Dear Mr. King:

Thank you for your application for registration dated April 11, 2017 for the Eljen GSF, which includes the following models: A42 & B43.

In accordance with Minn. R. chs. 7080 through 7083, the Minnesota Pollution Control Agency (MPCA) has reviewed Eljen Corporation’s submitted materials for proprietary distribution product registration. Based on the submitted documentation, the MPCA finds the Eljen GSF model series is eligible for registration under the following conditions in order to meet the requirements for proprietary distribution product registration.

The Eljen GSF model series is registered for mound applications in accordance with Minn. R. ch. 7080.2220 and the manufacturer’s installation requirements. Pressure distribution requirements, as described in Minn. R. ch. 7080.2050, shall be met. Table 1 lists registered GSF models and dimensions as presented in the initial application submittal, dated April 11, 2017, and related documents submitted prior to this registration.

Table 1. Eljen GSF Models and Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Product Dimensions (Length x Width x Height) (inches)</th>
<th>Open Bottom Area (feet)</th>
<th>Maximum Bed Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A42</td>
<td>48 x 24 x 7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>B43</td>
<td>48 x 36 x 7</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

Subject to this determination, the Eljen GSF model series will be designed per the sizing and conditions specified by the MPCA, and reflected in this letter of registration. The product information listed in this Notice of Proprietary Product Listing will be maintained on the MPCA website and may not be altered by the manufacturer without permission from the MPCA.
The Eljen GSF model series registration as a distribution medium is authorized for applications in **mound systems only**. Absorption area loading rates and the mound absorption ratios are based on requirements Minn. R. 7080.2220, subp. 3(A) and local ordinance.

**Mound Applications**

Eljen GSF module runs are considered to be, and designed/constructed, as an individual mound beds. Mound distribution media bed widths are restricted to two feet for A42 installations and three feet for B43 installations. Multiple mound beds may be utilized on site provided the absorption area of each mound is outside of the area of influence of all other mound beds. Illustrations of potential layouts for multiple mound beds are provided in Figures 1-4.

Mound designs shall be sized based on bottom area only with no additional reduction given for sidewall absorption. Mound distribution media beds shall be sized in accordance with Minn. R. 7080.2220, subp. 3(A) and (B) except the maximum allowable width for each mound distribution media bed is two (2) feet for Eljen GSF A42, and three (3) feet for Eljen GSF B43. These widths must be used in conjunction with Table IX or IXa in Minn. R. 7080.2150, subp. 3(E) for determining the original soil mound absorption area.

Figures 1-4 provide examples for Eljen GSF configurations when utilized in mound applications using the bottom area sizing as specified above. The area around each Eljen GSF mound distribution media bed shall be filled with clean sand according to manufacturer specifications. The cover placed on top of single mounds, and in between multiple mound beds if such a configuration is used, must meet the requirements specified in Minn. R. 7080.2220, subp. 3 Item S. The top six inches of cover must be established as required in Minn. R. 7080.2220, subp. 3(U).

**Figure 1. Top view illustrating multiple mound bed concept for mounds with slopes from 0 to 1%**

![Mound Diagram](image-url)
Figure 2. Top view illustrating multiple mound bed concept for mounds with slopes > 1%

Mound footprint for final cover
3:1 minimum slope

Note - Absorption areas for each bed do not overlap

Figure 3. Side view illustrating multiple mound bed concept for mounds with slopes from 0 to 1%

Original Soil Mound Absorption Areas (in red – must not overlap)

Figure 4. Side view illustrating multiple mound bed concept for mounds with slopes > 1%

Original Soil Mound Absorption Areas (in red – must not overlap)
General Requirements

The registration of products in Minnesota is contingent upon compliance with the following conditions:

1. The manufacturer shall have readily accessible information, specific to a product’s registered use in Minnesota, for designers, installers, regulators, system owners, and service providers for the following items: a) product manual; b) design instructions; c) installation instructions; d) information regarding operation and maintenance; e) homeowner instructions and f) list of manufacturer-certified service providers, if any, as required by Minn. R. ch. 7083.4040 (H).

