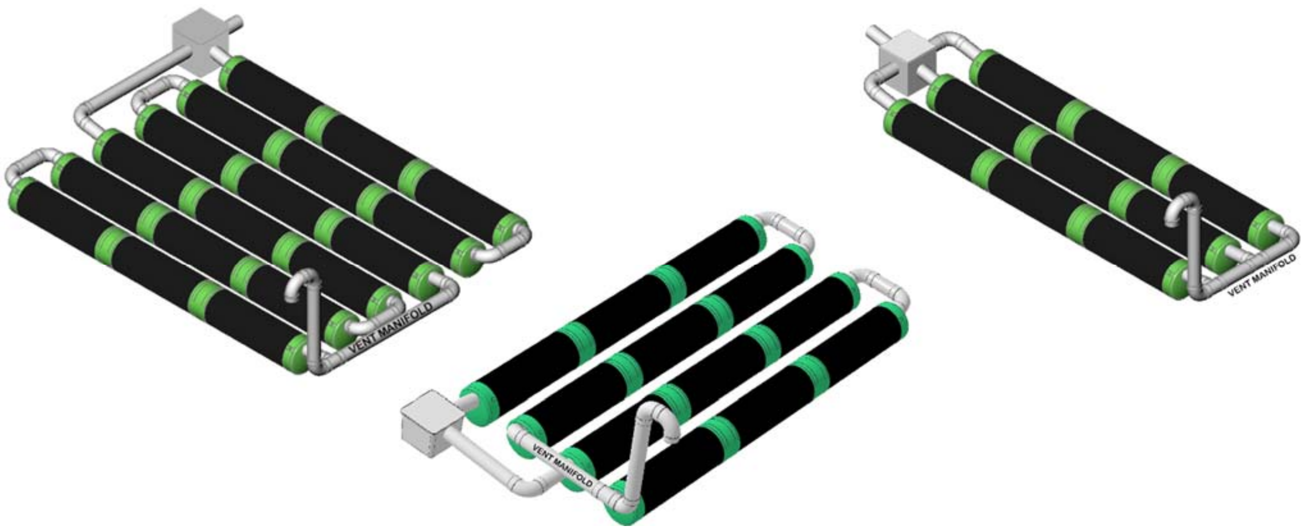
25.4 Pump System Vent Locations

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 attached to 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 and High vents may be swapped proved the distribution box is insulated against freezing in cold climates.
f) See Remote Venting (para. 25.7, page 22) and Bypass Venting (para. 25.8, page 23) for options to relocate or eliminate the High Vent.

25.5 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. Slope the lines connecting the manifold to the Presby pipes to drain condensation. See diagrams below:



