GSF®

Geotextile Sand Filter

North Carolina
Design & Installation Manual

eljen
CORPORATION

Innovative Onsite Products & Solutions Since 1970

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DRAWINGS

TABLES

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 120 gallons per day per Bedroom.

GSF The Eljen Geotextile Sand Filter Modules and the 12-inch sand layer at the base and 6 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

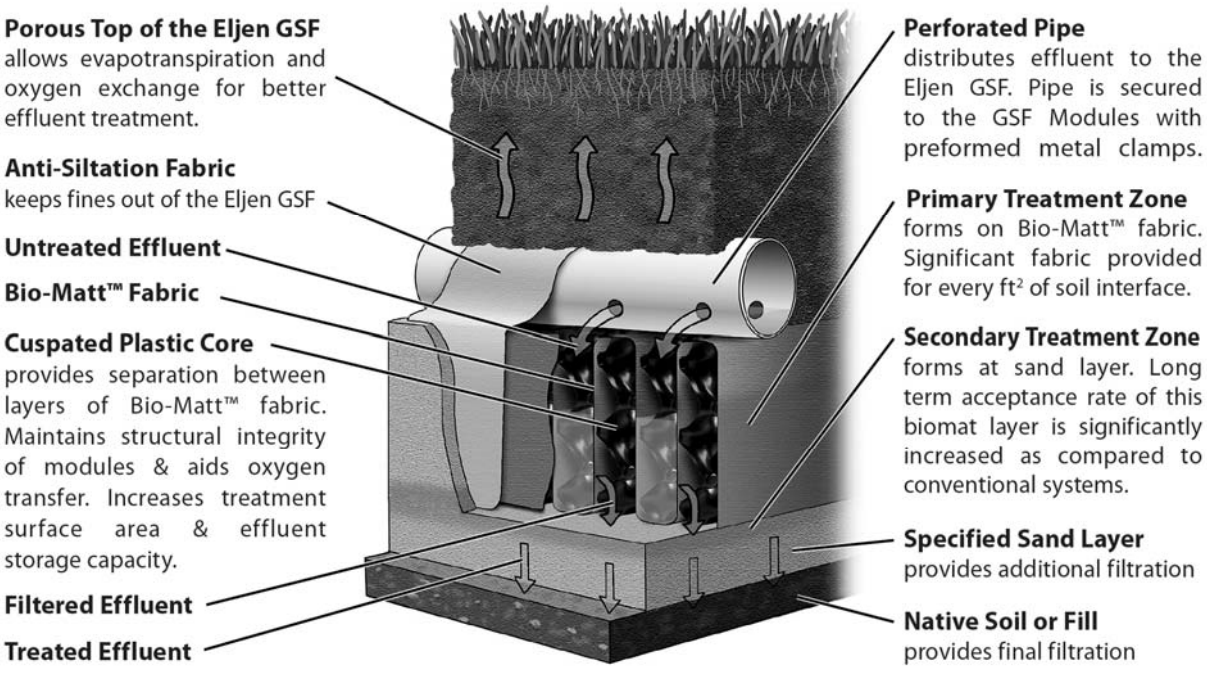
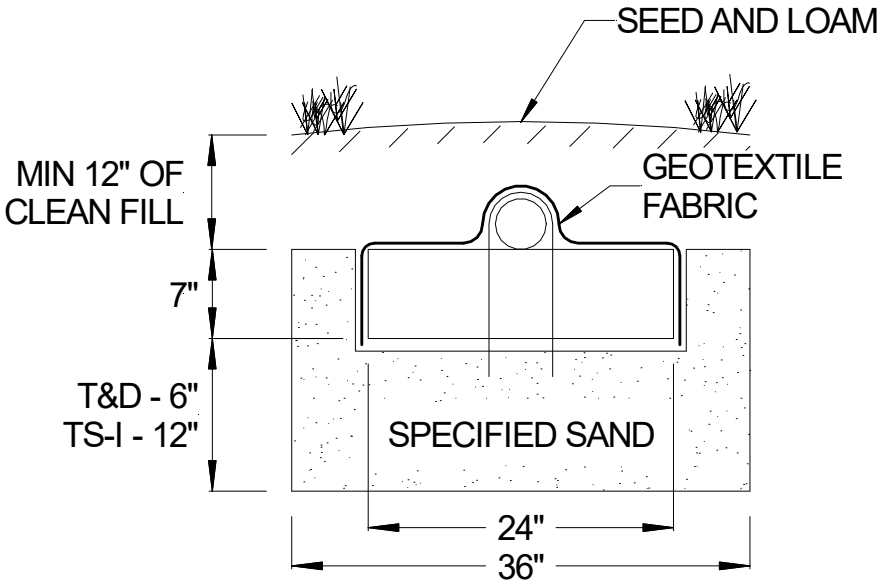


FIGURE 2: TYPICAL A42 GSF CROSS SECTION



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 Row.
- 12 inches of Specified Sand is directly below the GSF module.
- Minimum 12 inches of native soil fill above the module.

1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The North Carolina Administrative Code, Section .1900 – Sewage Treatment and 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 5% PASSING A #200 SIEVE.*** Treatment and Dispersal (T&D) systems require 6 inches of sand under the units and TS-I systems require a minimum of 12 inches of sand under the units. 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 "Painted 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 painted 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.

Pressure distribution may be used as well. Two delivery methods are acceptable. Orifice shields are placed over a SCH 40 pipe, one per unit. A second delivery method is also permissible. Using SDR-35 pipe or equivalent; a pressure manifold is placed inside the distribution pipe. Section 6.0 of this manual goes into details of how to construct the distribution network. 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 12 inches of clean porous fill measured from the top of the GSF unit. 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 number 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. Increasing the septic tank size from minimum requirements, tanks placed in series and upsizing the field are helpful in contesting the increased load. In addition, an effluent screening device is recommended.

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 FILL SYSTEM: Fill systems are systems in which the sand soil interface is directly on the native soil.

1.11 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 required.

1.12 SEPTIC TANK FILTERS: Septic tank effluent filters are ***REQUIRED*** on the outlet end of septic tank. 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.

1.13 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. See Section 7.0 for a more detailed explanation of venting GSF products.