2. Distribution of sewage must be pressurized in accordance with Minn. R. ch. 7080.2050 and the manufacturer’s installation requirements. The distribution of effluent shall be done in a manner that does not scour or excessively pit the soil’s infiltrative surface or cause sealing from fines at the soil’s infiltrative surface.

3. Original soil mound absorption ratios shall be as specified in Minn. R. ch. 7080.2150, subp.3. Tables IX and IXa and in Minn. R. ch. 7080.2350. Loading rates to the clean sand shall be at 1.2 gal/ft²/day.

4. The minimum depth of soil cover, including six inches of topsoil borrow over the center of the mound or mound beds, is 12 inches. The material placed on top of single mounds, and in between multiple mounds if such a configuration is used, must meet the requirements specified in Minn. R. 7080.2220, subp. 3 Item S at a minimum. The material for the top 6 inch of cover must be as specified in Minn. R. 7080.2220, subp. 3(U).

5. Any excavation into the absorption area must be in a manner that maintains soil structure in an un-smeared and un-compacted condition. Excavation and placement of Eljen GSF modules are allowed when: 1) the soil moisture is less than the plastic limit and 2) the soil is not frozen or freezing per Minn. R. 7080.2150, subp. 3(G).

6. Placement of Eljen GSF modules shall be performed in a manner that minimizes soil compaction due to foot traffic related to the installation of module products.

7. Supply pipes must remain below finished grade in all configurations and meet all requirements outlined in Minn. R. 7080.2050, subp. 2(B).

8. One vertical inspection pipe must be properly installed within each mound, terminating at the clean sand and Eljen GSF module interface, per Minn. R. 7080.2220, subp. 3(O). The manufacturer’s installation instructions for mounds shall illustrate this requirement.

9. Training shall be provided to practitioners in the proper application and use of the Eljen GSF model series as registered for use in Minnesota.

10. During the period of product registration and as part of the renewal process, systems using registered distribution products are subject to an audit established by the MPCA.
Please be advised that this registration expires on December 31, 2022. Manufacturers desiring to continue product registration beyond this date must obtain MPCA renewal according to the requirements in Minn. R. 7083.4080, subp. 5. If the MPCA finds the product has changed in any way that may affect performance, it may not be renewed and must meet the requirements for initial registration.

The MPCA is in no way endorsing these products or any advertising, and is not responsible for any situation which may result from its use or misuse. The MPCA is not liable for any product failure and these statements are not intended and cannot be relied upon to establish any substantive or procedural rights with the state of Minnesota or the MPCA, either express or implied, that can be enforced in litigation or any administrative proceeding.

If you have any questions, please contact Cody Robinson at 651-757-2535 or by email at cody.robinson@state.mn.us.

Sincerely,

Cody Robinson
Soil Scientist
Municipal Division

CR:map

cc: File
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A42 Module</strong></td>
<td>48” x 24” x 7” (L x W x H)</td>
</tr>
<tr>
<td><strong>B43 Module</strong></td>
<td>48” x 36” x 7” (L x W x H)</td>
</tr>
<tr>
<td><strong>Cover Fabric</strong></td>
<td>The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.</td>
</tr>
<tr>
<td><strong>Design Flow</strong></td>
<td>The estimated peak flow that is used to size a GSF system is 150 gallons per day per Bedroom.</td>
</tr>
<tr>
<td><strong>GSF</strong></td>
<td>The Eljen Geotextile Sand Filter Modules and the 6-inch sand layer at the base and 6 inches along the sides of the modules.</td>
</tr>
<tr>
<td><strong>GSF Module</strong></td>
<td>The individual module of a GSF system. The module is comprised of a cuspated plastic core and geotextile fabric.</td>
</tr>
</tbody>
</table>
1.0 System Preconditions

1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The Minnesota Regulations Chapter 7080 and the local regulations will be referred to as the guidelines. The designs in this manual are guided by the design instructions for Type 1 Mound system in the guidelines.

Please contact Eljen’s Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

1.2 WATER SOFTENER BACKWASH: At no time should water softener backwash be disposed of in the septic system. Water softener backwash should be discharged to a separate soil absorption field.

