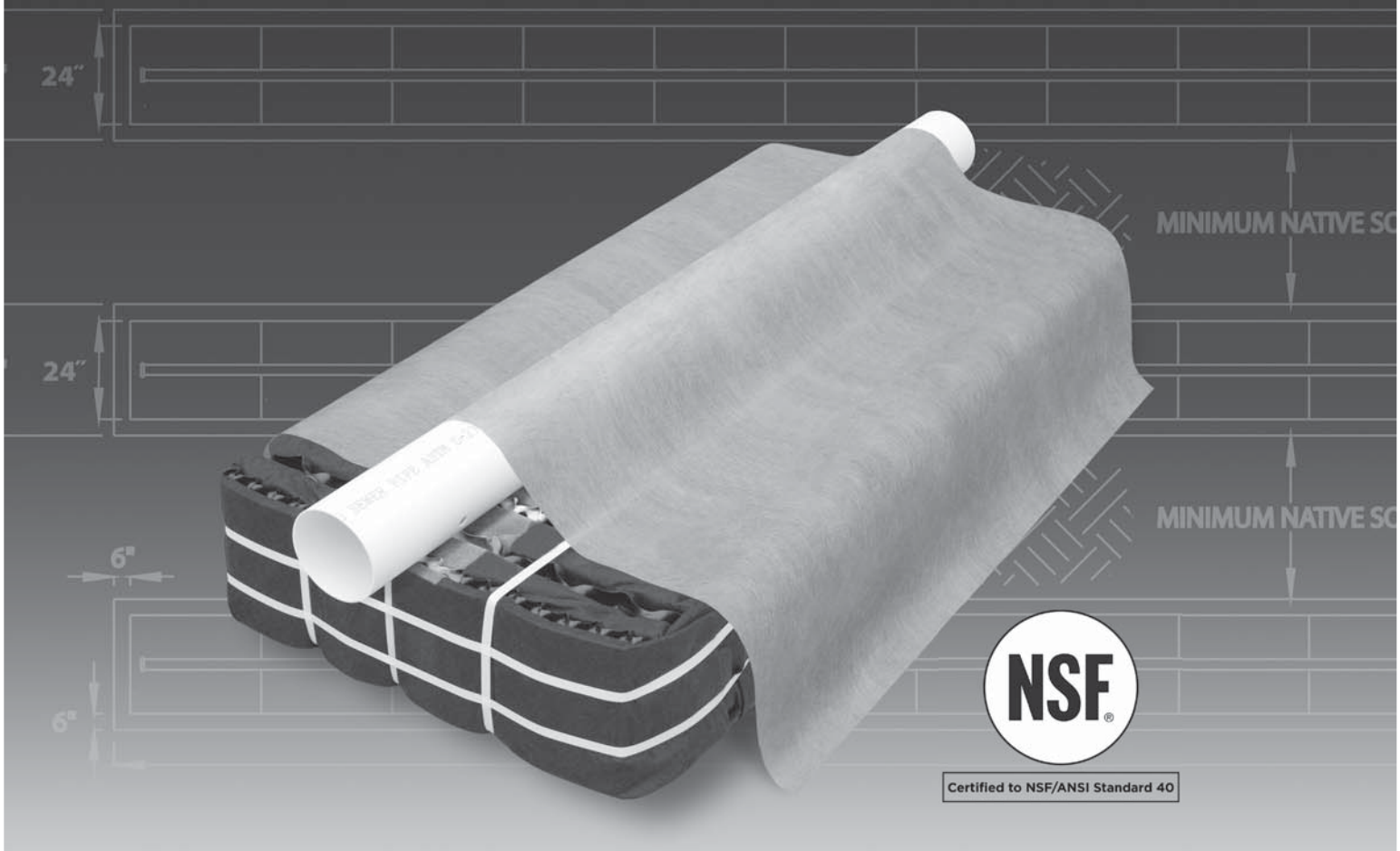
GSF®

Geotextile Sand Filter

Iowa
Design & Installation Manual



eljen CORPORATION

Innovative Environmental Products & Solutions Since 1970

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Glossary of Terms

A42 Module 48” x 24” x 7” (L x W x H)

Cover Fabric The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.

Design Flow The estimated peak flow that is used to size a GSF system is 150 gallons per day per Bedroom.

GSF The Eljen Geotextile Sand Filter Modules and the 12-inch sand layer at the base and 18 inches along the sides of the modules.

GSF Module The individual module of a GSF system. The module is comprised of a cuspated plastic core and corrugated geotextile fabric.

Specified Sand To ensure proper system operation, the system MUST be installed using ASTM C33 Sand.

ASTM C33 sand will have less than 10% passing the #100 Sieve and less than 5% passing the # 200 sieve. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS

ASTM C33 SAND SPECIFICATION		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
3/8 inch	9.52 mm	100
No. 4	4.76 mm	95 - 100
No. 8	2.38 mm	80 - 100
No. 16	1.19 mm	50 - 85
No. 30	590 µm	25 - 60
No. 50	297 µm	5 - 30
No. 100	149 µm	0 - 10
No. 200	75 µm	0 - 5