1.14 VERTICAL SEPARATION TO GROUND WATER OR LIMITING LAYER: Separation distance is measured from the restrictive layer to the bottom of the sand soil interface and must comply with state and/or local requirements.

1.15 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.

1.16 GSF SYSTEM LOADING RATES:

TABLE 2: TRENCH LOADING RATES

SOIL GROUP	SOIL TEXTURE CLASSES (USDA CLASSIFICATION)	TRENCH LTAR (GPD/ft^2)		
		NC STATE LTAR	NSF-40	TS-1
I	Sands (With S or PS structure and clay mineralogy)	1.2 - 0.8	1.6 - 1.1	2.4 - 1.6
II	Coarse Loams (With S or PS structure and clay mineralogy)	0.8 - 0.6	1.1 - 0.8	1.6 - 1.2
III	Fine Loams (With S or PS structure and clay mineralogy)	0.6 - 0.3	0.6 - 0.3	1.2 - 0.6
IV	Clays (With S or PS structure and clay mineralogy)	0.4 - 0.1	0.4 - 0.1	0.8 - 0.2

Notes:
Treatment and Dispersal (T&D) loading rates reflect a 25% reduction in trench area for Group I & II soils.
TS-1 loading rates reflect a 50% reduction in trench area.

TABLE 3: BED LOADING RATES

SOIL GROUP	SOIL TEXTURE CLASSES (USDA CLASSIFICATION)	BED LTAR (GPD/ft^2)			MINIMUM LENGTH TO WIDTH RATIO	MINIMUM A42'S PER BEDROOM
		NC STATE LTAR	NSF-40	TS-1		
I	Sands (With S or PS structure and clay mineralogy)	1.2 - 0.8	1.1 - 0.7	1.6 - 1.1	2:1	6
II	Coarse Loams (With S or PS structure and clay mineralogy)	0.8 - 0.6	0.7 - 0.5	1.1 - 0.8	3:1	8
III	Fine Loams (With S or PS structure and clay mineralogy)	0.6 - 0.3	0.4 - 0.2	N/A	3:1	10

Notes:
Loading rates reflect a 50% increase in bed size.
Treatment and Dispersal (T&D) loading rates reflect a 25% reduction in bed bottom area for Group I & II soils.
Treatment and Dispersal (T&D) Bed systems have a maximum daily design flow of 600 GPD.
TS-1 loading rates reflect a 50% reduction in bed bottom area for Group I & II soils.
TS-1 Systems for “fill” sites are limited to 480 GPD design flow.
TS-1 Systems have a maximum daily design flow of 1,500 GPD.

Trench Example:

House size:	4 Bedrooms
Soil Evaluation:	Soil Group II; NC STATE LTAR 0.8
Design Flow: 120 gpd x 4 bedrooms =	480 gpd
Desired Effluent Quality Standard:	Treatment and Dispersal (T&D)

Calculate Minimum Absorption Area

Lookup the desired effluent quality standard LTAR from Table 2:

SOIL GROUP	SOIL TEXTURE CLASSES (USDA CLASSIFICATION)	TRENCH LTAR (GPD/ft^2)		
		NC STATE LTAR	NSF-40	TS-1
II	Coarse Loams (With S or PS structure and clay mineralogy)	0.8 - 0.6	1.1 - 0.8	1.6 - 1.2

Trench Area: Design Flow ÷ Loading Rate

480 gpd ÷ 1.1 gpd / ft^2 = 437 ft^2

Calculate Number of Modules Required

Number of units required = Absorption Area ÷ 12 Square Foot Per Module

A42 units required

437 ft^2 ÷ 12 ft^2 / module =	36.4 Modules
Round to:	37 A42 Modules
2-Rows	38 A42 Modules, 2-rows of 19

Calculate Minimum Trench Length

A42: 37 Units x 4 ft/unit =	152 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	152 ft
(note: 6 inches of sand required at each end of trench which makes the minimum trench length 149 ft)	
Trench Width	2 rows 3 ft wide
Min. Number of Units	38 A42 Units
Min. System Area	456 ft^2