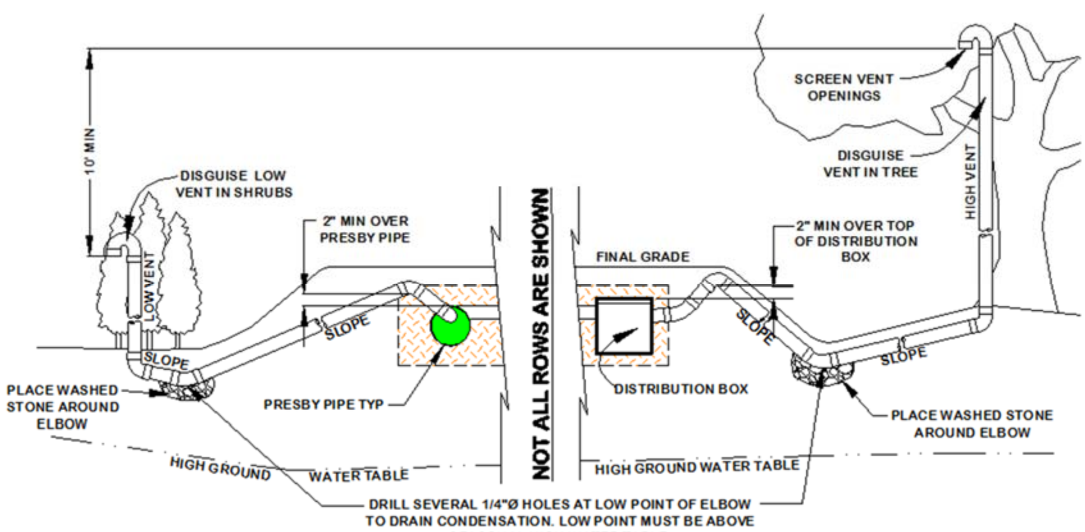
25.6 Vent Piping Slope

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

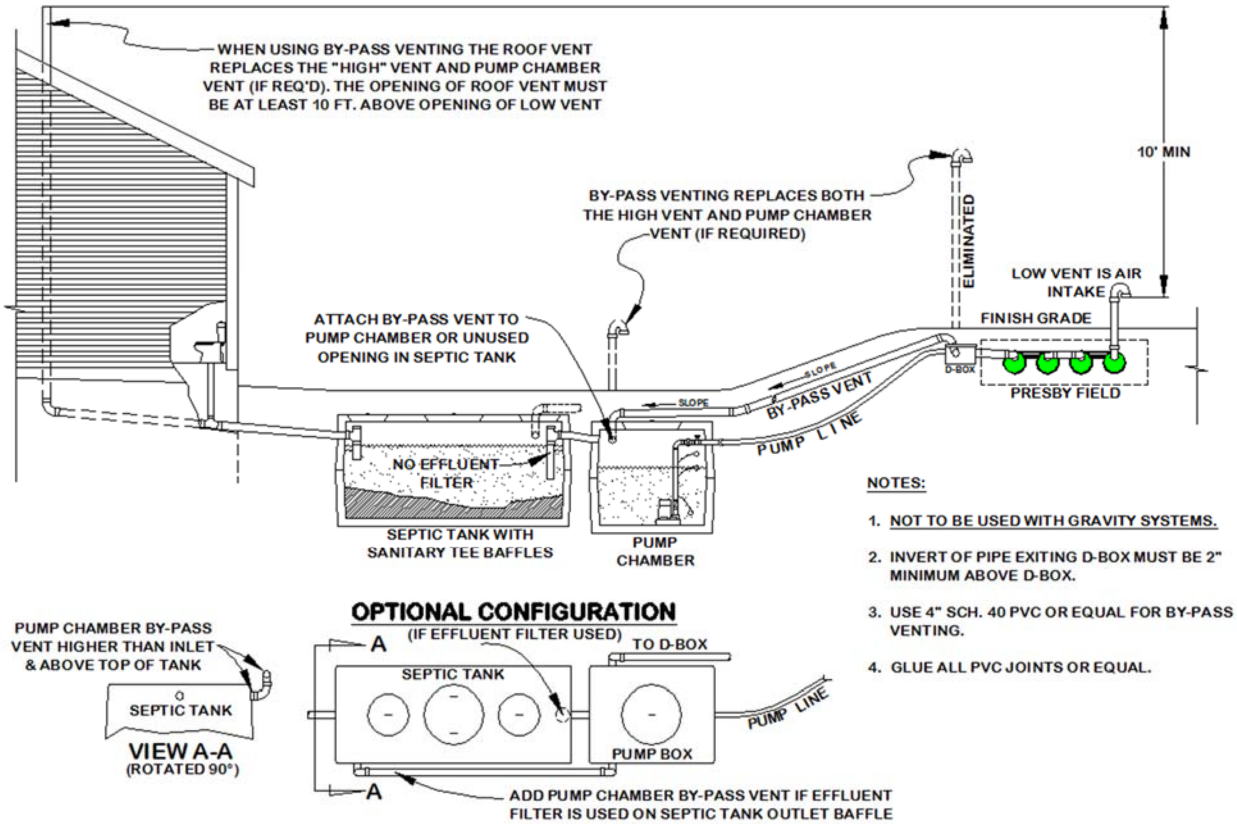
25.7 Remote Venting

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 below.)



25.8 By-Pass Venting



26.0 Site Selection

26.1 Determining Site Suitability
Refer to State or local rules regarding site suitability requirements.

26.2 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.