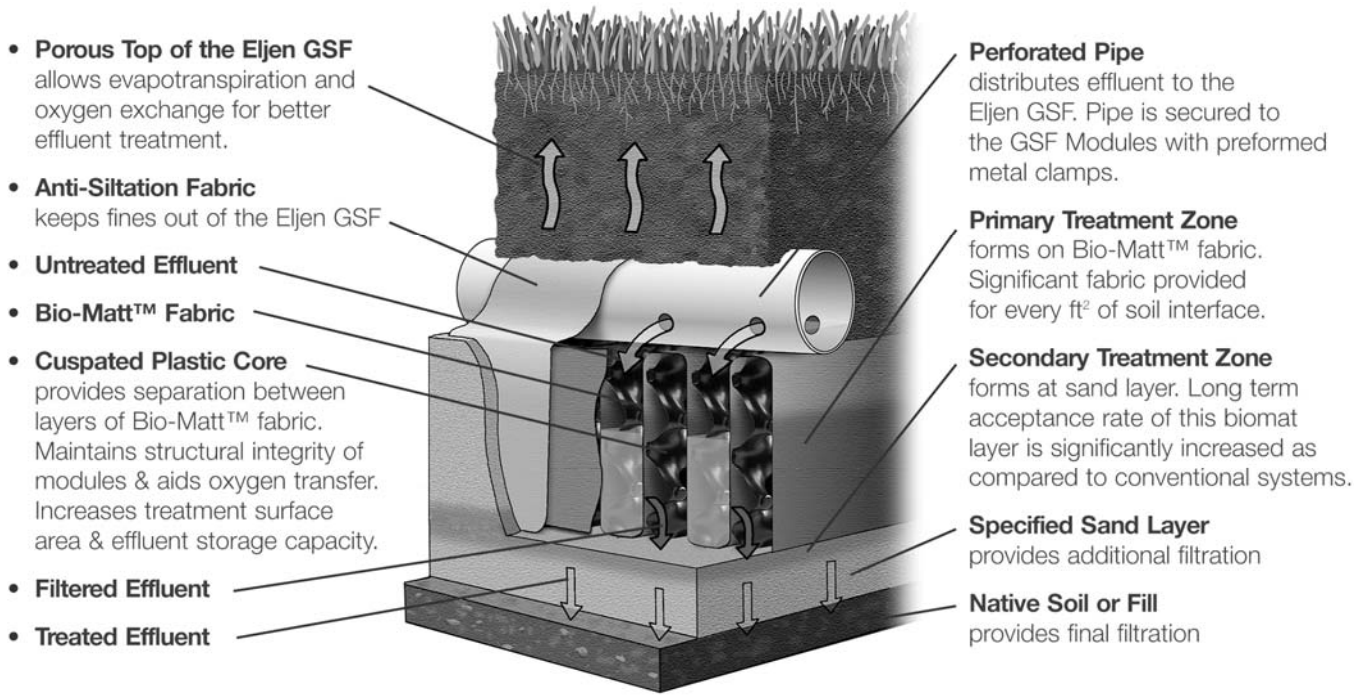
Primary Treatment Zone

- Perforated pipe is centered above the GSF module to distribute septic effluent over and into corrugations created by the cuspated core of the geotextile module.
- Septic effluent is filtered through the Bio-Matt fabric. The module's unique design provides increased surface area for biological treatment that greatly exceeds the module's footprint.
- Open air channels within the module support aerobic bacterial growth on the modules geotextile fabric interface, surpassing the surface area required for traditional absorption systems.
- An anti-siltation geotextile fabric covers the top and sides of the GSF module and protects the Specified Sand and soil from clogging, while maintaining effluent storage within the module.

Secondary Treatment Zone

- Effluent drips into the Specified Sand layer and supports unsaturated flow into the native soil. This Specified Sand/soil interface maintains soil structure, thereby maximizing the available absorption interface in the native soil. The Specified Sand supports nitrification of the effluent, which reduces oxygen demand in the soil, thus minimizing soil clogging from anaerobic bacteria.
- The Specified Sand layer also protects the soil from compaction and helps maintain cracks and crevices in the soil. This preserves the soil's natural infiltration capacity, which is especially important in finer textured soils, where these large channels are critical for long-term performance.
- Native soil provides final filtration and allows for groundwater recharge.

FIGURE 1: GSF SYSTEM OPERATION



GSF Modules were subjected to independent third-party testing in accordance with NSF/ANSI Standard 40 Protocol. Three different methods of distribution were tested:

- Pressure Distribution
- Lift Pump/Gravity Demand Dosed Distribution
- Gravity Distribution

The data and detailed reports for each system tested were reviewed by NSF in accordance with NSF/ANSI Standard 40 Protocol and the Pennsylvania Department of Environmental Protection Technical Verification Program. This independent review validates the performance data listed below for Demand Dosed, Pressure Dosed, and Gravity systems.

Testing Arrangement & Common Factors:

Common Factors for all tested systems listed in Table 2:

- A42 modules: (L x W x H) 48" x 24" x 7" plus Specified Sand.
- Six modules per bedroom at 150 gal/day, 18 modules total for three bedrooms per house equals 450 gal/day.
- Standard distribution pipe with orifices at the 4 & 8 o'clock position,
- 12 inches of Specified Sand base extending 6 inches at either edge of the modules.

Lift Pump/Gravity Demand Dosed System:

- 1000 gal septic tank – 500 gallon pump chamber to distribution box.
- Dial-a-flow fittings set level to deliver effluent into each of the three rows of laterals via a 4-inch perforated distribution pipe with orifices at the 4 & 8 o'clock position.
- A non-perforated pipe connects the distal end to the end of other rows.

Time Pressure Dosed System:

- 1000 gal septic tank – 500 gal pump chamber – 1.25" low-pressure pipe (LPP) or other diameter as required.
- LPP placed inside a 4-inch perforated distribution pipe with orifices at 12 o' clock, at least one drain hole per line at 6 o'clock.
- The 4-inch perforated pipe orifices are placed at the 4 & 8 o'clock positions with the end of pipe capped

Gravity System Trench Design:

- 1000 gal septic tank–gravity to distribution box.
- Dial-a-flow fittings set level to deliver influent into three individual trenches.
- Perforated distribution pipe with orifices at the 4 & 8 o'clock positions with the end of pipe capped.

TABLE 2: TESTING RESULTS

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Demand Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2	2.7
Median	1	2.5
Min Value	1	2.5
Max Value	7.2	7

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 190 mg/L

Timed Pressure Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2.6	2.7
Median	2.2	2.5
Min Value	1	2.5
Max Value	14	9

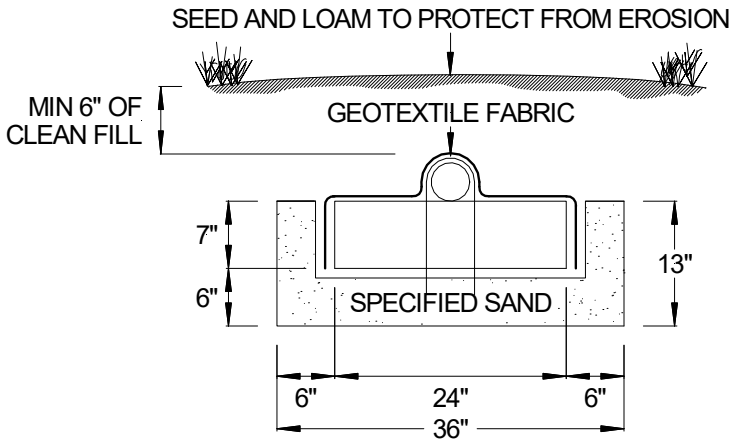
GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Gravity

	CBOD (mg/L)	TSS (mg/L)
Mean	8	7.4
Median	7.6	5
Min Value	1	2.5
Max Value	18	55

TSS 2.5mg/L = sample was below detection limits
CBOD 1.0mg/L = sample was below detection

FIGURE 2: TYPICAL A42 GSF CROSS SECTION



A42 MODULE (L x W x H) 48" x 24" x 7"

All Systems are Required to Have a Minimum of:

- 6 inches of Specified Sand is at the edges of the GSF module.
- 6 inches of Specified Sand is at the beginning and end of each GSF Trench.
- 6 inches of Specified Sand is directly below the GSF module.
- Minimum 6 inches of native soil fill above the distribution pipe.

1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The Chapter 69 of the Iowa Regulations, Private Sewage Disposal Systems and the local regulations will be referred to as the *guidelines*.

The sizing charts apply to residential systems only and are found in section 1.16. Please contact Eljen's Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

1.2 SPECIFIED SAND SPECIFICATION FOR GSF SYSTEMS: The sand immediately under, between rows and around the perimeter of the GSF system must meet ***ASTM C33 SPECIFICATIONS, WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 3% PASSING A #200 SIEVE.*** Please place a prominent note to this effect on each design drawing. See Table 1 for more information on the sand and sieve specifications.

1.3 CONNECTIONS AND FITTINGS: Connections of lines to tanks and distribution boxes must be made using watertight mechanical seals. Use of any grouting material is not permitted.

1.4 PLACING GSF MODULES: The "White Stripe" on the GSF modules indicates the top of the module and is not intended to indicate the location of the distribution pipe. With the white stripe facing up, all rows of GSF modules are set level, end to end on the Specified Sand layer. No mechanical connection is required between modules.

1.5 DISTRIBUTION PIPE: SDR-35 or equivalent is required. Place perforated pipe on top of GSF modules with holes at 4 and 8 o'clock. Secure pipe to GSF modules with provided wire clamps, one clamp per Eljen module. Furthermore, all piping must meet state and local regulations.