1.3 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. Minnesota code requires that systems where a garbage disposal unit is anticipated or installed in a dwelling, the septic tank capacity must be at least 50 percent greater than that required in 7080.1930 subpart 2 of the regulations and must include either multiple compartments or multiple tanks. 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.

1.4 ADDITIONAL FACTORS AFFECTING 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.

1.5 SYSTEM PROHIBITED AREAS: All vehicular traffic is prohibited over the GSF system. GSF systems shall not be installed under paved or concreted areas. If the system is to be installed in livestock areas, the system must be fenced off around the perimeter to prevent compaction of the cover material and damage to the system.
2.1 GSF UNITS:

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 cover above the module.
2.0 Design and Installation

2.2 SEPTIC TANKS: Dual compartment tanks are recommended for all systems. Eljen supports this practice as it helps to promote long system life by reducing TSS and BOD to the effluent disposal area. Effluent filters are required.

2.3 SEPTIC TANK FILTERS: Septic tank effluent filters are REQUIRED on the outlet end of septic tank. Filter manufacturers 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.

2.4 VERTICAL SEPARATION TO LIMITING LAYER: A minimum vertical separation of 36 inches of unsaturated soil or sand between the bottom of the GSF unit and the periodically saturated soil level or bedrock. Specified sand may count towards constructability requirements for mounds.

![FIGURE 3: VERTICAL SEPARATION TO RESTRICTIVE LAYER](image)

2.5 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. Please place a prominent note to this effect on each design drawing. Washed concrete sand easily meets the above specification and is a reliable choice. Suitability of bank run sand must be verified.

2.6 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.

2.7 DISTRIBUTION: Pressure distribution must be used. Two delivery methods are acceptable. Orifice shields are placed over a SCH 40 pipe, one per unit.

A second delivery method is also permissible. 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. A pressure manifold is placed inside the distribution pipe. All piping must meet state and local regulations.

Section 7.0 of this manual goes into details of how to construct the distribution network.
2.0 Design and Installation

2.8 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.

2.9 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.

2.10 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 6.0 for a more detailed explanation of venting GSF products.

2.11 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.

2.12 SYSTEM GEOMETRY: Design systems as long and narrow as practical along site contours to minimize ground water mounding especially in poorly drained low permeability soils. If possible, design level systems with equal number of modules per row.

For trench system using the A42, the edge to edge spacing is a minimum of 6 ft. For the B43 unit, the edge to edge spacing for trenches is 8 ft.

2.13 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of six (6) A42 modules per bedroom or five (5) B43 modules per bedroom. See Section 1.16 for more information on systems sizing.

2.14 SIZING GSF SYSTEM FOR SAND MOUNDS:

TABLE 1: LOADING RATES FOR DETERMINING BOTTOM ABSORPTION AREA AND ABSORPTION RATIOS USING PERCOLATION TESTS

<table>
<thead>
<tr>
<th>Percolation Rate (MPI)</th>
<th>Mound Absorption Area Loading Rate (gpd/ft2)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.1</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>0.1 to 5</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>0.1 to 5 (fine sand and loamy fine sand)</td>
<td>0.6</td>
<td>2.0</td>
</tr>
<tr>
<td>6 to 15</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>16 to 30</td>
<td>0.6</td>
<td>2.0</td>
</tr>
<tr>
<td>31 to 45</td>
<td>0.5</td>
<td>2.4</td>
</tr>
<tr>
<td>46 to 60</td>
<td>0.5</td>
<td>2.6</td>
</tr>
<tr>
<td>61 to 120</td>
<td>-</td>
<td>5.0</td>
</tr>
<tr>
<td>&gt;120</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
## 2.0 Design and Installation

