IDAHO

GeoMat™ Leaching Systems

Design Manual for
Pressure and Gravity Applications

August 2020

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Tables, Design Examples, and Figures

Introduction

The GeoMat Flat Leaching System ("GeoMat"), is a low-profile leaching system designed for maximum treatment and infiltration of wastewater into soil. GeoMat is nominally 1 inch thick and available in widths of 6, 12, and 39 inches. It is comprised of an entangled filament core covered by a hygroscopic membrane with an incorporated distribution pipe.

Due to the shallow burial depth and the high surface area to void space ratio in the GeoMat, gas exchange has been shown to be significantly greater in GeoMat than in other leach field technologies. This increased oxygen transfer rate results in increased removal of pathogens, B.O.D., T.S.S., and nutrients such as nitrogen and phosphorus in a shallower soil profile.

The combination of the highly transmissive core and hygroscopic membrane draw the water between the application points and uniformly apply the water to the surrounding soil. The soil then draws the water away from the surrounding membrane through capillary action. This results in a much more uniform application of water to the soil and minimizes the point loading associated with other low-profile systems.

In general, GeoMat can be utilized in many different configurations; please check with your regulatory agency or contact Geomatrix for the configurations that may be available in your area. GeoMat can be installed in trench and bed layouts and function with gravity, pump to gravity, and pressure distribution system configurations. GeoMat with 6 inches of medium manufactured sand beneath it can be configured to achieve NSF Standard 40 treatment levels. Idaho regulations require 12 inches of manufactured medium sand under the GeoMat. GeoMat can also be used for subsurface irrigation and nutrient reuse.

Geomatrix products are the result of intensive research and development, including in house and third-party testing. Test reports are available by contacting Geomatrix.

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Definitions

"GeoMat" means a nominally 1 inch fused entangled plastic filament core with a hygroscopic membrane on top and bottom.

"GeoMat Component" means GeoMat on top of 12 inches of manufactured medium sand.

"GeoMat 1200" means GeoMat that is 12 inches wide and nominally 1 inch thick.

"GeoMat 3900" means GeoMat that is 39 inches wide and nominally 1 inch thick.

Designing a GeoMat System

GeoMat shall be designed in accordance with **all State and local regulations including the Idaho Technical Guidance Manual (TGM).**

Leach fields are designed based on a peak design flow measured in gallons per day (GPD) set by Local or State Agencies. The peak design flow is typically 1.5 to 2 times the average water consumption. Leach fields are not designed to be loaded at the peak design flow for extended periods of time. Leach fields that are loaded at the peak design for extended periods without sufficient time to rest may experience clogging and/or premature failure. Designers of GeoMat systems must take care to understand the intended use of the GeoMat system and design in accordance with both the regulatory design flow and the intended use. If the 30 day average flow will be greater than 50% of the peak design flow, systems should be upsized accordingly.

Systems with high peak loading events can benefit from time dosing.

The designer is responsible for specifying the diameter of the distribution pipe used (typically 1 inch – 2 inches), the spacing of the orifice holes, and for calculating frictional losses. Distal head should be a **minimum** of 2 feet and a **maximum** of 5 feet of residual head (static pressure) at the end of each drainfield distribution lateral.

In all configurations, the GeoMat must be placed on a minimum of 12 inches of manufactured medium sand.

Design software for pump, lateral line, transport pipe, manifold, orifice size and associated frictional losses is available on our website at www.geomatrixsystems.com or by emailing request to info@geomatrixsystems.com.

GeoMat must be designed and installed utilizing the following parameters:

- Gravity or Pressure distribution may be used. In Idaho, pressure distribution requires design by a professional engineer.
- GeoMat 1200 and 3900 can be utilized in the same trench or bed to provide the necessary square footage.

GeoMat in Trench Configuration

GeoMat may be constructed in a traditional trench configuration or capping fill configuration (See Figures 9-11). For traditional trench configurations:

- Adjacent trenches must be separated by a minimum of 6 feet of undisturbed soil; if soil between trenches becomes disturbed due to collapse, removal of boulders, etc., the disturbed soil should be replaced with medium manufactured sand.
- GeoMat systems in trench configuration may use gravity or pressure distribution unless configuration exceeds 1,500 square feet which must be designed using pressure distribution.
- Multiple laterals of GeoMat may be placed in the same trench. Laterals may be placed edge to edge or evenly spaced within the trench. Table 2 provides the appropriate length of GeoMat for each configuration.
- Two laterals of GeoMat 3900, each with a distribution pipe, can be utilized in a 5 to 6-foot-wide trench if one of the runs of GeoMat is overlapped on top of the other (Figure 11).