1.6 COVER FABRIC: Geotextile cover fabric is provided by Eljen Corporation for all GSF systems. It is placed over the top and sides of the module rows to prevent long term siltation and failure. **Cover fabric substitution is not allowed.** Fabric should drape vertically over the pipe and must *not* block holes in the distribution pipe or be stretched from the top of the pipe to the outside edge of the modules. "Tenting" will cause undue stress on fabric and pipe.

1.7 BACKFILL & FINISH GRADING: Complete backfill with a minimum of 6 inches of clean porous fill measured from the top of the distribution pipe. Backfill exceeding 18 inches requires venting at the far end of the trench. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff from the Effluent Disposal Area, (EDA). Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

1.8 ADDITIONAL FACTORS EFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water usage may consider increasing the septic tank volume as well as incorporating a multiple compartment septic tank. Consideration for disposal area may be up-sized for expected higher than normal water use.

For example:

- Luxury homes, homes with a Jacuzzi style tubs, and other high use fixtures.
- Homes with known higher than normal occupancy.

1.9 GARBAGE DISPOSALS: The use of a garbage disposal is not recommended as they can cause septic system problems by generating an increased amount of suspended solids, grease and nutrients.

However, if such units are proposed to be used, other measures should be taken to mitigate the increased nutrients to the field.

NOTE: Eljen requires the use of septic tank outlet effluent filters on all systems. Filters with higher filtration are recommended for systems with garbage disposals.

1.10 SEPTIC TANKS: Many designers are now specifying dual compartment tanks for all their systems. Eljen supports this practice as it helps to promote long system life by reducing TSS and BOD to the effluent disposal area. Gas baffles and/or effluent filters are also recommended.

1.11 SEPTIC TANK FILTERS: Wastewater filters are strongly recommended as a means of preventing solids from leaving the tank and entering your system. Filter manufactures require that filters be cleaned from time to time. Ask your installer or designer for specific cleaning requirements based on the type or make of the filter installed. Eljen requires the septic tank to be pumped every three years or as needed which would be a good time to check and conduct filter maintenance.

1.12 SYSTEM VENTING: It is strongly recommended to vent all systems that are over 18” below finished grade and systems beneath any surface condition that would not allow for surface air exchange with the system such as patios. See Section 8.0 for a more detailed explanation of venting GSF products.

1.13 VERTICAL SEPARATION TO GROUND WATER OR LIMITING LAYER: Separation distance from the bottom of the unit to the seasonal high groundwater level, bedrock, hardpan or other confining layer, but under no circumstances shall this vertical separation be less than 3 feet.

1.14 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of six (6) A42 modules per bedroom. See Section 1.16 for more information on systems sizing.

1.15 BED SYSTEMS: Absorption beds may only be used when site space restrictions require and shall not be used when the soil percolation rate exceeds 30 min./inch.

1.16 SIZING GSF SYSTEM FOR TRENCHES, BEDS & SAND MOUNDS: Tables 4 and 5 reflect reductions and upsizing for trenches and beds.

TABLE 3: SQUARE FOOT PER MODULE WHEN INSTALLED IN A TRENCH

SQUARE FOOT PER MODULE	
A42	26.6

TABLE 4: LOADING RATES FOR DETERMINING BOTTOM ABSORPTION AREA AND ABSORPTION RATIOS USING PERCOLATION TESTS

Percolation Rate (Minutes per Inch)	Pretreated Effluent BOD5 ≤ 30 mg/L TSS ≤ 30 mg/L (gals/sq ft/day)
0 to 5	1.6
Fine Sands	0.9
6 to 10	1.2
11 to 29	0.9
30 to 45	0.7
46 to 60	0.5
61 to 120	0.3
Greater than 120	0.0

TABLE 5: MAXIMUM SOIL LOADING RATES BASED UPON SOIL EVALUATIONS IN GALLONS PER SQUARE FOOT PER DAY

Soil Texture	Single Grain	Massive	Structure Granular, Blocky or Prismatic			Platy	
			Weak	Moderate	Strong	Weak	Moderate to Strong
Coarse sand and gravel	1.6		1.6			1.6	
Medium sands	1.4		1.4			1.4	
Fine sands	0.9		0.9			0.9	
Very fine sands*	0.5		0.5			0.5	
Sandy loam		0.5	0.7	1.1	1.2	0.6	0.5
Loam		0.6	0.7	0.8	0.8	0.6	0.5
Silty loam		NS	0.6	0.8	0.8	0.5	0.3
Clay loam		NS	0.3	0.7	0.7	0.2	0.2
Silty clay loam		NS	0.3	0.7	0.7	NS	NS

NS - Not Suitable for soil absoprtion

* Flow rates are difficult to determine for some very fine sands; experience may provide better information and flow rates

TABLE 6: MAXIMUM LENGTH OF ABSORPTION TRENCHES IN FEET**

Soil Loading Rate (gal/ft^2)	2 Bedroom 300 gal.	3 Bedroom 450 gal.	4 Bedroom 600 gal.	5 Bedroom 750 gal.	6 Bedroom 900 gal.
0.1	Not suitable for Soil Absoprtion Trenches				
0.2	500	750	1000*	1250*	1500*
0.3	333	500	666	833*	1000*
0.4	250	375	500	625	750
0.5	200	300	400	500	600
0.6	167	250	333	417	500
0.7	143	214	286	357	429
0.8	125	188	250	312	375
0.9	111	167	222	278	333
1.0	100	150	200	250	300
1.1	91	136	182	227	273
1.2	84	125	167	208	250

* Requires pressure distribution

** All trenches use A42s and are installed in three (3) foot wide trench

TABLE 7: SLOPE CORRECTION FACTORS

Slope Correction Factors		
Slope %	Down Slope	Up Slope
2	1.06	0.94
3	1.1	0.915
4	1.14	0.89
5	1.18	0.875
6	1.22	0.85
7	1.27	0.83
8	1.32	0.81
9	1.37	0.79
10	1.43	0.77
11	1.49	0.75
12	1.56	0.735
13	1.64	0.72
14	1.72	0.705
15	1.82	0.69
16	1.92	0.675
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.5	0.625

TABLE 8: MOUND BASAL AND LINEAR LOADING RATES

				Hydraulic linear loading rate, gal/d/ft		
				Slope		
Soil Characteristics				2-4%	5-9%	>10%
Texture	Structure			Infiltration distance, inch	Infiltration distance, inch	Infiltration distance, inch
	Shape	Grade	<30 mg/L	24-28	24-28	24-28
COARSE SAND, SAND, LOAMY COARSE SAND, LOAMY SAND	--	0SG	1.6	6.0	7.0	8.0
FINE SAND, VERY FINE SAND, LOAMY FINE SAND, LOAMY VERY FINE SAND	--	0SG	1.0	5.5	6.0	7.0
COARSE SANDY LOAM, SANDY LOAM	--	0M	0.6	4.0	4.6	7.0
	PL	1	0.5	4.0	4.6	6.0
		2, 3	0.0	-	-	-
	PR/BK/GR	1	0.7	5.5	6.0	7.0
		2, 3	1.0	5.5	6.0	7.0
FINE SANDY LOAM, VERY FINE SANDY LOAM	--	0M	0.5	2.6	3.0	3.7
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.6	4.0	4.3	4.6
		2, 3	0.8	4.3	4.6	4.9
LOAM	--	0M	0.5	2.6	3.0	3.7
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.6	4.0	4.3	4.6
		2, 3	0.8	4.3	4.6	4.9
SILT LOAM	--	0M	0.2	3.0	3.2	3.4
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.6	3.0	3.3	4.0
		2, 3	0.8	3.3	4.0	4.3
SANDY CLAY LOAM, CLAY LOAM, SILTY CLAY LOAM	--	0M	0.0	-	-	-
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.3	3.0	3.2	3.4
		2, 3	0.6	3.4	3.3	4.0
SANDY CLAY, CLAY, SILTY CLAY	--	0M	0.0	-	-	-
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.0	-	-	-
		2, 3	0.3	3.0	3.2	3.4