26.3 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.

26.4 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.

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

26.6 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.

26.7 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.

26.8 Replacement System
In the event of system malfunction, contact PEI for technical assistance prior to attempting Rejuvenation procedures. In the unlikely event that a Presby System needs to be replaced …

a) It can be reinstalled in the same location, eliminating the need for a replacement field reserve area.

b) All unsuitable material must be removed prior to replacement system construction.
c) Disposal of hazardous materials to be in accordance with State and local requirements.
d) Permits may be required for system replacement; contact the appropriate local or state agency.

27.0 Installation Requirements, Component Handling and Site Preparation

27.1 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.

27.2 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.

27.3 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.

27.4 When to Excavate

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

27.5 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.

27.6 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.

27.7 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. For elevated bed systems remove the “A” horizon (topsoil), then use an excavator or backhoe to rake furrows 2 inches – 6 inches deep into the receiving area.

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

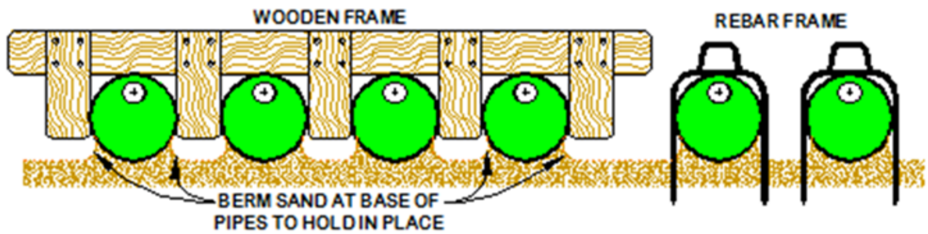
a) To protect the tilled area (System Sand bed area and System Sand extension area) from damage by precipitation, System Sand should be installed immediately after tilling.
b) Work off either end or the uphill side of the system to avoid compacting soil.
c) Keep at least 6 in. of sand between the vehicle 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 inches 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.

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

27.10 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.

27.11 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).

27.12 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. Caution: Remove all tools used as row spacers before final covering.



27.13 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. 3.7 page 4). Glue or mechanically fasten all pipe connections.

27.14 Backfilling Rows
a) Spread System Sand between the rows.
b) 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 and leave them exposed for inspection purposes.

27.15 Backfilling and Final Grading
Spread System Sand to a minimum of 3 inches over the pipe and a minimum of 6 inches beyond Presby Pipes on all four sides beyond the Presby Pipes. Spread soil material free of organics, stones over 4 inches 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 inches of cover material is placed over the Presby Pipes (H-10 Loading). 18 inches of cover material over the Presby System is required for H-20 loading (see para. 22.0, page 19).

27.16 System Soil Cover Material
A minimum of 4 inches 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.

27.17 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.

27.18 Trees and Shrubs
It is recommended that no trees or shrubs be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

28.0 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.

28.1 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 Presby System is its ability to be rejuvenated in place.

28.2 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 Presby 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.

29.0 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.

29.1 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.

30.0 Operation & Maintenance

30.1 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.

30.2 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) Antibiotics and 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

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

30.3 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.

30.4 Site Maintenance
It is important that the system site remain free of shrubs, trees, and other woody vegetation, 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.

31.0 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.

31.1 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. Each unit 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.

31.2 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 14).

31.3 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®.

31.4 Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each serial section or each row in a D-Box Distribution Configuration which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation (see illustration in para. 14.0, page 16).

31.5 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. 15.1, page 17).

31.6 Center-to-Center Row Spacing

The distance from the center of one Presby Row to the center of the adjacent row.

31.7 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).

31.8 Combination Serial Distribution

Incorporates two or more sections of Presby Pipe in a single bed, with each section receiving a maximum of 750 GPD of effluent from a distribution box. Combination Distribution is not required for daily flows of 750 GPD or less. See Combination Serial Distribution, para. 15.0, on page 16.

31.9 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).

31.10 Coupling

A plastic fitting that joins two Presby Pipe pieces in order to form rows (see para.3.3, page 3).

31.11 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 the State Rules. In general, actual daily use is expected to be one-half to two-thirds less than "daily design flow."