FIGURE 3: PLAN VIEW – A42 MODULES – TRENCH SYSTEM

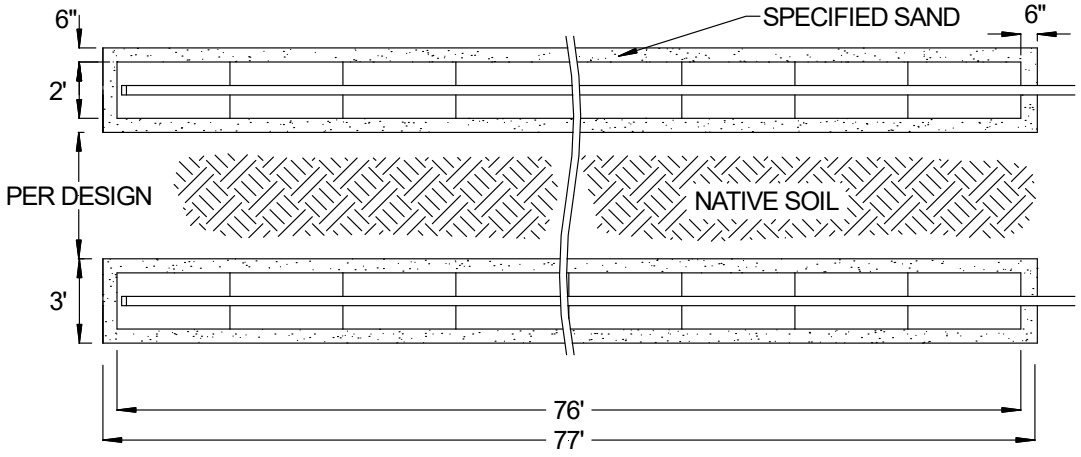


FIGURE 4: SECTION VIEW – A42 MODULES – TRENCH SYSTEM – LEVEL SITE

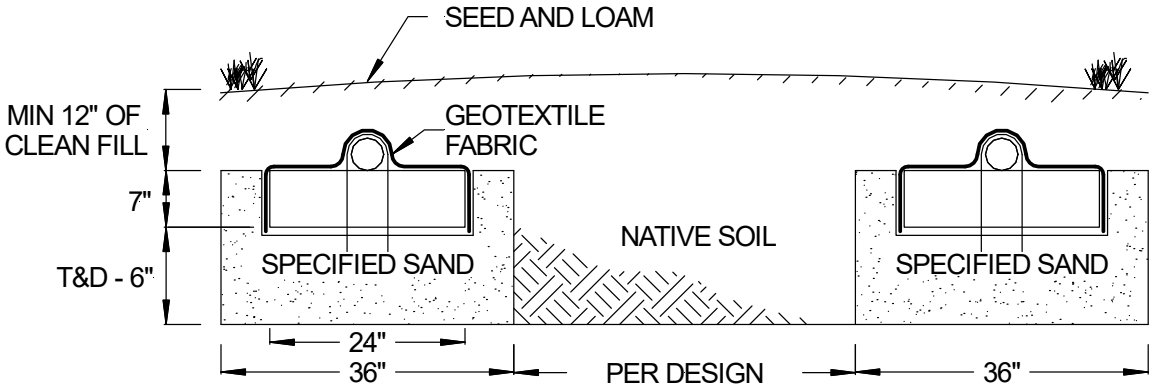
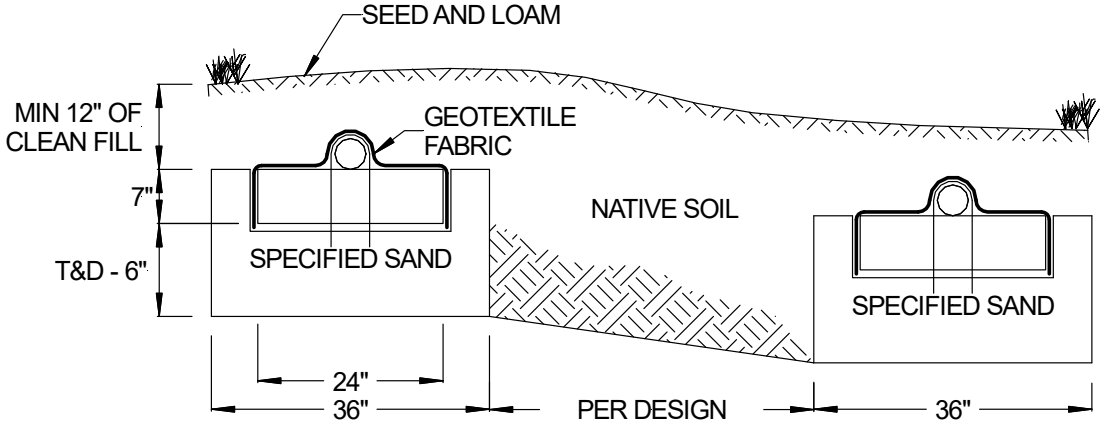


FIGURE 5: SECTION VIEW – A42 MODULES – TRENCH SYSTEM – SLOPING SITE



2.0 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 in 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 one to two 6-inch lifts, compact each lift at a time. The compacted height below the GSF module must be 6" for Treatment and Dispersal (T&D) systems and 12" for TS-I systems. A hand tamping tool or vibrating compactor are both acceptable.

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. The minimum dispersal length per row is 20', the maximum dispersal length is 60' with gravity distribution and 100' with pressure distribution.

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 12 inches of clean porous fill measured from the top of the module. 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.

Bed Example:

House size:	4 Bedrooms
Soil Evaluation:	Soil Group I; NC STATE LTAR 1.2
Design Flow: 120 gpd x 4 bedrooms =	480 gpd
Desired Effluent Quality Standard:	TS-I

Calculate Minimum Absorption Area

Lookup the desired effluent quality standard LTAR from Table 3:

SOIL GROUP	SOIL TEXTURE CLASSES (USDA CLASSIFICATION)	BED LTAR (GPD/ft^2)			MINIMUM LENGTH TO WIDTH RATIO	MINIMUM A42'S PER BEDROOM
		NC STATE LTAR	NSF-40	TS-1		
I	Sands (With S or PS structure and clay mineralogy)	1.2 - 0.8	1.1 - 0.7	1.6 - 1.1	2:1	6

Absorption Area: Design Flow ÷ Loading Rate

480 gpd ÷ 1.6 gpd / ft^2 = 300 ft^2

Determine Number of Modules Required

Lookup square foot per module from Table 3:

SOIL GROUP	SOIL TEXTURE CLASSES (USDA CLASSIFICATION)	BED LTAR (GPD/ft^2)			MINIMUM LENGTH TO WIDTH RATIO	MINIMUM A42'S PER BEDROOM
		NC STATE LTAR	NSF-40	TS-1		
I	Sands (With S or PS structure and clay mineralogy)	1.2 - 0.8	1.1 - 0.7	1.6 - 1.1	2:1	6

Units Required = Bedrooms x Units per Bedroom

A42 units required

4 Bed x 6 Units per Bedroom = 24 A42s

Bed Length

2 Rows – Modules per Row

A42: 24 Units ÷ 2 Rows = 12 Modules per Row

round to 12 A42 Units

Bed Length: Modules x 4 ft / module +1

12 Modules x 4 ft / module + 1 = 49 ft

Bed Width

Bed Width = Drainfield Size ÷ Bed Length

A42 units required

300 ft^2 ÷ 49 ft = 6.1 ft

Round to 6.5 ft

Final Dimension Layout

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

A42 – 2 Row

Bed Length	49 ft
Bed Width	6.5 ft
Minimum Number of Units	24 A42 Units
Units per Row	12 units per row
System Area	319 ft^2