Capping fill trenches must be designed in accordance with Section 4.3 “Capping Fill System” of the TGM including:

- For below-grade capping fill systems, site slope may not exceed 20 percent unless pressure distributed.
- For above-grade capping fill systems, site slope may not exceed 12 percent unless pressure distributed.
- Refer to Figure 13 for Capping Fill System design example.

GeoMat in a Sand Bed Configuration

Sand bed configuration may be considered when a site is suitable for a subsurface disposal system but is not large enough for a system in trench configuration. All systems in sand bed configuration must be approved by the permitting Public Health District.

A minimum of 12 inches of manufactured medium sand must be placed beneath the GeoMat and 2 inches of manufactured medium sand should be placed over the GeoMat fabric membrane.

- Gravity or pressure distribution may be used.
- A minimum of 6 inches and a maximum of 24 inches of medium manufactured sand must extend horizontally past all edges of the GeoMat.
- Cover depth shall be a minimum of 12 inches above the GeoMat.

- Multiple laterals of GeoMat may be placed in the same bed. Laterals may be placed edge to edge or evenly spaced within the bed. Tables 7 through 8 provide the appropriate length of GeoMat for each configuration.

GeoMat in Mound Configuration

GeoMat in mound configuration must de designed in accordance with the requirements of Section 4.24 “Sand Mound” of the TGM.

- GeoMat in mound configuration must be designed by a professional engineer licensed in Idaho.
- GeoMat in mound configuration must be covered with 2 inches of manufactured medium sand and a sufficient layer to topsoil; the remaining cover, to reach a total minimum of 12 inches of cover, shall be material equivalent to native soil in the area of installation.
- GeoMat in mound configuration must be designed using pressure distribution.
- The GeoMat cover material should be final graded to a 2% pitch over the GeoMat system and for 24 inches beyond the outermost edge of the GeoMat. If the cover material over the GeoMat is above the original grade, it shall maintain the 2% pitch for a minimum of 24 inches beyond the outermost edge of the GeoMat and then run at least a 3:1 slope to original grade.

Daily Design Flow

Daily design flows shall be in accordance with the design flows set forth in Table 4-22 of the TGM “Secondary biological treatment system hydraulic application rates”.

TGM Table 4-20

Secondary biological treatment system hydraulic application rates

Soil Design Subgroup	Soil Texture Classification	Application Rate (gal/sq. ft/day)
A-1	Medium Sand	1.7
A-2a	Loamy Coarse	1.2
A-2b	Fine Sand	1.0
	Loamy Sand	
B-1	Very Fine Sand	0.8
	Sandy Loam	
	Very Fine Sandy Loam	
B-2	Loam	0.6
	Silt Loam	

	Sandy Clay Loam	
C-1	Silt	0.4
	Sandy Clay Loam	
	Silty Clay Loam	
C-2	Clay Loam	0.3

Minimum Absorption Area Required

The minimum amount of absorption area required may be calculated by determining the required Flow Rate for the system based on the required flow rates set forth in IDAPA 53.01.03.007.08 “Wastewater Flows from Various Establishments in Gallons per Day”. The Flow Rate shall be divided by the applicable Application Rate from Table 4-20 of the TGM “Secondary biological treatment system hydraulic application rates”. The result is set forth as Minimum Absorption Area Required for Trench and Bed Configurations (Table 1).

GeoMat Sizing

System sizing is inherently related to cost. While more surface area is always beneficial, the cost per acre of land, additional construction costs, septic fill, septic tank/pretreatment efficiency, leaching system components, etc. must be balanced against the type of use, useful life and performance of the system.

Ultimately what and how much the user puts down the drain will determine the ultimate system lifespan and performance. Performance testing, national standards, and government regulations do not necessarily address all situations/users.

When a leaching system is not being used (i.e. not being dosed with wastewater), the organic matter that has accumulated over time can dry out and breakdown in a process similar to composting. Zoned systems can be utilized to run and rest portions of the system and facilitate this resting process if the use pattern of the system will not naturally facilitate it. Inorganic materials that are put down the drain will be unaffected and not breakdown.

The use of SoilAir can greatly enhance rest intervals and the breakdown of organic clogging matter. If a SoilAir system is not installed when the system is constructed, the installation of an air introduction point is advisable to allow rejuvenation of the system should this be necessary at some point in the future.

A frank, honest discussion between the installer/designer and the property owner about how the system will be utilized is the best way to determine what type of design, specific components and what sizing/safety factor is best to apply to any given design. Geomatrix encourages the designer and property owner to make the system as big as possible; but any final design is ultimately a compromise between cost, performance and longevity. If cost is not an issue...designing as conservatively as possible is encouraged.