31.12 Differential Venting

A method of venting a Presby System utilizing high and low vents (see para. 25.2, page 21).

31.13 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. 23.4, page 20.

31.14 Drop Connection (Multi-Level™ Systems)
A drop connection is a PVC Sewer & Drain pipe configuration which is used to connect upper level rows to lower level rows in a Multi-Level™ bed. Drop connections extend 2 in. to 4 in. into the pipe and are installed with at least 2 in. of drop from the upper level row to the lower level row. All PVC joints should be glued or mechanically fastened.

31.15 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. 17.0, page 18.

31.16 End-to-End Configuration
Consists of two or more beds constructed in a line (i.e., aligned along the width of the beds).

31.17 Flow Equalizer
An adjustable plastic insert installed in the outlet pipes of a D-Box to equalize effluent distribution to each outlet.

31.18 GPD and GPM
An acronym for Gallons per Day and Gallons per Minute respectively.

31.19 High and Low Vents
Pipes used in differential venting. Detailed information about venting requirements can be found in Venting Requirements, para. 25.0, page 20.

31.20 High Strength Effluent
High strength wastewater is septic tank effluent quality with combined 30-day average carbonaceous biochemical oxygen demand (BOD5) and total suspended solids (TSS) in excess of two-hundred and forty (240) mg/L.

31.21 Manifolded Splitter Box
A PVC configuration which connects several distribution box outlets together in order to equalize effluent flow. Refer to drawing in para. 3.6, on page 3.

31.22 Multi-Level™
A Multi-Level™ System is a patented process using Presby Pipe; it consists of essentially two Presby Systems installed in the same bed with one system on top of another with 6 in. of System Sand between the two levels. Multi-Level Systems are limited to soils with a Soil Application rate of 0.6 GDP/ft² and greater.

31.23 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 para. 18.0, page 18).

31.24 Non-Conventional Configurations
Have irregular shapes or row lengths shorter than 30 ft to accommodate site constraints (see para. 13.1, page 15).

31.25 Offset Adapter
A plastic fitting with a 4-inch hole installed at the 12 o'clock position which allows for connections from one row to another and for installation of venting (see para. 3.2, page 3).

31.26 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.

31.27 Pump Systems
Utilize a pump to gain elevation in order to deliver effluent to a D-Box (see para. 23.0, page 20).

31.28 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. 3.8, page 4.

31.29 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. 27.7, page 24.

31.30 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. 11.14, page 12).

31.31 Sand Fill
Clean sand, free of organic materials and meeting the specifications set forth in Sand Fill, para. 24.2, page 20. 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.

31.32 Section / Serial Section
A group of interconnected rows receiving effluent from one distribution box outlet. Sections are limited to 750 GPD daily design flow maximum.

31.33 Serial Distribution
Two or more Presby Rows connected by a Raised Connection. Basic Serial distribution is described in detail in sections 12.0 on page 14. Combination Serial distribution is described in detail in paragraphs 15.0 and 16.0, pages 16 and 17.

31.34 Skimmer Tabs
Projections into the AES pipe that help to capture grease and suspended solids from the existing effluent (see illustration in para. 2.0, page 2).

31.35 Side-to-Side Configuration
Consist of two or more beds arranged so that the rows are parallel to one another.

31.36 Slope (3:1)
In this Manual's illustrations, slope is expressed as a ratio of run to rise. Example: A slope with a grade of (3:1) is the difference in horizontal distance of two (3) horizontal feet (run) over an elevation difference of one (1) ft (rise).

31.37 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. Example: 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).

31.38 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.

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

31.40 System Sand Bed
System Sand area required/used in Presby Systems. The System Sand bed extends a minimum of 12-inches below, 3-inches above and 6-inches horizontally from the outside edges of the Presby Pipes.

31.41 System Sand
System Sand must be clean, granular sand free of organic matter and must adhere to the Presby System Sand Specification with no more than 3% passing the #200 sieve (see complete details in para. 3.10 on page 4).