**TABLE 2: LOADING RATES FOR DETERMINING BOTTOM ABSORPTION AREA AND ABSORPTION RATIOS USING DETAILED SOIL DESCRIPTIONS**

<table>
<thead>
<tr>
<th>USDA Soil Texture</th>
<th>Soil Structure and Grade</th>
<th>Mound Absorption Area Loading Rate (gpd/ft²)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand, Coarse Sand, Loamy Sand, Loamy Coarse Sand, Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand, 35 to 50% Rock Fragments</td>
<td>Single grain, granular, blocky, or prismatic structure; weak grade</td>
<td>**</td>
<td>1.0</td>
</tr>
<tr>
<td>Sand, Coarse Sand, Loamy Sand, Loamy Coarse Sand, &lt;35% Rock Fragments</td>
<td>Single grain, granular, blocky, or prismatic structure; weak grade</td>
<td>1.20</td>
<td>1.0</td>
</tr>
<tr>
<td>Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand, &lt;35% Rock Fragments</td>
<td>Single grain, granular, blocky, or prismatic structure; weak grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
<tr>
<td>Sandy Loam, Coarse Loamy Sand, Fine Sandy Loam, Very Fine Sandy Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.78</td>
<td>1.5</td>
</tr>
<tr>
<td>Sandy Loam, Coarse Loamy Sand, Fine Sandy Loam, Very Fine Sandy Loam</td>
<td>Platyl with weak grade or massive</td>
<td>0.68</td>
<td>1.8</td>
</tr>
<tr>
<td>Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
<tr>
<td>Loam</td>
<td>Platyl with weak grade or massive</td>
<td>0.52</td>
<td>2.3</td>
</tr>
<tr>
<td>Silt Loam, Silt</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.50</td>
<td>2.4</td>
</tr>
<tr>
<td>Silt Loam, Silt</td>
<td>Platyl with weak grade or massive</td>
<td>0.42</td>
<td>2.9</td>
</tr>
<tr>
<td>Clay Loam, Sandy Clay Loam, Silty Clay Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.45</td>
<td>2.6</td>
</tr>
<tr>
<td>Clay, Sandy Clay, Silty Clay</td>
<td>-</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>
3.0 Level Mound Sizing

Level Mound Example:
House size: 3 Bedrooms
Classification: Classification I
Soil Evaluation: Loam; Blocky
Depth to Limiting Condition: 36 inches
Site Slope: 0%
Berm Ratio: 4:1
Distribution Type: Pressure Distribution


1.B: In situ soil application rate

<table>
<thead>
<tr>
<th>USDA Soil Texture</th>
<th>Soil Structure and Grade</th>
<th>Mound Absorption Area Loading Rate (gpd/ft²)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
</tbody>
</table>

1.C: Depth to Limiting Condition: 36 inches

1.D: Site Slope: 0%

1.E: Design Media Loading Rate: 1.2 gpd/ft²

1.F: Mound Absorption Ratio

<table>
<thead>
<tr>
<th>USDA Soil Texture</th>
<th>Soil Structure and Grade</th>
<th>Mound Absorption Area Loading Rate (gpd/ft²)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Eljen GSF Media Sizing

450 gpd ÷ 1.2 gpd/ft² = 375 ft²

2.B: Dispersal Bed Width (if using A42 = 2 ft, B43 = 3 ft): 3 ft

2.C: Contour Loading Rate = 2.B x 1.E (if greater than 12, reduce Dispersal Bed Width in 2.B)
3 ft x 1.2 gpd/ft² = 3.6 gal/ft

2.D: Number of Cells = (Designer may shorten the mound using additional cells)
3 cells

375 ft² ÷ 3 ft = 41.6 ft, round to next greater number that is divisible by 4
44 ft

Absorption Area Sizing

3.A: Absorption Width per Cell = 2.B x 1.F
3 ft x 2.0 = 6.0 ft

(6.0 ft – 3 ft) ÷ 2 = 3.0 ft ÷ 2 = 1.5 ft
### 3.0 Level Mound Sizing

**Mound Sizing**


48 inches – 36 inches = 12 inches, convert to feet 1 ft

6.B: Mound Height = 6.A + 1.58 ft (1.58 = Height of Unit + Cover at Edge of Mound)

1 ft + 1.58 ft = 2.58 ft

6.C: Berm Width = 6.B x Berm Ratio

2.58 ft x 4 = 10.32 ft

6.D: Total Landscape Width = (3.A x 2.D) + (2 x 6.C)