FIGURE 6: PLAN VIEW – A42 MODULES – BED SYSTEM

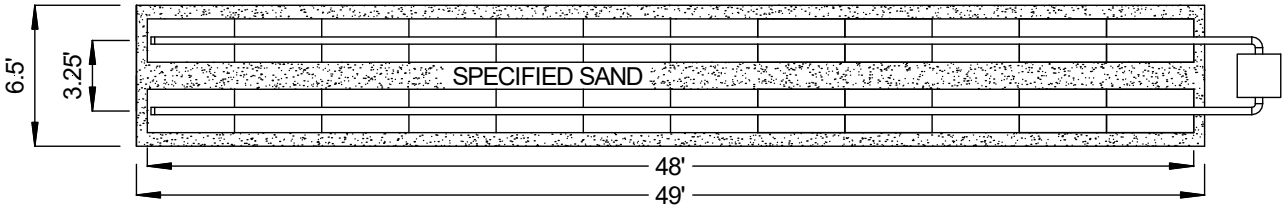


FIGURE 7: SECTION VIEW – A42 MODULES – BED SYSTEM

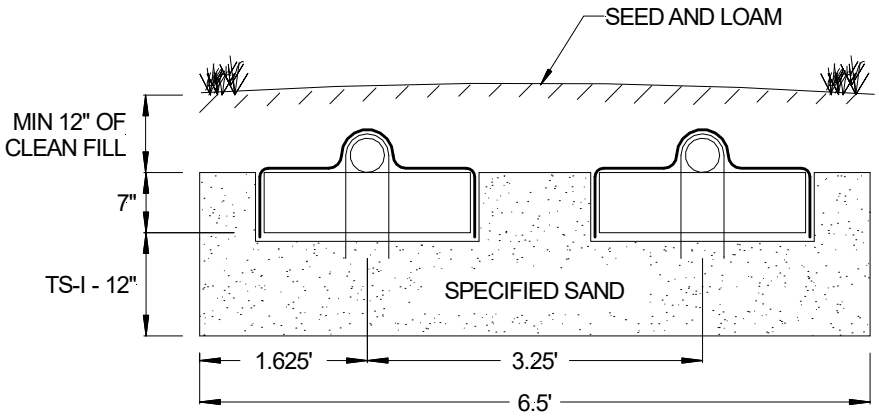
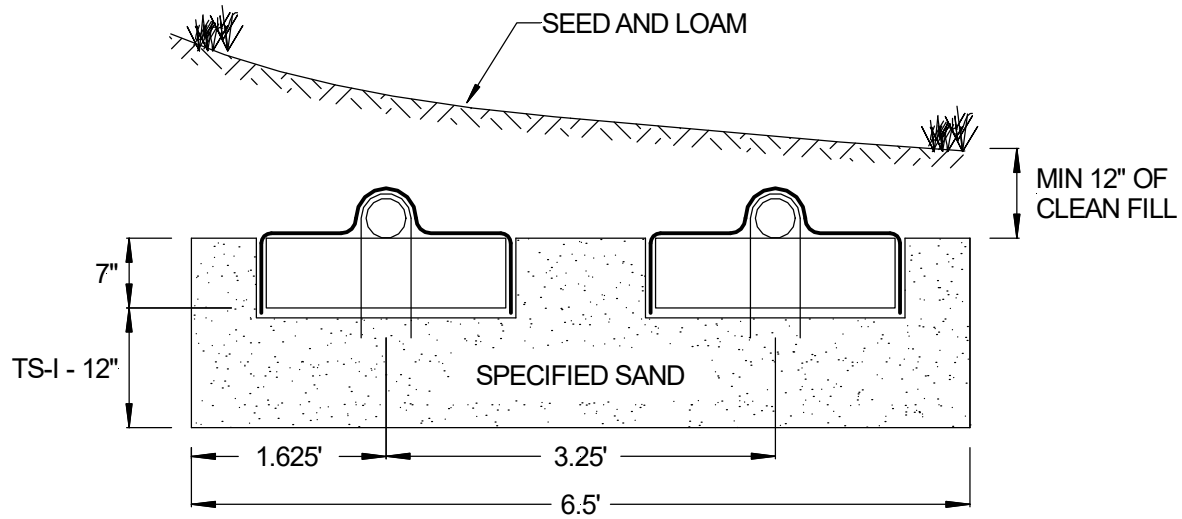


FIGURE 8: CROSS SECTION VIEW – A42 MODULES – BED SYSTEM – SLOPING SITE



3.0 Bed 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 bed sizing example.

3. Prepare the site. Do not install a system in 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 bed absorption area; scarify the receiving layer to maximize the interface between the native soil and specified sand.

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

7. Place Specified Sand in one to two 6-inch lifts, compact each lift at a time. The compacted height below the GSF module must be 6" for Treatment and Dispersal (T&D) systems and 12" for TS-I systems. A hand tamping tool or vibrating compactor is both acceptable.

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 each module row.

12. ***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.

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 module row. A minimum of 12 inches of Specified Sand is placed in between module rows.

14. Complete backfill with a minimum of 12 inches of clean porous fill measured from the top of the module. 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.

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

4.0 Pressure Mound Installation 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 a minimum of 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 12 inches of clean porous fill measured from the top of the unit. Backfill exceeding 18 inches of the unit 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.

5.0 Dosing Distribution Guidance

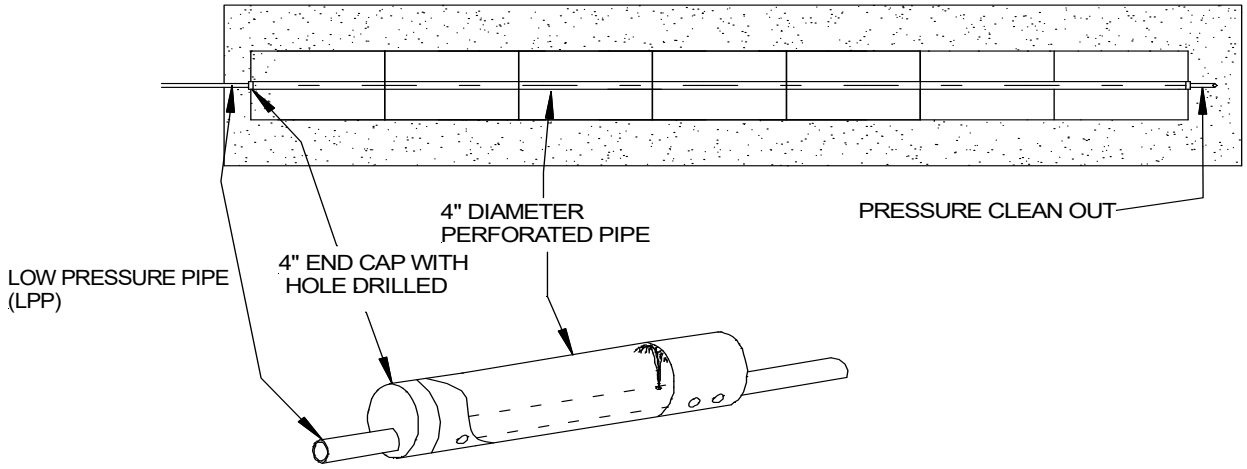
5.1 PUMP DISTRIBUTION BOX: Specify an oversized distribution box for pumped systems. Provide velocity reduction in the D-box with a tee or baffle. Set D-box invert higher than invert of perforated pipe over GSF modules. If the absorption area is installed deeper than 18 inches, the system must be vented. See section 7.0 of this manual for detailed information on venting of systems.