31.42 System Sand Extension Area
The System Sand extension area is a minimum of 6 in. deep for Single Level systems and 12 in. deep for Multi-Level systems. The System Sand extension is placed on the down slope side of sloping systems. System sloping more than 10% require a 2.5 ft minimum extension. The System Sand extension is measured from the tall portion of the System Sand bed (see illustration in para. 18.1, page 19).

31.43 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.

31.44 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. 23.4, page 20).

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June 1, 2010

To Whom It May Concern:

Introduction:

The following discussion summarizes my experiences with the approval and use of Presby Environmental's Enviro-Septic technology in the State of New Hampshire. Presented below are my personal observations of the System's capabilities and field performance in the State of New Hampshire over the past fourteen (14) years.

As former administrator of the Subsurface Systems Bureau of the New Hampshire Department of Environmental Services (NH DES), I was directly involved in the approval process, permitting, plan review and inspection of Enviro-Septic systems from 1995 through 2009 (please refer to attached Curriculum Vitae for details of my credentials and experience). During this time period, there were approximately 80,000 Enviro-Septic systems installed in New Hampshire; in fact, about 9 out of 10 plans for onsite wastewater treatment systems that come to the NH Subsurface Systems Bureau for approval today are for Enviro-Septic system designs. It has been my experience that when properly installed, Enviro-Septic systems have an extremely low failure rate (less than 1%) and, even after as much as 14 years in service, these systems are continuing to work as expected with only minimal required maintenance. These systems have consistently performed with a very high degree of reliability and have demonstrated superior durability and longevity. Based on the results of third-party testing (Stokes, Canada and BNQ/NSF), NH DES determined that the treatment capabilities of the Enviro-Septic system were so far superior to other alternatives that the Enviro-Septic system was approved for use with a smaller required separation distance from restrictive features than what has been granted for any other product approved for use in New Hampshire.

In my opinion, Enviro-Septic® technology is an effective and practical innovation in the field of onsite wastewater treatment technology for two primary reasons: 1) the protected biomat surface area provides for highly effective, long-term treatment of effluent, and 2) the system's hydraulic features maintain unsaturated flow conditions allowing treated wastewater to be safely dispersed into underlying native soils:

1. Effective Biomat Surface Area:

The Enviro-Septic System allows for a greater effective biomat surface area. The pipe's design features allow for controlling and protecting the development of an effective treatment biomat surface area that remains oxygenated (aerobic) and permeable. Significant additional pretreatment of septic tank effluent occurs within the pipe, where suspended solids, oils, and greases (F.O.G.) not retained in the septic tank are allowed to settle, cool down and be retained inside the pipe. Additional physical and biological removal of solids and F.O.G. is accomplished as effluent passes through the layer of green plastic fibers. The excess solids and grease are never directly deposited on the protected biomat surface area, which forms on the inner surface of the outer fabric layer.

2. Unsaturated Flow Conditions are Maintained:

The Enviro-Septic Design and Installation Manual submitted as part of Presby Environmental's application for approval in New Hampshire specifies the layout and configuration of the Enviro-Septic pipes, the amount of pipe required to provide the necessary effective biomat surface area, appropriate row spacing given slope and soil conditions, and minimum System Sand bed sizing parameters that will conservatively provide an unsaturated flow condition outside of the pipe, allowing treated wastewater to permeate gradually into the natural soil at a controlled rate that the in situ soil can accept.

This technology has been well tested in the field, having been used in the State of New Hampshire for more than 14 years. It has been my experience that with thousands of installed Enviro-Septic® onsite wastewater disposal systems, NH DES observed few if any problems when the System is installed and operated according to the Design Manual. In fact, Enviro-Septic technology has been used to replace numerous problematic onsite systems that have failed prematurely due to poor site conditions or because of high effluent mass loading rates (i.e., restaurants, laundromats, and food stores). I have personally inspected a significant number of these installations in order to monitor these systems' performance. The Enviro-Septic® systems have been observed to be functioning as intended, even on difficult sites and/or under heavier than usual wastewater strength or loading.