As there are many variables affecting septic systems performance, when possible, increasing surface area is beneficial. Designing at the highest approved hydraulic loading rate, just because it is allowed, may not be in the property owners best long-term interest.

Leach fields are typically designed based on the following standard residential wastewater effluent strength from a primary septic tank BOD_5(1) of <180 mg/L, TSS(2) <100 mg/L and FOG(3) <10 mg/L. When effluent exceeds typical residential wastewater strength, the leach field surface area needs to be increased to allow a greater soil surface area (sq. ft) to effluent (gpd) ratio to ensure adequate oxygen transfer. Failure to increase the square foot area will result in premature leach field failure.

1. Biochemical Oxygen Demand (BOD)- the approximate amount of oxygen required to treat wastewater; is a proxy measure for the amount of organic matter in a system.
2. Total Suspended Solids (TSS) – determines the amount of solids that do not settle out in the tank and can pass through to the leach field.
3. Fat, Oil, and Grease (FOG) – the portion of wastewater constituents that are less dense than water; can cause maintenance issues and increased clogging of the leach field and interferes with the biological action of the treatment process.

Leach fields are designed based on a peak design flow measured in gallons per day (GPD) set by Local or State Agencies. The peak factor is typically 1.5 to 2 times the average water consumption over a 30-day period. Leach fields are not designed to be loaded at the peak design flow for an extended period of time. Leach fields that are loaded at the peak design for an extended period may experience premature failure. It is important to repair leaking water fixtures promptly and if the, system is designed for residential uses, high water uses such as laundry needs to spread out throughout the week instead of doing several loads in one day.

<u>A minimum of 24 linear feet of GeoMat 3900 per bedroom and a minimum of 78 linear feet of GeoMat 1200 per bedroom must be used on all systems. Refer to Tables 2-5 for minimum GeoMat required.</u>

System Design Steps

Trench Sizing Steps: Examples and “Experienced User Guide” in Appendix

Step 1. Determine Minimum Trench[1] Bottom Area by referring to Table 1.

Table 1: Minimum Bottom Area Required for Trench and Bed Configuration

	Application Rate (GPD/sq. ft) / Soil Design Subgroup						
	1.7/A-1	**1.2/A-2a**	**1.0/A-2b**	**0.8/B-1**	**0.6/B-2**	**0.4/C-1**	**0.3/C-2**
Bedrooms	**Minimum Surface Area Required (sq. ft)**						
1	89	125	150	188	250	375	500
2	118	167	200	250	334	500	667
3	148	209	250	313	417	625	834
4	177	250	300	375	500	750	1000
5	206	292	350	438	584	875	1167
Each Additional	30	42	50	63	84	125	167

Minimum bottom area required: ____________________

In this step we are calculated the total trench bottom area required by State regulations.

Step 2. Determine width of each trench and total length of trench required:

Divide required trench bottom area from Step 1 by desired trench width to determine the total length that is required among all trenches.

________________	÷	________________	=	________________
Required area from step 1		Trench width (any width, 1-6’)		Total trench length required

GeoMat systems may be designed in a single trench or in multiple equal length trenches with 6 feet of undisturbed soil between adjacent trenches (Step 3). In this step we are calculating the total length of trench which may be split evenly between multiple trenches if multiple trenches are required/desired.

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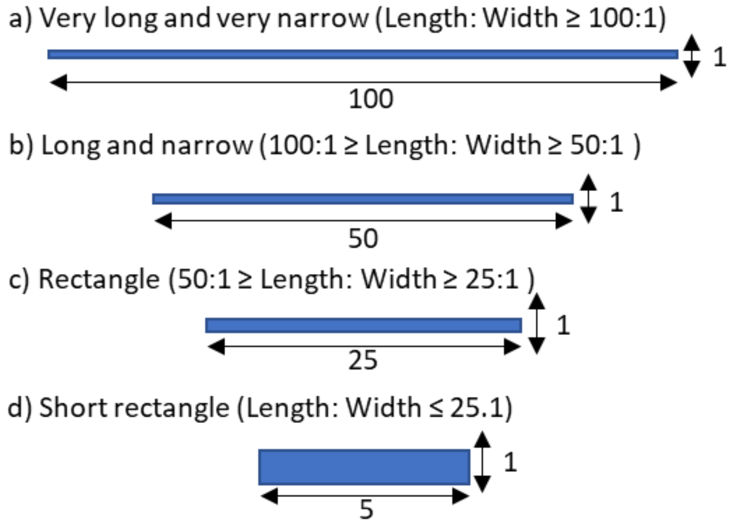
[1] When trenches cannot fit on a site, the designer may request approval from the approving health district to design a bed system. Using area from Step 1, repeat Steps 3 through 6 with excavation widths greater than 6 feet. GeoMat laterals in bed designs can be spaced no more than 6 feet on center and no more than 3 feet from the sidewall.