5.2 DOSING DESIGN CRITERIA: Dosing volume must be set to deliver a maximum of **3 gallons per A42 Module** per dosing cycle. Head loss and drain back volume must be considered in choosing the pump size and force main diameter.

6.0 Pressure Distribution Guidance

Standard procedures for design of pressure distribution networks apply to the GSF filter. A minimum orifice size of 1/8 to 1/4 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

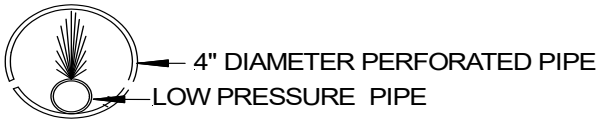


FIGURE 10: PRESSURE CLEAN OUT

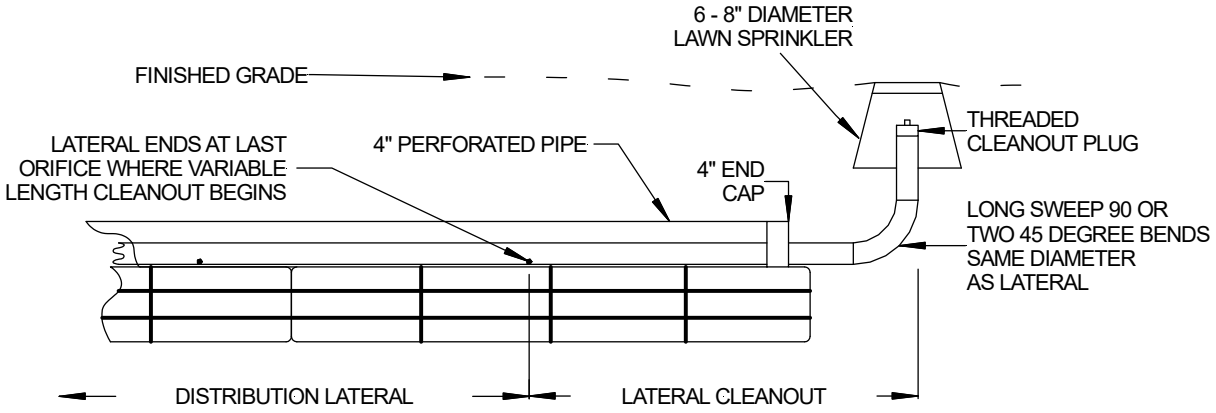
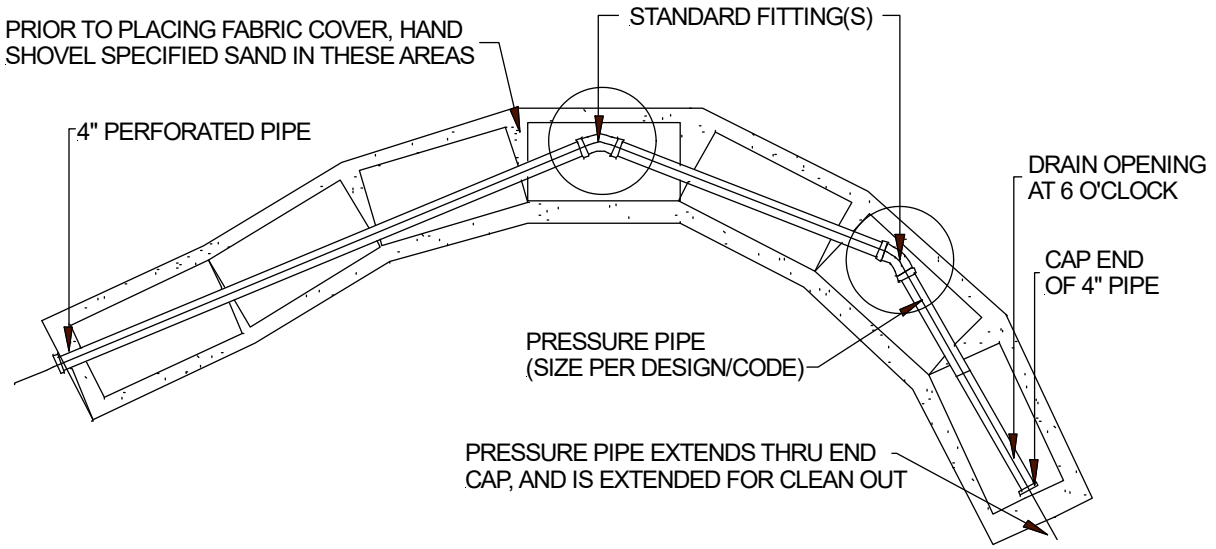


FIGURE 11: CONTOURED TRENCH PRESSURE DISTRIBUTION



GSF Pressure Distribution trench placed on a contour or winding trenches to maintain horizontal separation distances.