Trench Example:

House size:	3 Bedrooms
Design Flow:	450 gpd
Soil Evaluation:	Loam with weak platy structure
Absorption Field Type:	Trench

Calculate Minimum Absorption Area

Lookup loading rate from Table 5 and determine the application rate:

Soil Texture	Single Grain	Massive	Structure Granular, Blocky or Prismatic			Platy	
			Weak	Moderate	Strong	Weak	Moderate to Strong
Loam		0.6	0.7	0.8	0.8	0.6	0.5

Absorption Area: Design Flow ÷ Loading Rate

450 gpd ÷ 0.6 gpd / ft^2 = 750.0 ft^2

Calculate Number of Modules Required

SQUARE FOOT PER MODULE	
A42	26.6

Number of units required = Absorption Area ÷ Square Foot Per Module

A42 units required

750 ft^2 ÷ 26.6 ft^2 / module =	28.2 Modules
Round to:	29 A42 Modules

Calculate Minimum Trench Length

A42: 29 Units x 4 ft/unit = 116 linear ft

Trench Width

A42: 3 ft

Final Dimension Layout

(Note: System layout and number of rows will vary based on site constraints)

A42

Min. Product Length	116 ft
(note: 6 inches sand required at each end of trench which makes the minimum trench length 117 ft)	
Trench Width	3 ft
Minimum Number of Units	29 A42 Modules
Min. System Area	351 ft^2

FIGURE 3: PLAN VIEW – A42 MODULES – TRENCH SYSTEM

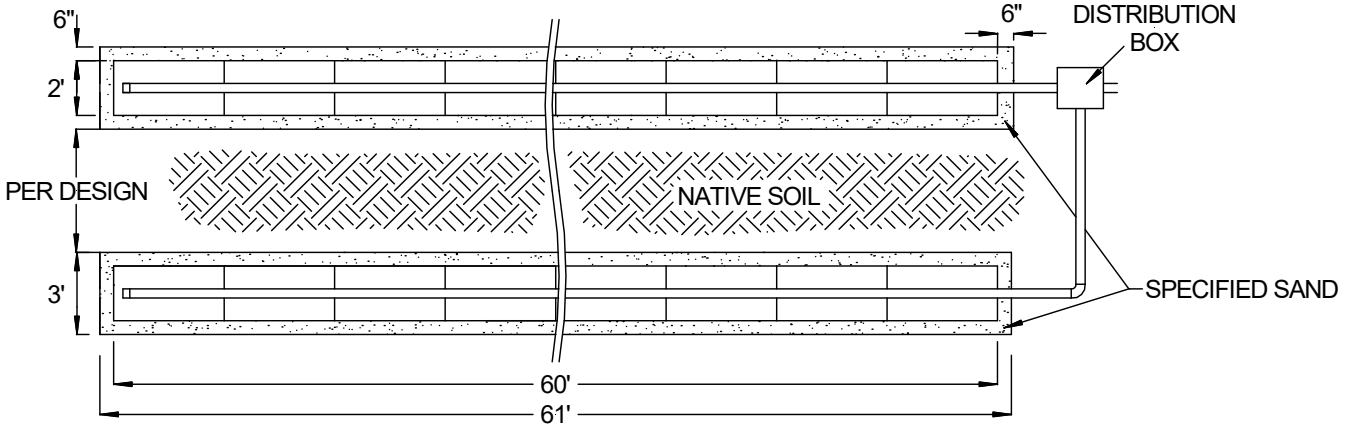


FIGURE 4: SECTION VIEW – A42 MODULES – TRENCH SYSTEM – LEVEL SITE

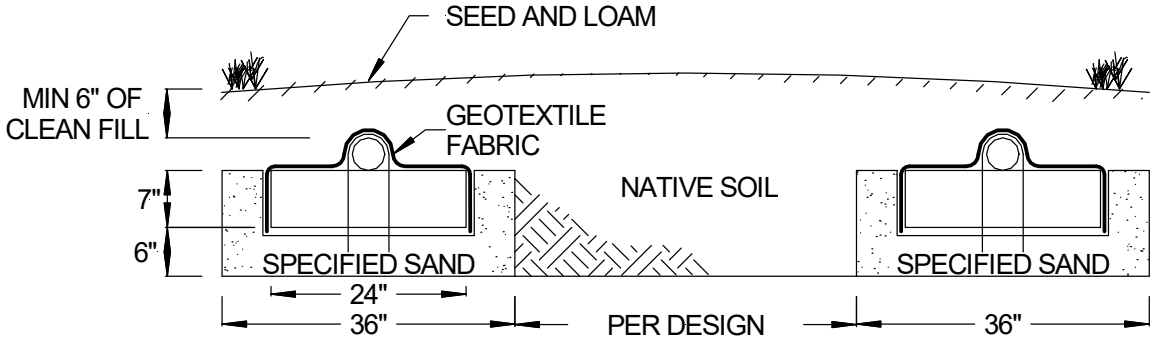
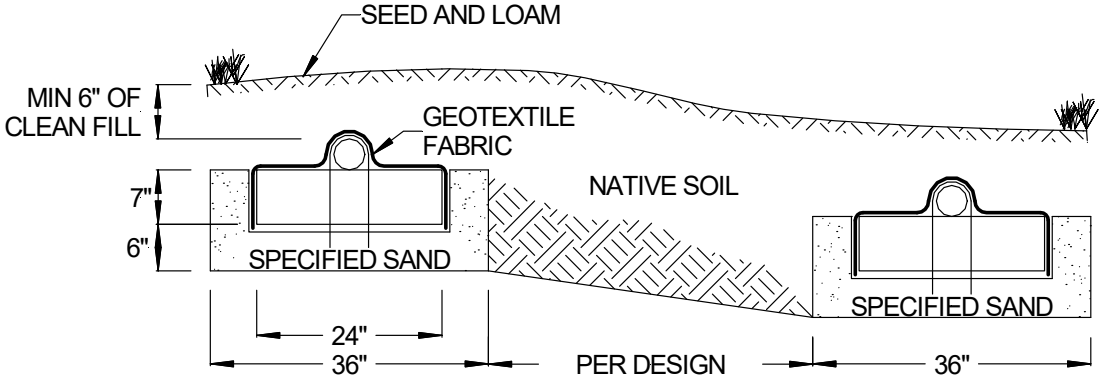


FIGURE 5: SECTION VIEW – A42 MODULES – TRENCH SYSTEM – SLOPING SITE



2.1 Trench Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the number of GSF Modules required using the trench sizing example.

3. Prepare the site. Do not install a system I n saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Excavate the trench; scarify the receiving layer to maximize the interface between the native soil and specified sand.