Design tip: *If you do not know how wide you want the trench(es), start with the narrowest trench possible. The narrowest trench possible is 1 foot with one GeoMat 1200 lateral. Also consider the basic desired trench width to length ratio from the following*[2]*:*



If you want to consider other dimensions, use the space below to alter trench width and determine alternate lengths. Repeat with various trench widths up to 6 feet until the dimensions are suitable for the site.

Required area from step 1	÷	Trench width (any width, 1-6’)	=	Total trench length required
Required area from step 1	÷	Trench width (any width, 1-6’)	=	Total trench length required
Required area from step 1	÷	Trench width (any width, 1-6’)	=	Total trench length required

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[2] Based on site constraints including usable lot space, existing infrastructure/obstacles, distance to groundwater, contour direction, and soil type. In soils with low acceptance ratings, longer narrower soil treatment areas, designed parallel to contours, have a larger groundwater acceptance window and increased hydraulic performance relative to short and wide systems

Step 3. Determine number and length of trenches: GeoMat systems may be designed in multiple equal length trenches. If a single trench is longer than desired for the site, the required bottom area can be divided among multiple trenches[3].

Divide the total trench length from Step 2 by desired number of trenches to determine each trench length.

________________	÷	________________	=	________________
Total trench length from Step 2		# of trenches		Length of each trench

Step 4. Select GeoMat lateral type and determine number of laterals: The GeoMat can be designed with GeoMat 1200 (1 foot wide) or GeoMat 3900 (3.25 feet wide) laterals. Determine the number of GeoMat 1200 laterals that will fit in your selected trench width in Step 4a and the number of GeoMat 3900 laterals that will fit in your selected trench width in Step 4b. Select type of GeoMat that will work best for your site in step 4c.

Step 4a. Determine how many GeoMat 1200 laterals will fit in each trench by dividing trench width from Step 2 by GeoMat 1200 width (1 foot):

________________	÷	1 foot	=	________________
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

If your result from Step 4a was a whole number it is the maximum number of GeoMat laterals that will fit. If your result was not a whole number, round down to determine maximum number of GeoMat laterals that will fit in a trench.

Step 4b. Determine how many GeoMat 3900 laterals will fit in trench by dividing trench width from Step 2 by GeoMat 3900 width (3.25 foot):

________________	÷	3.25 feet	=	________________
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

If your result from Step 4b was less than 0.8 use GeoMat 1200s. If your result from Step 4b was between 0.9 and 1.4 center 1 lateral in the trench. If your result was equal to or

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[3] A minimum of 6 feet of undisturbed soil is required between each adjacent trench.

greater than 1.5 overlap 2 GeoMat 3900 laterals (see Figure 11).

Step 4c. Based on your results from Steps 4a and 4b, select type of GeoMat and number of laterals that will maximize performance and cost effectiveness:

Type of GeoMat (circle one): GeoMat 1200 GeoMat 3900

Number of laterals per trench[4]: ___________

Step 5. Ensure design meets minimum GeoMat required: Geomatrix requires a minimum length of GeoMat per bedroom to ensure adequate sizing for long-term hydraulic performance.

Step 5a. Multiply trench length from Step 2 by the number of the number of laterals in each trench from Step 4d to get total GeoMat length.

____________	x	____________	=	____________
Total trench/bed length from Step 2		# of GeoMat laterals per trench/bed from Step 4c		Total GeoMat length in system

Step 5b. Compare total GeoMat length from Step 5a to values in Table 2 and ensure it meets minimum for bedrooms in design.

Table 2: Minimum required GeoMat length (linear feet) required per bedroom

	Min Required feet of GeoMat 1200 (linear feet)	Min Required feet of GeoMat 3900 (linear feet)			
# of bedrooms	Any lateral # All trench widths*	One lateral All trench widths	Two laterals 5' trench*	Two laterals 5.5' trench*	Two laterals 6' trench*
1	78	24	36	34	30
2	156	48	52	55.5	59
3	234	72	89	83	77.5
4	312	96	103.5	111	118.5
5	390	120	129.5	138.5	148
Each Add'l	78	24	36	34	30

If area meets the minimum, continue to next step.