7.0 System Ventilation

7.1 SYSTEM VENTILATION: Air vents are required on all absorption 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.

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 12: GRAVITY VENTING

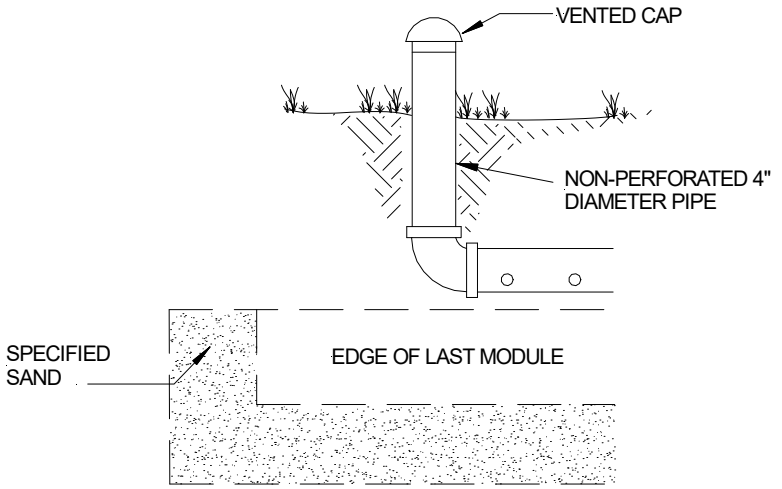
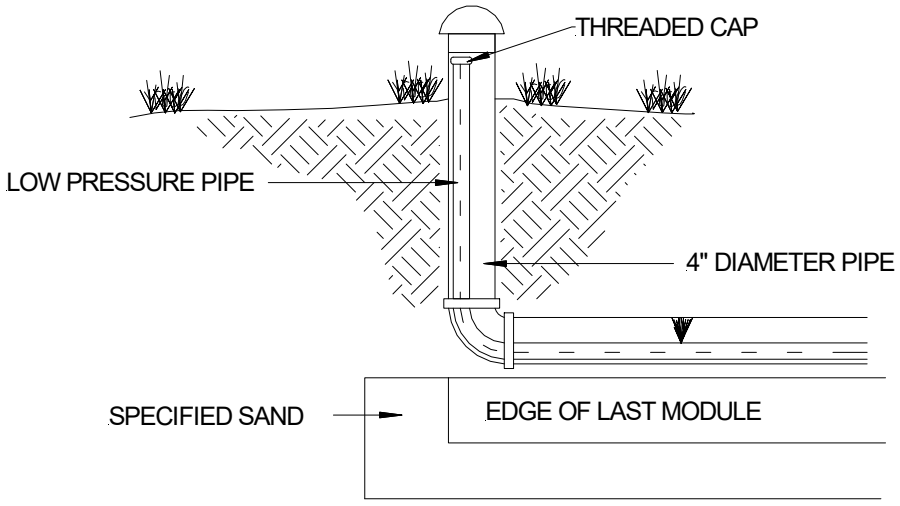


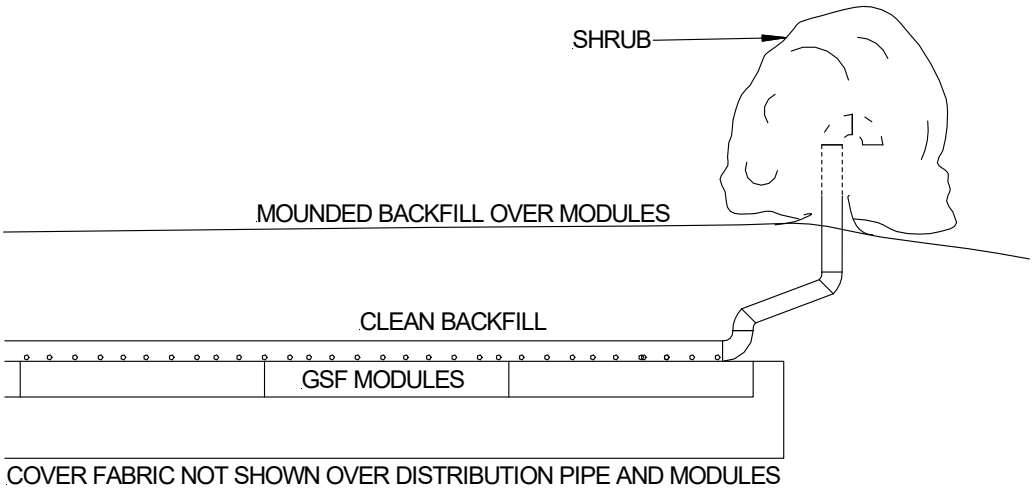
FIGURE 13: PRESSURE CLEAN OUT PRESSURE DOSED SYSTEMS



7.0 System Ventilation

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 the figure below. 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 14: GSF WITH 4" VENT EXTENDED TO CONVENIENT LOCATION



8.0 System Maintenance and Sampling Requirements

The purpose of this section is to help provide an easy and effective way to monitor and sample Eljen Onsite Sewage System. Installing an Eljen Sampling and Collection Unit will allow you to sample your Eljen GSF System and meet the requirements listed below. If you have any questions pertaining to any part of this document or regarding Eljen products in general, please call our Technical Services Department at 1-800-444-1359.

OWNER RESPONSIBILITIES:

- Maintain an operator: At all times, a certified service provider should be retained for routine maintenance and inspections.
- Keep a log: A log must be maintained on any services or inspections. Requirements for log entries are in the section below, *Operators Responsibilities*.
- Keep operators manual on the premises for transfer to next owner.
- Schedule routine Operator visits.
    - All sampling shall be done in accordance with Rule .1970 (n) (3) and (5).
    - Sampling is required annually.
    - Influent for all systems shall be analyzed for BOD5 and TKN.
    - Treatment and Dispersal (T&D) systems shall have effluent tested for CBOD5 and TSS.
    - TS-I systems shall have effluent tested for CBOD5, TSS, NH4-N and fecal coliforms.