As NH DES staff became more experienced with the capabilities of the technology, Enviro-Septic®'s approval has been modified over the years; the required separation distance from restrictive features has been reduced, and Enviro-Septic® is now approved for use in level, sloping, and even multi-level systems. The product's literature details the following specific functional advantages of the system that NH DES was able to verify in the field: 1) Pipe allows undesirable materials such as grease and oils to settle out and be retained inside the pipe, 2) The coarse fiber mat traps solids and protects the biological mat which grows on the inside of the outer fabric, 3) System Sand remains compacted in place around the pipe regardless of system loading, so there is no silt transfer in the sand surrounding the system, 4) System provides ample storage capacity for peak flow times, and 5) A aerobic biological mat that is effective (highly efficient) and permeable develops on the inside of the fabric and fibers which surround the pipe.

Experience with Sloping Sites and Sloping Beds:

Enviro-Septic technology also has other unique operational characteristics that have led it to be widely and successfully used in the State of New Hampshire. One of these characteristics is the use of this technology on sloping sites and in sloping bed configurations.

As a result of the soil forming processes that occurred since the last glaciation period, most of New Hampshire's present day soils are glacial till. Soil forming processes over the last 10,000 to 12,000 years have resulted in a predominance of soil that typically has hardpan (restrictive) layers between 24 and 30 inches below grade. NH DES considers this hard pan layer as the apparent seasonal high water table, or in the case of bedrock, to be the restrictive design feature from which required separation distances are measured. Because of this and the fact that most of New Hampshire's topography is to some degree sloping in nature (average slope is approximately 15%), a majority of the systems designed in this State must be installed at or above grade. Because conventional onsite wastewater treatment systems such as pipe and stone leachfields have to be installed in fill and constructed on level ground, this results in excessive fills to support the system fill extensions and the required 3:1 structural side slopes necessary to support the system on slopes. Therefore, because trees and natural vegetation have to be removed to allow for the placement of these structural fills, considerable impacts are necessary to the natural landscape that are significantly larger than the footprint of the required leaching field in order to construct a conventional leaching field system.

Furthermore, the design of raised stepped stone and pipe trenches is not a feasible solution because they cannot effectively be built and stabilized in fill on slopes. As a result, the introduction of Enviro-Septic technology throughout New Hampshire has been and continues to provide a practical and effective solution for sites with sloping terrain. Enviro-Septic systems can be installed on varying slopes (up to 35%) with minimal disturbance of existing natural onsite vegetation and down gradient receiving soils.

It has been my experience that constructing Enviro-Septic systems on slopes and in sloping bed configurations has allowed designers to use the more permeable/less compacted soils found on our sloping landscapes. Because structural fill extensions are not necessary, impact to the landscape is kept to a minimum. This also results in the ability to blend a system in with the natural topography resulting in an aesthetically more pleasing design. Designers can usually configure the system using gravity distribution, resulting in a passive, less expensive treatment system for the consumer. Because Enviro-Septic systems can be constructed on sloping sites, they are less subject to flooding/ponding impacts from precipitation. Where site conditions dictate, up-slope interceptor trenches can also be constructed to make sure that surface and ground water can pass around the system. NH DES did not observe any failures due to sloping bed installations, provided they were constructed in accordance with the Design Manual and provisions were made to shed/divert up-gradient ground and surface water if necessary. Enviro-Septic Systems were not found to have problems with effluent pooling at the base of the system, nor did NH DES observe any tendency for effluent to surface or "blow out" at the base of sloping sites. This is due to the fact that the sand distributes the purified wastewater gradually and evenly, allowing it either to percolate vertically over the entire footprint of the system or to move into the preserved down gradient natural receiving soil layer.

Serial Distribution:

NH DES approved and encouraged the use of serial distribution configurations for the Enviro-Septic® system in New Hampshire. One primary benefit of the use of serial distribution is that it eliminates the need for a distribution box. My experience has been that distribution boxes typically are found in the field to be out-of-level or not functioning as designed. The use of serial distribution also guarantees air flow and therefore aerobic conditions will be promoted throughout the entire system.