6. Minimize walking in the trench prior to placement of the specified sand to avoid soil compaction.

7. Place specified sand in a 6" lift, stabilize by foot, a hand held tamping tool or a portable vibrating compactor. The stabilized height below the GSF module must be level at 6".

8. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

9. A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock position.

10. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.

11. (Pressure Distribution Systems) Insert a pressure pipe (size per design and code) into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 9. Each pressure lateral will have a drain hole at the 6 o'clock position. Each pressure lateral shall have a clean out at the end of the trench.

12. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the trench, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

13. Place 6 inches of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each trench.

14. Complete backfill with a minimum of 6 inches of clean porous fill measured from the top of the distribution pipe. Backfill exceeding 18 inches requires venting at the far end of the trench. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

15. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

Mound Example:

House size:	3 Bedrooms (6 People)
Design Flow:	100 gpd/person (600 Gallons)
Soil Type:	Blocky Loam; Grade 1
Slope:	4%
Depth to Restrictive Layer:	24 inches

Determine Basal Loading Rate and Linear Loading Rate

Lookup loading rate from Table 8 and determine the Basal Loading Rate and Linear Loading Rate:

				Hydraulic linear loading rate, gal/d/ft		
				Slope		
Soil Characteristics				2-4%	5-9%	>10%
Texture	Structure			Infiltration distance, inch	Infiltration distance, inch	Infiltration distance, inch
	Shape	Grade	<30 mg/L	24-28	24-28	24-28
LOAM	--	0M	0.5	2.6	3.0	3.7
	PL	1, 2, 3	0.0	-	-	-
	PR/BK/GR	1	0.6	4.0	4.3	4.6
		2, 3	0.8	4.3	4.6	4.9

Basal Loading Rate: 0.6 g/ft^2
Linear Loading Rate: 4.0 gallons/day/foot

A – Dispersal Cell Length:

A: Daily Design Flow ÷ Linear Loading Rate
A: 600 g/d ÷ 4.0 g/d/foot
A: 150 ft

Total A42s required: 150 ft ÷ 4 ft /unit
Total A42s required: 37.5 units
Round to 37 units

B – Dispersal Cell Width:

B: Linear Loading Rate ÷ 2.0 g/d/ft^2
B: 4.0 g/d/ft ÷ 2.0 g/d/ft^2
B: 2 ft (The minimum width is 3 ft, round up to 3 ft)

D – Depth of Sand Under Cell (Up Slope):

D: Minimum Depth below Cell must be 12 inches and is measured from below the unit, 6 inches of that sand may go into grade.
D: 12 inches, use 1 foot

E – Depth of Sand Under Cell (Down Slope):

E: D + (% natural slope expressed as a decimal x B)
E: 1 ft + (0.04 x 3)
E: 1.12 ft

F – Distribution Cell Depth:

F: Constant 7 inch
F: 0.58 ft

H – Cover over center of Dispersal Cell:

H: Minimum 12 inch
H: 1 ft

G – Cover over Dispersal Cell at edges:

G: Minimum 6 inch
G: 0.5 ft

I – Down Slope Width (Minimum Side Slope 3:1):

I: (E + F + G) x (3 x slope correction from Table 7)

Slope Correction Factors		
Slope %	Down Slope	Up Slope
4	1.14	0.89

I: (1.12 ft + 0.58 ft + 0.5 ft) x (3 x 1.14)
I: (2.2) x (3.42)
I: 7.524 ft

J – Up Slope Width (Minimum Side Slope 3:1):

J: (D + F + G) x (3 x slope correction from Table 7)

Slope Correction Factors		
Slope %	Down Slope	Up Slope
4	1.14	0.89

J: (1 ft + 0.58 ft + 0.5 ft) x (3 x 0.89)
J: (2.08) x (2.67)
J: 5.554 ft

Basal Area Check

Basal Area = A x (I + B)
Basal Area = 150 ft x (7.524 ft + 3 ft)
Basal Area = 150 ft x (10.524 ft)
Basal Area = 1,578.6 ft^2

Basal Area Required = Daily Design Flow ÷ Soil Loading Rate
Basal Area Required = 600 g/d ÷ 0.6 g/ft^2
Basal Area Required = 1000 ft^2

Basal Area Required < Basal Area
1000 ft^2 < 1,578.6 ft^2, yes, no additional basal area required.

W – Total Mound Width:

W: J + B + I
W: 5.554 ft + 3 ft + 7.524 ft
W: 16.1 ft

K – End Slope Length (Minimum Side Slope 3:1):

K: {[(D + E) ÷ 2] + F + H} x 3
K: {[(1 ft + 1.12 ft) ÷2] + 0.58 ft + 1 ft} x 3
K: {([(2.12 ft) ÷2] + 0.58 ft + 1 ft} x 3
K: {[1.06 ft] + 0.58 ft + 1 ft} x 3
K: {2.64 ft} x 3
K: 7.92 ft

L – Total Mound Length:

L: A + (2 x K)
L: 150 ft + (2 x 7.92 ft)
L: 150 ft + (15.84 ft)
L: 165.84 ft

FIGURE 6: MOUND DISTRIBUTION CELL

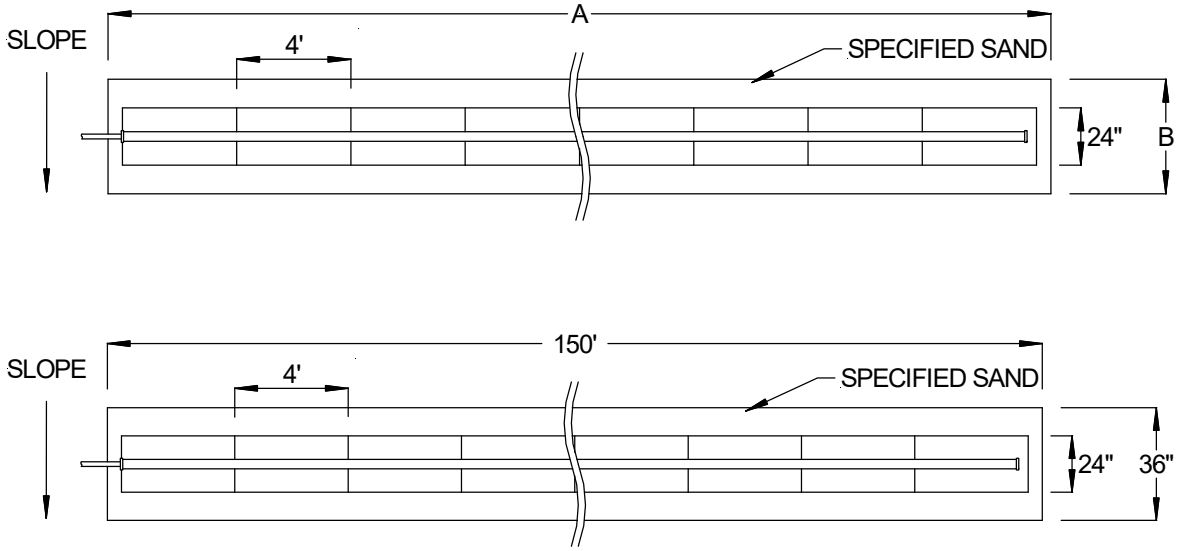


FIGURE 7: MOUND PLAN VIEW

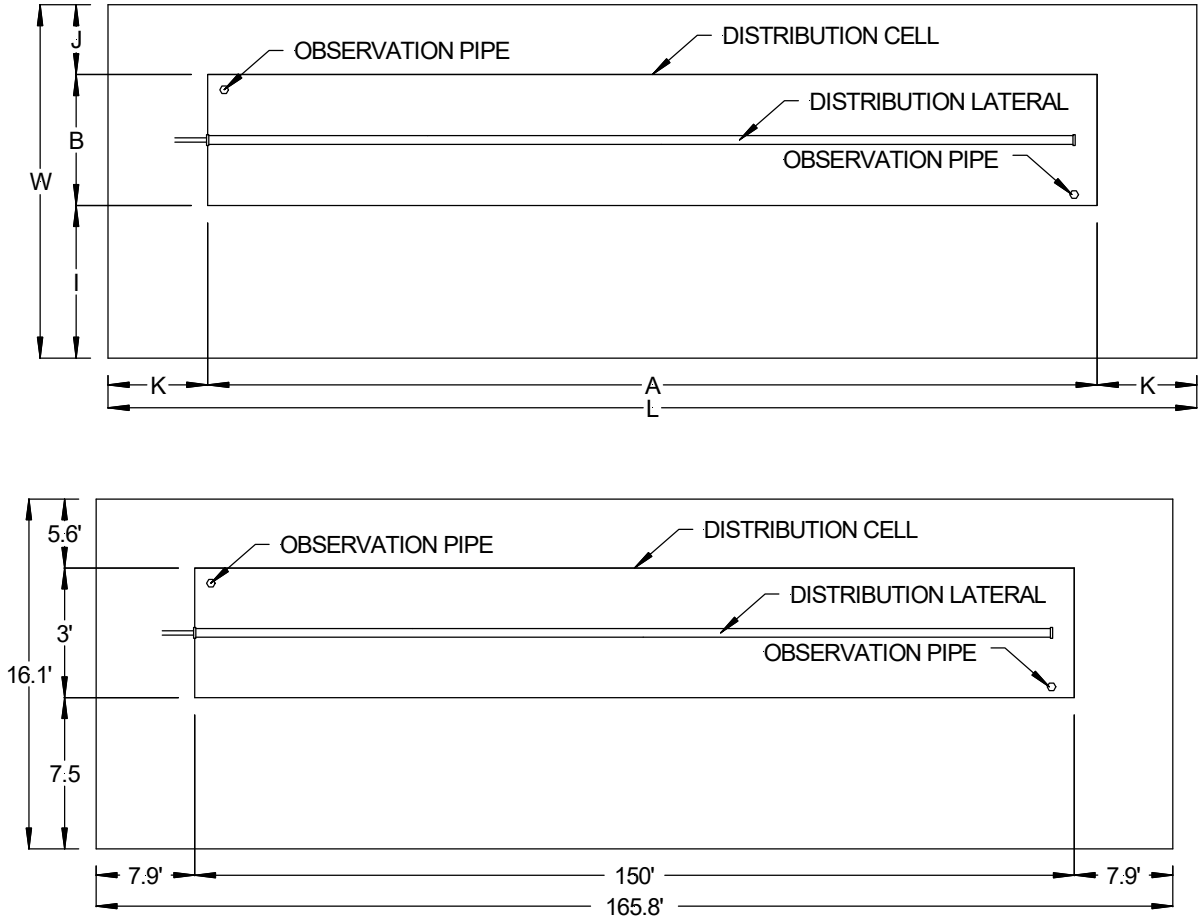
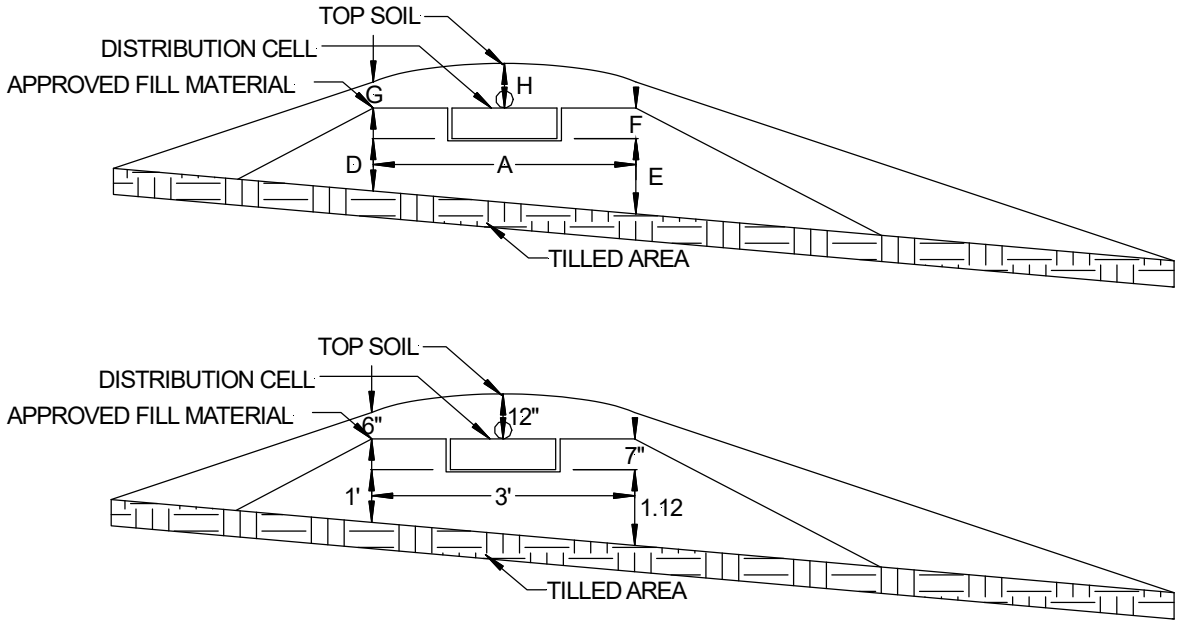


FIGURE 8: MOUND CROSS SECTION



3.1 Mound Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the mound dimensions using the design example.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Scarify the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the bed prior to placement of the Specified Sand to avoid soil compaction.

6. Place Specified Sand in two 6 inch lifts, compact each lift at a time. The compacted height below the GSF module must be level at 12 inches. 6 inches may go into grade. A hand tamping tool or vibrating compactor is both acceptable.

7. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

8. A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock position.

9. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.

10. (Pressure Distribution Systems) Insert a pressure pipe (size per design and code) into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 9. Each pressure lateral will have a drain hole at the 6 o'clock position. Each pressure lateral shall have a clean out at the end of each module row.

11. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the row, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

12. Place 6 inches of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each module row. A minimum of 12 inches of Specified Sand is placed in between module rows.