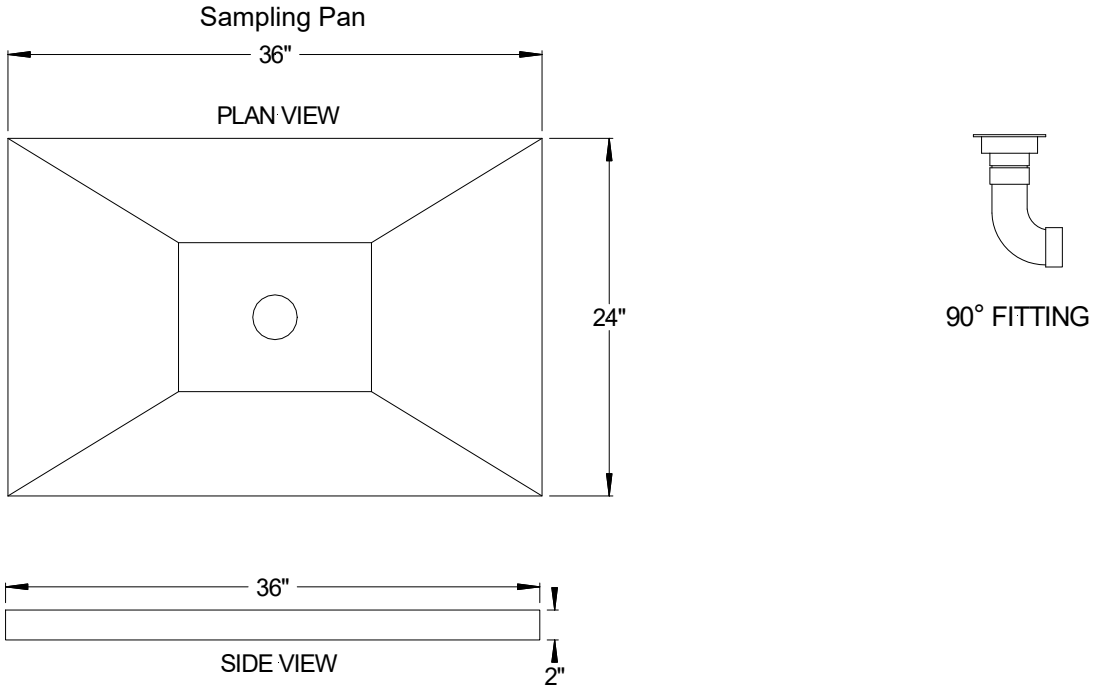
OPERATOR RESPONSIBILITIES:

- Keep a log for the system
    - Results of all testing and sampling
    - Reportable incidents
    - Maintenance, corrective actions, and repair of system components
    - Sludge or solids removal
    - Date and time reports were made and delivered to the system owner

9.0 Sampling Port

FIGURE 15: PARTS AND DEVICES

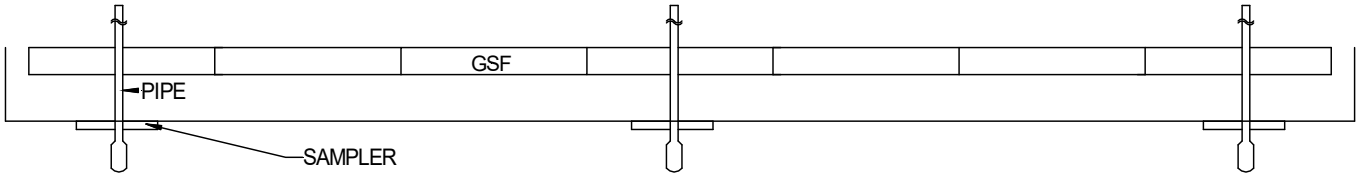
Field Sampling Parts to be installed with system:



10.0 Sampling Port Design

1. Determine the collection pipe and observation & sampling port placement in the system. We recommend three samplers are place in the same row. One sampler under the first module, one under the last, and one in the middle.

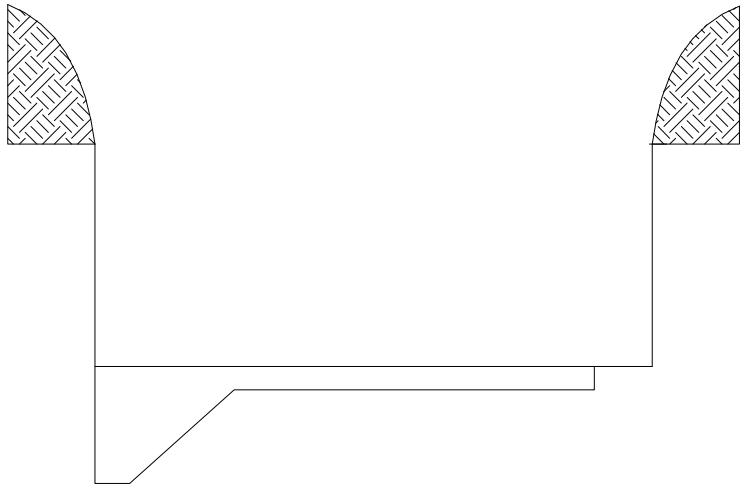
FIGURE 16: OBSERVATION AND SAMPLING PORT PREPARATION PLAN VIEW



2. Carefully lay out the system area and boundaries.
3. Prepare the site. Excavate a trench to the design elevation for the system. *Note: this includes the 12 inches of Specified Sand.*

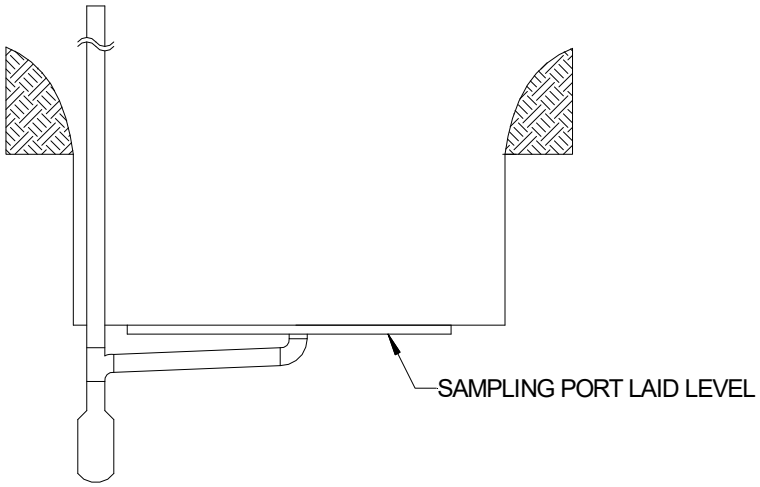
1. In the excavated trench, place Specified Sand in a 3-inch lift and stabilize.