(6.0 ft x 3 cells) + (2 x 10.32 ft) = 18 ft + 20.64 ft = 38.64 ft

6.E: Additional Berm Width (if (3.A x 2.D) – 6.D is 0 or less, 0 ft, otherwise (3.A x 2.D) – 6.D)

(6.0 ft x 3 cells) – 38.64 ft = -20.64, therefore 0 ft


10.32 ft + 0 ft = 10.32 ft


(2 x 10.32 ft) + (6 ft x 3 cells – (6 ft – 3 ft)) = 20.64 ft + 18 ft – 6 ft = 35.64 ft

6.H: Total Mound Length = (2 x 6.F) + 2.E

(2 x 10.32 ft) + 44 ft = (20.64 ft) + 44 ft = 64.64 ft

6.I: Setbacks from the Bed = (3.A – 2.B) ÷ 2

(6.0 ft – 3 ft) ÷ 2 = (3.0 ft) ÷ 2 = 1.5 ft

---

**FIGURE 4: PLAN VIEW LEVEL MOUND**

3.0 Level Mound Sizing

FIGURE 5: CROSS SECTION LEVEL MOUND

FIGURE 6: PLAN VIEW LEVEL MOUND EXAMPLE

FIGURE 7: CROSS SECTION LEVEL MOUND EXAMPLE
4.0 Sloped Mound Sizing

**Sloped Mound Example:**
House size: 3 Bedrooms
Classification: Classification I
Soil Evaluation: Loam; Blocky
Depth to Limiting Condition: 36 inches
Site Slope: 5%
Berm Ratio: 4:1
Distribution Type: Pressure Distribution

1.A: **Daily Design Flow:** From 7080.1860:
450 gpd

1.B: **In situ soil application rate**

<table>
<thead>
<tr>
<th>USDA Soil Texture</th>
<th>Soil Structure and Grade</th>
<th>Mound Absorption Area Loading Rate (gpd/ft²)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
</tbody>
</table>

1.C: **Depth to Limiting Condition**
36 inches

1.D: **Site Slope**
5%

1.E: **Design Media Loading Rate**
1.2 gpd/ft²

1.F: **Mound Absorption Ratio**

<table>
<thead>
<tr>
<th>USDA Soil Texture</th>
<th>Soil Structure and Grade</th>
<th>Mound Absorption Area Loading Rate (gpd/ft²)</th>
<th>Mound Absorption Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loam</td>
<td>Granular, Blocky or Prismatic Structure; Weak to Strong Grade</td>
<td>0.60</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Eljen GSF Media Sizing**

450 gpd ÷ 1.2 gpd/ft² = 375 ft²

2.B: **Dispersal Bed Width (if using A42 = 2 ft, B43 = 3 ft)**
3 ft

2.C: **Contour Loading Rate = 2.B x 1.E (if greater than 12, reduce Dispersal Bed Width in 2.B)**
3 ft x 1.2 gpd/ft² = 3.6 gal/ft

2.D: **Number of Cells = (Designer may shorten the mound using additional cells)**
3 cells

375 ft² ÷ 3 ft ÷ 3 = 41.6 ft, round to next greater number that is divisible by 4
44 ft

**Absorption Area Sizing**

3 ft x 2.0 = 6.0 ft

6.0 ft – 3 ft = 3.0 ft
4.0 Sloped Mound Sizing

Mound Sizing


48 inches – 36 inches = 12 inches, convert to feet 1 ft

6.B: **Upslope Mound Height = 6.A + 1.58 ft (Height of Unit + Cover at Edge of Mound)**

1 ft + 1.58 ft = 2.58 ft

6.C: **Upslope Berm Multiplier**

<table>
<thead>
<tr>
<th>Land Slope %</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upslope Berm Ratio</td>
<td>3:1</td>
<td>3.00</td>
<td>2.91</td>
<td>2.83</td>
<td>2.75</td>
<td>2.68</td>
<td>2.61</td>
<td>2.54</td>
<td>2.48</td>
<td>2.42</td>
<td>2.36</td>
<td>2.31</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>4:1</td>
<td>4.00</td>
<td>3.85</td>
<td>3.70</td>
<td>3.57</td>
<td>3.45</td>
<td><strong>3.33</strong></td>
<td>3.23</td>
<td>3.12</td>
<td>3.03</td>
<td>2.94</td>
<td>2.86</td>
<td>2.78</td>
</tr>
</tbody>
</table>

We used the 4:1 ratio as that was specified in the example conditions.