13. Complete backfill with a minimum of 6 inches of clean porous fill measured from the top of the distribution pipe. Backfill exceeding 18 inches requires venting at the far end of the bed. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

14. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

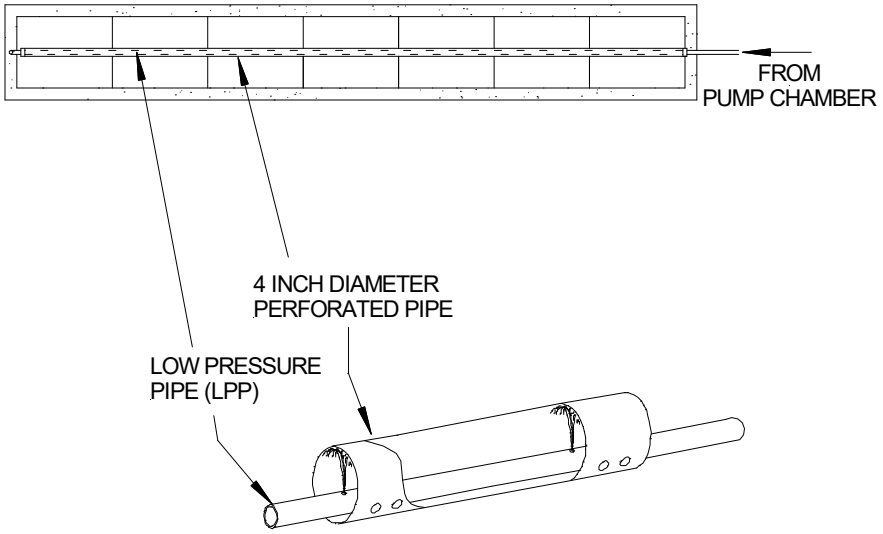
4.0 Dosing Distribution Guidance

DOSING DESIGN CRITERIA: Dosing volume must be set to deliver a maximum of gallons per A42 Module per dosing cycle. A valve on the force main is recommended to set the flow rate so that the orifices on the outlet pipes are submerged and the d-box does not overflow. Adjustment of the flow rate is likely needed if a row of modules are rested thus changing the number or outlets. Fewer outlets in the d-box force more effluent down each line and improve linear loading. Head loss and drain back volume must be considered in choosing the pump size and force main diameter.

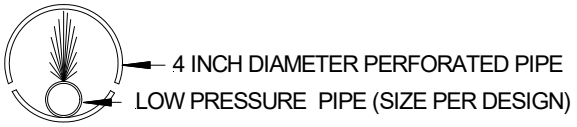
5.0 Pressure Distribution Guidance

Standard procedures for design of pressure distribution networks apply to the GSF filter. Orifices shall be a minimum of 4-foot on center spacing so the orifices fall in the center of each module. A minimum orifice size of ¼ inch shall be maintained. A ¼ inch diameter drain hole is required at the 6 o'clock position of each pressure lateral for drainage purposes. The lateral pipe network *(size per design and code)* is placed within a standard 4-inch perforated pipe. The perforation in the 4-inch outer pipe are set at the 4 and 8 o'clock position, the drilled orifices on the pressure pipe are set to spray at the 12 o'clock position directly to the top of the 4-inch perforated pipe as shown below.

FIGURE 9: PRESSURE PIPE PLACEMENT

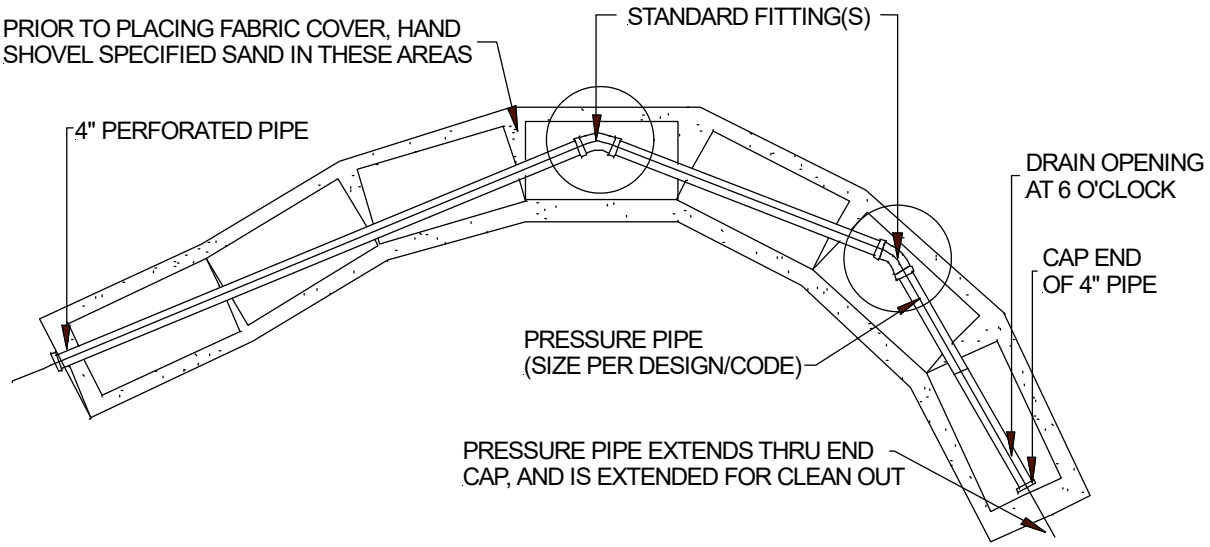


PRESSURE PIPE CROSS SECTION FOR ALL APPLICATIONS



5.0 Pressure Distribution Guidance

FIGURE 10: CONTOURED TRENCH PRESSURE DISTRIBUTION



GSF Pressure Distribution trench placed on a contour or winding trenches to maintain horizontal separation distances may also be used in Dosed or Gravity system by removing the pressure pipe and using the 4-inch diameter perforated distribution pipe.

6.0 Pump Controls

Demand and Pressure Dosed controlled systems will include an electrical control system that has the alarm circuit independent of the pump circuit, controls and components that are listed by UL or equivalent, is located outside, within line of sight of the pump chamber and is secure from tampering and resistant to weather (minimum of NEMA 4). The control panel shall be equipped with cycle counters and elapsed time meters. Where a water supply water meter is available it may be possible to eliminate the counters or timers.

The control panel shall be equipped with both audible and visual high liquid level alarms installed in a conspicuous location. Float switches shall be mounted independent of the pump and force main so that they can be easily replaced and/or adjusted without removing the pump.

7.0 System Ventilation

7.1 SYSTEM VENTILATION: Air vents are required on all absorption systems located under impervious surfaces or systems **with *more than 18 inches of cover material*** as measured from the top of the GSF module to finished grade. This will ensure proper aeration of the modules and sand filter. The GSF has aeration channels between the rows of GSF modules connecting to cuspations within the GSF modules. Under normal operating conditions, only a fraction of the filter is in use. The unused channels remain open for intermittent peak flows and the transfer of air. The extension of the distribution pipe to the vent provides adequate delivery of air into the GSF system, as shown in Figure 13.

Home plumbing operates under negative pressure due to hot water heating the pipes and reducing the density of air in the house vent. As hot air rises and exits the home, it must be replaced by air from the GSF. To maintain this airflow and fully aerate the GSF system, it is important that air vents are located only on the distal end of the GSF pipe network.

7.2 VENT PIPE FOR LOW PRESSURE DISTRIBUTION SYSTEMS: If the system is a low pressure distribution system with greater than 18 inches of cover, ensure that the LPP clean outs are located in the vent for easy access.