When serial distribution is employed, the first row of the system quickly develops an active aerobic biomat on the inside of the fabric and fibers. The liquid level in the first row can only reach a depth of approximately 0.58' or 7" before it will overflow into the next line, and so on if necessary. Aerobic conditions are continuously maintained in an Enviro-Septic System due to the fact that oxygen continues to circulate through the head space remaining in the pipe and then into the specified sand that surrounds the pipe. Because the sand acts like the respiratory system of the AES System, the developed high rate biomat formed on the inside of the fabric surrounding the pipe stays permeable and operating in an aerobic manner. Once the LTAR (Long Term Acceptance Rate) of the biomat has been reached additional sewage flow will then travel to the next line in series. This is a key operational factor that separates the Enviro-Septic system from other conventional leaching systems and is another reason the system has been used so successfully in the State of New Hampshire.

Purpose of System Sand:

As mentioned in the discussion of serial distribution above, the use of specified sand that surrounds the pipes on all sides is essential to the proper functioning of the system. It is crucial to providing the required oxygen/gas exchange necessary to provide aerobic conditions that support the biomat that develops on the inside of the fabric that surrounds the pipes. The sand is the conduit for oxygen that travels in the head space of the pipe due to air flow (draft) from the low vent at the end of the system, through the system, and out the building plumbing vent (roof vent). System sand also provides storage capacity for treated wastewater as it infiltrates into the underlying soils.

The specified sand also provides a capillary effect which helps to move treated wastewater away from the pipes. While the majority of treatment and contaminant reduction occurs as a result of passing through the developed biomat found on the inside of the fabric, some additional polishing of purified wastewater released from the Enviro-Septic pipes occurs in the sand. Specifically phosphorus can be adsorbed and some additional bacteria and virus removal has been found to occur. Presby Environmental provided reports of third-party testing which proved that Enviro-Septic technology was consistently able to produce effluent quality that meets if not exceeds EPA Tertiary guidelines. In other words, the aerobic biomat located on the inside of the pipe has been found to be consistently doing what it was designed to accomplish. Furthermore, after observing dozens of actively functioning Enviro-Septic systems, there is no visible evidence of any type of secondary biomat (which would indicate additional treatment occurring) being developed in the sand or at the sand/soil interface.

Conclusion:

Presby Environmental, Inc. has become an industry leader in the State of New Hampshire, providing an unprecedented level of quality control, technical support, training for industry professionals and customer assistance. Their products (Enviro-Septic and the new Advanced Enviro-Septic) provide a cost-effective alternative onsite system with unique design features that adapt to a site's terrain. These systems are more protective of the environment due to the high level of treatment provided. Presby Environmental has also shown a commitment to ongoing research and product development in an effort to make an effective product even better.

In my opinion, Enviro-Septic's superficial resemblance to leaching system products which only provide dispersal of septic tank effluent and rely on the soil to provide treatment has been misleading to some regulators, industry professionals and consumers. Enviro-Septic has been proven to provide exceptional treatment (consistently meeting US EPA Tertiary standards or better) while also providing efficient dispersal via non-mechanical processes. The fact that the system is releasing highly treated wastewater from the pipes means that the system is not subject to progressive failure; the underlying soils are preserved, maintaining their ability to accept treated wastewater. This eliminates the need for a replacement area with the AES / ES system, extends system longevity, and reduces any possibility of discharge or surfacing of inadequately treated wastewater. The system's simplicity means there is little to go wrong; no replacement parts or media are ever needed, and since there is virtually no maintenance other than pumping the septic tank, the system is not compromised by non-compliance with maintenance procedures. Once the system is properly installed, there is minimal expense to the owner to operate and maintain it in order to ensure proper functioning.

In conclusion, I feel Enviro-Septic® technology is an effective and practical innovation in the field of onsite wastewater treatment technology; it has provided a superior onsite wastewater treatment alternative which has greatly benefited the State of New Hampshire, its citizens and its environment. As a former regulator, I can attest to the fact that the availability of a smaller, less expensive, longer-lasting onsite wastewater treatment system has encouraged the replacement of failed or failing systems that jeopardize the soils, surface waters and ground waters in their vicinity.

Sincerely,

William E. Evans

William Evans, P.E.