3.33 x 2.58 ft = 8.59 ft


3 ft x .05 = 0.15 ft


2.58 ft + 0.15 ft = 2.73 ft

6.G: **Downslope Berm Multiplier**

<table>
<thead>
<tr>
<th>Land Slope %</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<td>3.09</td>
<td>3.19</td>
<td>3.30</td>
<td>3.41</td>
<td>3.53</td>
<td>3.66</td>
<td>3.80</td>
<td>3.95</td>
<td>4.11</td>
<td>4.29</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>4:1</td>
<td>4.00</td>
<td>4.17</td>
<td>4.35</td>
<td>4.54</td>
<td>4.76</td>
<td><strong>5.00</strong></td>
<td>5.26</td>
<td>5.56</td>
<td>5.88</td>
<td>6.25</td>
<td>6.67</td>
<td>7.14</td>
</tr>
</tbody>
</table>

We used the 4:1 ratio as that was specified in the example conditions.


5.00 x 2.73 ft = 13.65 ft

6.I: **Berm to Cover Absorption Area = 3.B + 4 ft**

3.0 ft + 4 ft = 7.0 ft

6.J: **Downslope Berm = either 6.H or 6.I, whichever is larger**

13.65 ft > 7.0 ft 13.65 ft

6.K: **Berm Multiplier = usually 3.0 or 4.0**

We used the 4:1 ratio as that was specified in the example conditions. 4.0


4.0 x 2.73 ft = 10.92 ft


8.59 ft + (6 ft x 3 cells) – (6 ft – 3 ft) + 13.65 ft = 37.24 ft


10.92 ft + 44 ft + 10.92 ft = 65.84 ft
4.0 Sloped Mound Sizing

FIGURE 8: PLAN VIEW SLOPED MOUND

FIGURE 9: CROSS SECTION SLOPED MOUND
5.0 Dispersal Bed Construction for Mounds

**DISPERsal BED SIZING:** Options are 2 or 3 ft using the A42 or B43 respectively.

**A42 UNITS:** Have a width of 2 feet when used in a Dispersal Bed.

**B43 UNITS:** Have a width of 3 feet when used in a Dispersal Bed.

**UNITS REQUIRED:** Units are 4 feet long. Divide the Dispersal Bed Length by 4 and round up to determine the units required per row. Keep equal distance from the ends of the Dispersal Bed when placing the unit rows. Multiply the number of units required per row and that will determine the number of units required.
6.0 Mound Installation Guidelines

6.1 MOUND REFERENCE: The following guidelines provide an overview for mound design and construction.

FIGURE 12: CROSS SECTION – MOUND SYSTEM
*Note: Design Can Utilize Either B43 or A42 Modules

FIGURE 13: CROSS SECTION – SLOPED MOUND SYSTEM
*Note: Design Can Utilize Either B43 or A42 Modules
6.0 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 number of GSF Modules required using the sizing formula.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during preparation. 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. Remove the organic soil layer. Prepare the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the absorption area prior to placement of the Specified Sand to avoid soil compaction.

6. Place fill material meeting local requirements (or Specified Sand requirements) onto the soil interface as you move down the excavated area. 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 shall meet the mound design requirements.

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 perforated 4-inch distribution pipe is centered along the modules 4-inch length. Orifices are set at the 4 & 8 o’clock position.

9. All distribution pipes are secured with manufacturers supplied wire clamps, one per module.

10. (Pressure Distribution Systems) Insert a PVC Sch. 40 pressure pipe (size per design and code) into the standard perforated distribution pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 14. Each pressure lateral will have a drain hole at the 6 o’clock position. Each pressure lateral shall include sweeping cleanouts at the terminal ends and be accessible from grade.