If minimum length of required GeoMat from Table 2 is not met:

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[*] You may reduce the number of GeoMat laterals in the trench as long as the amount of GeoMat required in Step 5 is met. In this case, provide equal spacing between laterals and between laterals and the sidewalls.

Divide the minimum required GeoMat length from Table 2 by desired number of laterals per trench.

Min. GeoMat (ft) per bedroom from Table 2 ÷ # of laterals = New total trench length

If using multiple trenches, divide new trench length by the number of trenches.

New total trench length ÷ # of trenches = Each trench length

-OR-

Revisit steps 2 and 4 to increase GeoMat in excavation by increasing trench width and adding additional laterals. Repeat until the minimum GeoMat needed per Table 2 is met.

If increasing trench length and/or width does will not work for this design and multiple trenches are not an option, restart from Step 1[5] using the minimum GeoMat area per bedroom from Table 3 below as the minimum bottom area required and fill the entire bottom area with GeoMat.

Table 3: Minimum required GeoMat area required per bedroom

# of bedrooms:	Min Required area (square feet)
1	78 ft^2
2	156 ft^2
3	234 ft^2
4	312 ft^2
5	390 ft^2
Each Add’l	78 ft^2

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[5] If using area from Table 3 to design bottom area, ensure this area is enough to meet minimums required by Idaho State Regulations from Table 1.

Step 6: Complete the design by filling in the following information and doing a rough sketch of the design. Remember to design at least 6 feet of undisturbed soil between each adjacent trench or bed.

TRENCH OR BED WIDTH:
TRENCH OR BED LENGTH:
TYPE OF GEOMAT:
 # OF LATERALS:
 # OF TRENCHES OR BEDS:

Sketch Design

GeoMat systems are incredibly flexible and there are many more configurations possible with the given example parameters.

Basic Design Considerations

Cover depth shall maintain a minimum of 12 inches above the GeoMat. Use clean sandy fill and topsoil suitable for growing grass.

Remember to follow these design parameters when designing and installing GeoMat:

- Preservation of the native soil between trenches and minimizing its disruption and compaction during construction is essential to maintaining soil structure and therefore water and gas movement in the soil around the trenches. For this reason, construction is to be trench-by-trench when possible unless a manufactured medium sand layer is utilized as a continuous base beneath, around and covering the GeoMat.

- Keep the bottom of the GeoMat shallow (13-48 inches below existing and finish grades).

- Separation distances from the bottom of the system sand shall be in accordance with Table 4-21 of the TGM "Intermittent sand filter vertical setback to limiting layers (feet)" See Table 9.

Table 4: Vertical Separation Distances

Limiting Layer	**Flow <2500 GPD**	**Flow >2500 GPD**
Impermeable Layer	2	4
Fractured Rock or Very Porous Layer	1	2
Normal High Ground Water	1	2
Seasonal High Ground Water	1	2

- Keep the bottoms of the individual GeoMat laterals level.

- Do not over-dig the width or depth of the drainfield trenches unless approved sand is utilized as fill.

- Avoid working soils that are moist or wet because they can easily smear and compact.

- Scarify the drainfield base before installing components.

When first reviewing a site and developing a design, position the GeoMat laterals parallel to ground surface contours whenever possible. This will help make it easier to keep drainfield base elevations uniform. Designing perpendicular to a surface contour will mean that the down gradient end of the drainfield trench will be shallow placed, whereas the up gradient end will be much deeper. Systems that are perpendicular to the surface contours also result in a smaller hydraulic window.

GeoMat Excavation Requirements

The soil between the dispersal trenches shall remain undisturbed when possible. If the presence of boulders or other obstacles make trench construction impractical, the entire leach field area may be excavated as necessary, backfilled with a suitable sand fill such as manufactured medium sand to the design elevation of the bottom of trench and the GeoMat constructed and backfilled in manufactured medium sand.

Gravity Distribution Design Parameters

Gravity GeoMat laterals shall not exceed 50 feet; laterals can be 100 feet with distribution tee in the center of the lateral.

Parallel distribution shall be used whenever possible.

Laterals for gravity systems can either be 2 inch SCH40 pipe or SDR35 3 or 4 inch pipe with a min. of two rows, at 5 and 7 o'clock, of ½ inch perforations on 5 inch centers.

Dosing volume does not inherently apply in systems configured for gravity distribution.

Internal GeoMat pipe will be Geomatrix 2 inch perforated pipe or SDR35 3 or 4 inch perforated pipe in gravity systems.

GeoMat laterals at the same elevation should have distribution piping tied together at the ends (Figures 14, 16, and 18).

It is recommended that a state approved effluent filter be utilized.