FIGURE 11: PRESSURE CLEAN OUT PRESSURE DOSED SYSTEMS

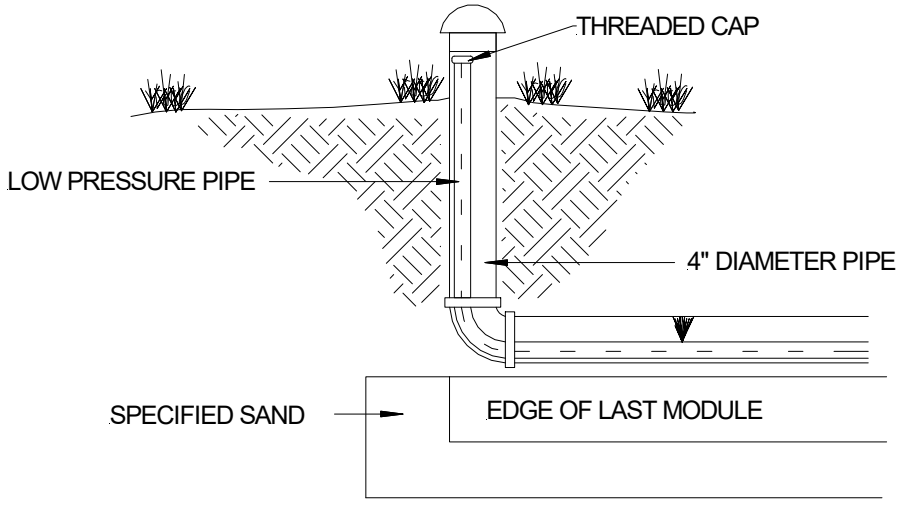
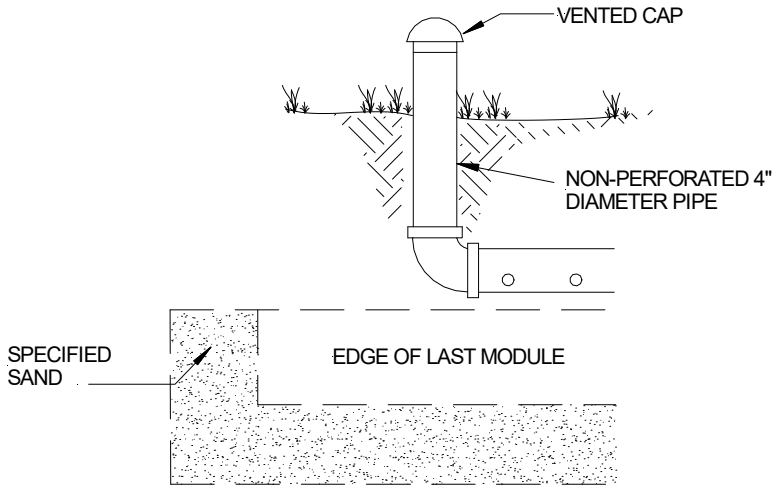
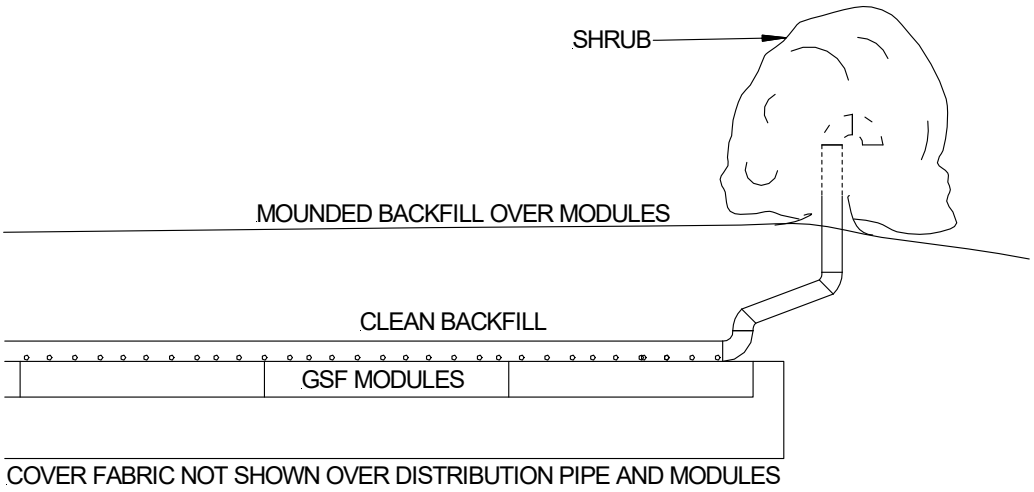


FIGURE 12: GRAVITY VENTING



7.3 VENTILATION PLACEMENT: In a GSF system, the vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs, as shown in Figure 13. Corrugated pipe may be used. If using corrugated pipe, ensure that the pipe does not have any bends that will allow condensation to pond in the pipe. This may close off the vent line. The pipe must have an invert higher than the system so that it does not drain effluent.

FIGURE 13: GSF WITH 4" VENT EXTENDED TO CONVENIENT LOCATION



8.0 GSF Inspection Check List

Geotextile Sand Filter, (GSF) Checklist				
Facility Owner:				
Facility Address:				
Installation Date: (MDY)				
Previous Inspection Date: (MDY)				
Date of Inspection : (MDY)				
Residential Number of Bedrooms:				
Is this a Commercial Design? If yes what type:	Yes	No		
What is the estimated BOD5 and TSS strength?	BOD5	TSS	Comments	
Observation Port Location(s):	1		2	3
Inspection Data, (complete all fields)				
Is daily flow within the system design flow? If no, explain:	Yes	No		
Does the owner verify the system use as described above? If no, explain:	Yes	No		
Septic tank last inspection date:	Date			
Inspected by:				
Septic tank last pumped date:				
Is pumping recommended?	Yes	No		
Condition of the soil absorption system: Wet, Dry, Firm, Soft, Vegetative, or Other. If Other, explain:	W	D	S	F	V
Is there evidence of storm water flows or erosion over the septic system? If yes, explain:	Yes	No		

8.0 GSF Inspection Check List

Is there evidence of soil slump or compaction by traffic or other means in the vicinity of the soil absorption system? If yes, describe:	Yes	No	Comments
Is effluent visible through the observation port? If yes, describe the condition and the fluid level:	Yes	No	Comments
Is there a garbage disposal in the home?	Yes	No	Comments
Is a water softer connected to the system?	Yes	No	Comments
Are solids visible through the observation port? If yes, describe the condition and depth of solids:	Yes	No	Comments
Is there evidence of surcharging or effluent ponding in the D-Box? If yes, describe and measure:	Yes	No	Comments
Are the system vents in place?	Yes	No	Comments
Are they operational? If no, describe conditions and location:	Yes	No	
Describe any other pertinent issues:			

Inspected by:	
License Number:	
Date:	
Time:	
Print Name & Signature of Inspector:	
I certify I have inspected the system at the above address, completed this report, and the information reported is true, accurate, and complete.	

COMPANY HISTORY

Established in 1970, Eljen Corporation created the world's first prefabricated drainage system for foundation drainage and erosion control applications. In the mid-1980s, we introduced our Geotextile Sand Filter products for the passive advanced treatment of onsite wastewater in both residential and commercial applications. Today, Eljen is a global leader in providing innovative products and solutions for protecting our environment and public health.

COMPANY PHILOSOPHY

Eljen Corporation is committed to advancing the onsite industry through continuous development of innovative new products, delivering high quality products and services to our customers at the best price, and building lasting partnerships with our employees, suppliers, and customers.

eljen CORPORATION

Innovative Environmental Products & Solutions Since 1970

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