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. Ensure there is 6 inches of specified sand surrounding the GSF modules in the mound. Slope the sand away from the mound as described on the plan.

13. Complete backfill with a minimum of 12 inches of cover material measured from the top of the module. 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 system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

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

7.1 DOSING DESIGN AND FLOW RATE: Dosing volume must be set to deliver a maximum of **4 gallons per B43 Module** and **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.

7.2 PRESSURE DISTRIBUTION: Dosing with small diameter pressurized laterals is acceptable for GSF systems. The pipe networks must be engineered and follow principles established for pressure distribution. Using pipe-in-pipe networks as shown in Figure 14, the orifice size of 3/16 inch is respectively recommended, however designers are free to design the network to their specifications. On sloping sites, the orifices should be offset by 2 feet on each line. For example, the orifice on line one may be at 1 ft, 5 ft, 9 ft etc. with the next line at 3 ft, 7 ft, 11 ft etc. Flushing ports are required to maintain the free flow of effluent from orifices at the distal ends of each lateral. Contact Eljen’s Technical Resource Department at 1-800-444-1359 for more information on pressure distribution systems.

Standard procedures for design of pressure distribution networks apply to the GSF filter. A minimum orifice size according to the regulations shall be maintained. A drain hole is required at the 6 o’clock position of each pressure lateral for drainage purposes. The lateral pipe network, constructed of PVC Sch. 40 pipe (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. Pressure cleanouts are required at the end of each lateral.

**FIGURE 14: PRESSURE PIPE PLACEMENT**
FIGURE 15: PRESSURE CLEANOUT

- FINISHED GRADE
- 6 - 8" DIAMETER LAWN SPRINKLER
- THREADED CLEANOUT PLUG
- 4" END CAP
- LONG SWEEP 90 OR TWO 45 DEGREE BENDS SAME DIAMETER AS LATERAL
- LATERAL ENDS AT LAST ORIFICE WHERE VARIABLE LENGTH CLEANOUT BEGINS
- DISTRIBUTION LATERAL
- LATERAL CLEANOUT

FIGURE 16: CONTOURED TRENCH PRESSURE DISTRIBUTION

- STANDARD FITTING(S)
- 4" PERFORATED PIPE
- PRESSURE PIPE (SIZE PER DESIGN/ CODE)
- PRESSURE PIPE EXTENDS THRU END CAP, AND IS EXTENDED FOR CLEAN OUT
- DRAIN OPENING AT 6 O'CLOCK
- CAP END OF 4" PIPE

Prior to placing fabric cover, hand shovel specified sand in these areas.

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.
8.0 System Ventilation

8.1 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.

8.2 VENT PIPE FOR LOW-PRESSURE SYSTEMS: Systems with over 18” of cover over the top of the modules require a vent. If the system is a low-pressure distribution system, ensure that the LPP cleanouts are located in the vent for easy access.

FIGURE 17: VENT LAYOUTS FOR GRAVITY AND LOW-PRESSURE SYSTEMS

8.3 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 18: GSF WITH 4” VENT EXTENDED TO CONVENIENT LOCATION
9.0 Inspection/Monitoring Port

The system shall include one Inspection/Monitoring Port designed and installed with access from the ground surface. It shall be open and slotted at the bottom and be void of sand or gravel to the infiltrative surface to allow visual monitoring of standing liquid in the trench. The figures below depict construction and placement of the Inspection/Monitoring Port. Positioning of the port in reference to the length of the trench is in accordance to your local regulations and specifications.

**FIGURE 19: INSPECTION / CLEANOUT VENT**

**FIGURE 20: INSPECTION PORT**

- Non-perforated 4" pipe
- Perforated 4" pipe
- Coupling
- Pipe cover
- Tape or tie to pipe
- Typar sock
- Open bottom
- Specified sand surrounding pipe
- Geotextile fabric
- Specified sand
- Pipe flush with sand-soil at infiltrative surface
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.