Pressure Distribution Design Parameters

If pressure distribution is used, all aspects of the pressure distribution system shall be designed and installed in accordance with Section 4.19 "Pressure Distribution Systems" of the TGM. Systems designed for pressure distribution must be designed by a professional engineer.

Generally, the pressure transport pipe from the septic tank or treatment unit to the GeoMat is 1-½ to 3 inch SCH40 PVC pipe. The actual pipe size will depend upon such factors as distance, pump head, scour velocity, frictional losses and desired pressure at the distal orifices. The transport pipe should be sloped either back to the pump basin or toward the GeoMat to drain the line after each dose. In some cases, it may be better to slope the transport line in both directions. This should be done to prevent freezing in cold weather. An anti-siphon device should be used where any chance of siphoning water from the pump tank may occur.

GeoMat distribution manifolds are typically 1½ to 3 SCH40 PVC. Distribution laterals are typically 1 to 2 inch SCH40 PVC. Size will vary depending on design and site conditions. Distribution laterals should have flow equalization valves installed to provide equal flow of effluent to all rows when GeoMat laterals are at varying elevations. Flow equalization valves are often installed in the pump chamber for easy operation, protection from damage and prevention of freezing. A disconnect/throttle valve should be installed downstream of the pump to throttle and/or shut off flow to the GeoMat piping.

Designs should account for a minimum of 2 feet of distal head and a maximum of 5 feet at the distal end of each GeoMat distribution lateral.

Small frequent doses of effluent to the GeoMat are preferred over fewer larger doses; however, rest/reaeration intervals must also be provided for; 4 – 8 doses a day is typical. Pump chambers should preferably be designed with float switches controlling high water alarm, pump on/off, and low water/redundant off. An event counter is recommended. Time dosing can also enhance performance.

Each dose to the GeoMat shall not exceed 20% of the estimated average daily wastewater.

Design software for pump, lateral line, transport pipe, manifold, orifice size and additional head losses is available at our website www.geomatrixsystems.com or by emailing request to info@geomatrixsystems.com.

Based on the system design a series of orifice holes are drilled downward (six o'clock position) and spaced according to the dosing requirements of the system. Orifice sizing is typically 1/8 – 3/16-inch I.D.; with the smaller sizes used for pretreated effluent and the larger sizes for septic tank effluent. During construction/fabrication of the distribution lateral a new/sharp drill bit should be used to assure as smooth an orifice as possible. All drill shavings and burrs must be removed from the piping with a slug and/or brush to prevent clogging of orifices. Geomatrix orifice shields must be used or the GeoMat warranty is void. Orifice shields must be installed over the orifice holes and glued in place with PVC primer and glue.

SCH40 PVC sweep elbows or two 45 degree elbows (also called turn ups) shall be attached to the distal end of each GeoMat distribution lateral to facilitate setting and measuring distal head, maintenance and inspection. A standard 90 degree elbow should not be used because it will interfere with maintenance activities. The open end (upward end) of the turn up needs to be closed off with either a ball valve or threaded plug or cap. These turn ups also serve as distal head ports for measuring and setting distal head on GeoMat laterals at different elevations.

Zoned Drain Fields and Trenches at Different Elevations

Smaller pumps can be used on larger drainfields and result in acceptable frictional losses by utilizing automatic sequencing valves such as those manufactured by K-Rain. These valves automatically direct flow to each respective zone or distribution lateral, in a prescribed order.

Site conditions may not facilitate installing drainfield trenches at the same elevation. In these situations, distribution valves can be used to provide uniform wastewater distribution; alternatively throttle valves can also be utilized to the same effect. Access points must be installed for each valve. Valves can be located in the pump tank or in valve boxes.

Drain Field Cover

When covering the system, construction staples can be utilized to temporarily hold down piping components and the GeoMat until soil cover can be placed on them but they should not penetrate the top fabric. Drainfield cover shall be a minimum of 12 inches. Uniform cover depth over the drainfield results in uniform oxygen transfer to the entire system. The final grade over and around the drainfield should direct storm water sheet flow away from drainfield. The area over the drainfield and extending out from the outermost edge of the GeoMat, for a minimum distance of 24 inches, shall be final graded at a 2% slope. If the GeoMat system is elevated above the original grade, the slope beyond the area requiring the 2% slope shall be graded no steeper than a 3:1 slope (see Figure 11). Care should be exercised to keep a minimum of 12 inches of cover material over the system before operation of low ground pressure equipment. Excavation equipment should not exceed 10 psi ground pressure. Turning excavation equipment on top of the GeoMat should be avoided. Take care to not operate excavation equipment in the same location as this can compact this region relative to other areas.