FIGURE 17: PLACE BASE SAND



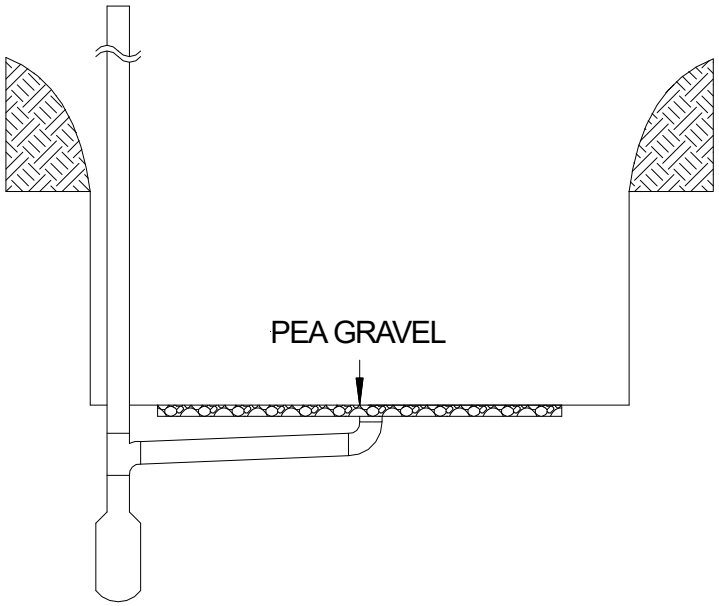
2. Place the three sampling pans level in the trench at the beginning, middle and end of the trench. The samplers should be centered underneath where the GSF will be placed.

FIGURE 18: PLACE SAMPLERS ON SAND



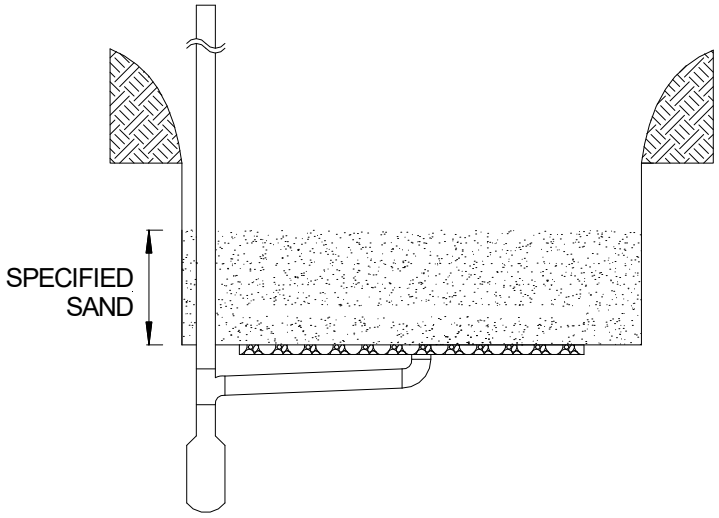
3. Fill Pan with pea gravel.

FIGURE 19: PLACE PEA GRAVEL IN PAN



4. Place the specified sand to required depth.

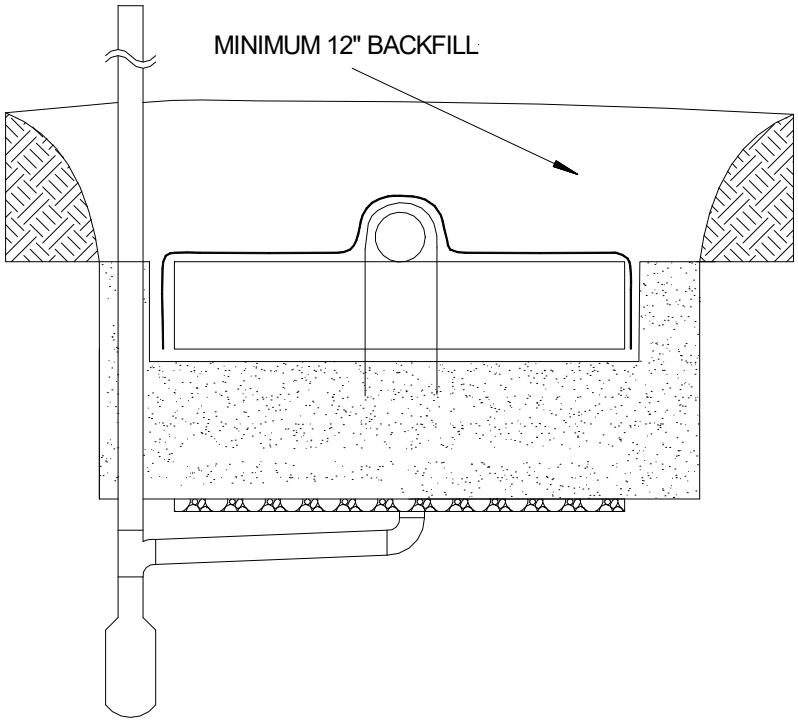
FIGURE 20: COMPLETE PLACING SPECIFIED SAND



5. Stabilize the Specified Sand height below the GSF module to 12 inches. A hand tamper or vibratory compactor is sufficient to stabilize the Specified Sand below the GSF modules. Check the zero grade of the top of the Specified Sand using a flat piece of lumber and a carpenter's level and/or a laser before placing the modules.
6. After the GSF modules have been installed, carefully place backfill over the modules, followed by loam to complete a total minimum depth of 12 inches as measured from the top of the module. Backfill material shall be a well graded sandy fill; clean, porous, and devoid of rocks.

11.0 Sampling Port Installation

FIGURE 21: COMPLETE BACKFILL



7. Cap or place irrigation box over top of pipe. Mark so that service provider can find for sampling.
8. Divert surface runoff and finish grade to prevent surface ponding. Seed, loam, and protect from erosion.

12.0 Sampling Port Sampling

1. Sampling can be done in two days. Ensure there is power onsite with appropriate amount of extension cord for your shop-vac.
2. Empty the sampler the day prior to sampling. Clean with a water solution containing 200 ppm bleach.
3. The following day, ensure your sampling beaker is clean and ready to receive sample.
4. Uncap or open irrigation box.
5. Retrieve sample with clean suction device.
6. Cap or close irrigation box.
7. Return sample to lab for testing in a cool storage container.

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

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