The area directly above and adjacent to any septic drainfield should be protected from heavy vehicle traffic and excess weight loads before, during and post construction.

On all new construction, it is recommended that the proposed drainfield location be staked and flagged/fenced to prevent encroachment during construction. If vehicle encroachment is expected to be a problem after construction, a structure, such as garden timbers, railroad ties, fences or walls should be used to protect the drainfield area. If the GeoMat drainfield will be subject to traffic, contact Geomatrix for design assistance. The drainfield area should be free of debris and planted with grass. Impermeable materials and structures should not be installed or stored over the drainfield. Trees and shrubs should be kept a minimum distance of ten (10) feet from the drainfield unless a root barrier is utilized. Roots from nearby moisture loving trees such as willow, black locust and red maple may cause problems with roots clogging drainfield. Greater setback distances are recommended for these tree species without use of a root barrier.

Maintenance Requirements

Overtime, biosolids or slime can accumulate in GeoMat lateral pipes and orifices and create uneven wastewater distribution along the lateral. To unclog the orifices, locate the distal port valve boxes and open the turn ups on the end of each lateral line. Manually engage the pump to purge any loose solids. Once all noticeable solids are purged, shut off the pump. Then, push a bottle brush (of the same size of the lateral pipe) attached to a small plumber's snake down each lateral line. With the bottle brush removed, manually engage the pump again to flush out any loose solids in the lateral line. To increase the flushing action and velocity, before and after bottle brushing, open only one equalization valve at a time. Alternatively, a small jetter may be used to clean the lines.

It is recommended that low pressure lateral lines be typically serviced annually. If being used in conjunction with a pressure filter it may be possible to extend this service frequency. An indication of orifice clogging is distal head pressure increasing by more than 20% or pump run times increase by greater than 20% relative to number of doses.

The septic tank and treatment system should be pumped, maintained and operated according to the requirements of the manufacturer and applicable regulatory agency.

Rejuvenating failed or stressed systems

Generally speaking, a failed septic system is a system that no longer treats and disperses wastewater; however, regulatory agencies may have specific definitions that differ. Signs of a failed system are water breakout at the soil surface or back up into the building pipes. Failed systems, especially those that include surface break out of wastewater, can be a human and environmental health hazard and should be dealt with as soon as possible. Stressed systems are those that have not failed, but may have limited treatment or are approaching failure. Signs of a stressed system include slow, smelly, or gurgling drains, bright green patches of grass and softening of soil over the drainfield.

While there are a number of possible causes for a failed or stressed septic system, the most common cause of drainfield failure is the formation of a clogging "biomat". Clogging biomats can occur if improper materials are discharged into the system or if a system is overused and/or undersized with no dry periods to oxidize the organic matter build up. System owners can work in cooperation with operation and maintenance providers to identify and remedy the cause of failure or stress and to potentially rejuvenate the system.

Systems that are failing or stressed because of an inorganic material addition (such as water treatment discharge or paint) will likely not be as easily remediated as those clogged with organic matter. In these cases, the owner and maintenance provider should work collaboratively to identify the source of the inorganic material and cease addition; the replacement of some or all components may be required[6]. If, however, the cause of failure or

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[6] If the failed or stressed system is connected to a water discharge system (water softeners, dehumidifiers, or drain lines) the system should be replumbed to discharge to a drainfield separate from the septic system.

stress is system overuse or a high level of organic matter in the waste stream, introducing oxygen will likely rejuvenate the system. However, if the factor that caused the clogging is not directly addressed, the problem may likely reoccur. The following are potential oxidation remediation procedures that the homeowner may explore with the operation and maintenance provider to attempt and reduce a clogging biomat:

- Pump the septic tank, clean the effluent filter (if present) and snake or jet the GeoMat lateral lines
    - A clogged effluent filter or clogged lateral orifices can cause water to drain slowly or backup into the building pipes
    - Ensure all drains in the building are off and watch for water entering the septic tank to rule out leaking toilets or drains that can overload the drainfield
    - Measure the time it takes to refill the septic tank to determine actual loading rate and if necessary, address potential overuse of water
    - Pumping the septic tank forces a drying period in the drainfield which may reduce or eliminate a clogging biomat if left dry long enough
- Use proprietary Geomatrix oxidation solution formulated to reduce organic matter and increase infiltration rates
    - Please contact Geomatrix for information on sourcing our oxidation solution and for proper application protocol[7]
    - Use of any additive or solution not approved or supplied by Geomatrix will result in voiding of the GeoMat Standard Limited Warranty

Consistent maintenance and appropriate use are vital parts of preventing failures and extending the life of septic systems. Owners who want to avoid problems that lead to the need for remediation and replacement should sustain maintenance, monitoring water use, and avoid any septic tank additives. While additives are marketed to break down solids and reduce or eliminate the need for pumping there is no peer-reviewed research to support these claims and septic tank additives are generally considered a waste of money. Both organic and inorganic additives should be avoided as they can cause or exacerbate clogging biomats and potentially void the GeoMat Standard Limited Warranty.

System remediation can save significant costs if system replacement can be avoided. Care must be exercised to ensure that the factor that caused the problem has been addressed or it will likely return.

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[7] Regulatory agency approval may be necessary.

Septic System Design and Use Do’s and Don’ts

It is important that system designers consider the following Do’s and Don’ts when designing a GeoMat system and provide this information to system owners and users to help ensure function and maximum life of the system.

Do:

- Generally, systems should be designed at 1.5 to 2 times peak design flows as set by the responsible state agency.
- Understand expected peak design flows for the specific system and design system to meet demand.
- Instruct users to conserve water to reduce the amount of wastewater that must be treated and disposed.
- Instruct users to repair any leaking faucets and toilets.
- Instruct users to only discharge biodegradable wastes into system.
- Consider garbage disposal use in system design and instruct users to restrict garbage disposal use.
- Ensure downspouts and other surface water is diverted away from the drain field & tanks.
- Keep the septic tank cover accessible for tank inspections and pumping.
- Instruct users to have the septic tank pumped regularly and checked for leaks and cracks.
- Provide information to use to enable them to call a professional when you have problems.
- Instruct use to compost garbage or put it in the trash.

Don’t:

- Discharge water softeners, dehumidifiers, drain lines, storm water, or other water discharging devices into the system; these devices should be discharged to a separate drain field.
- Use septic system additives; there are plenty of microorganisms present in wastewater and the surrounding soil for treatment to occur.
- Flush sanitary napkins, tampons, condoms, cigarette butts, diapers, wipes and such products into your system.
- Dump solvents, oils, paints, paint thinner, disinfectants, pesticides or poisons down the drain.
- Dig in your drain field or build anything over it.
- Plant anything other than grass over your drain field.
- Drive over your drain field or compact it in any way.

GeoMat Schematics

Figure 1: Pressure Dosed Cross Section

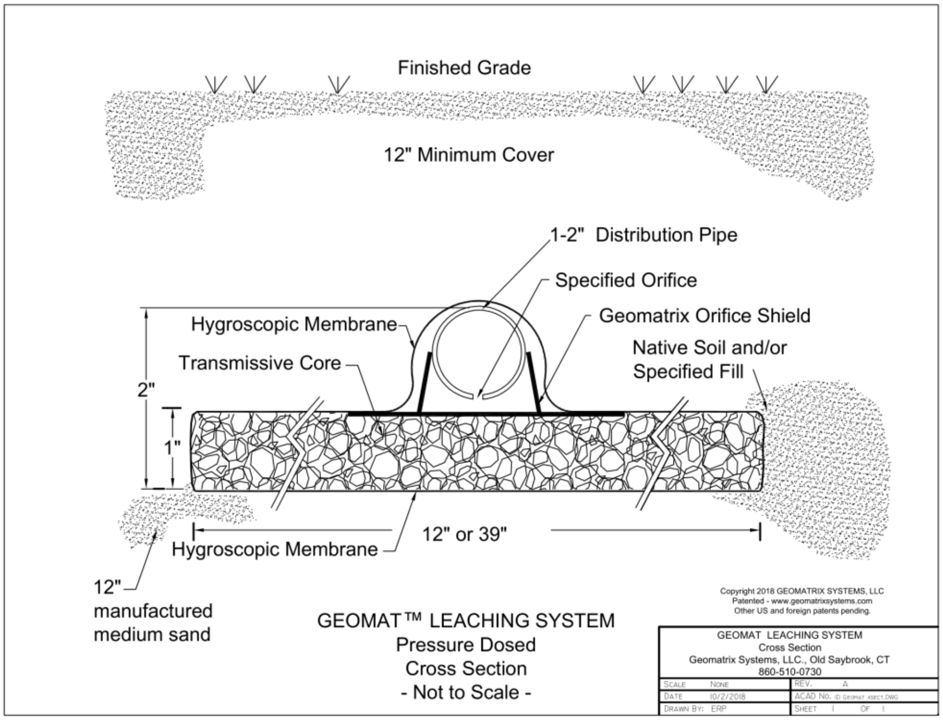
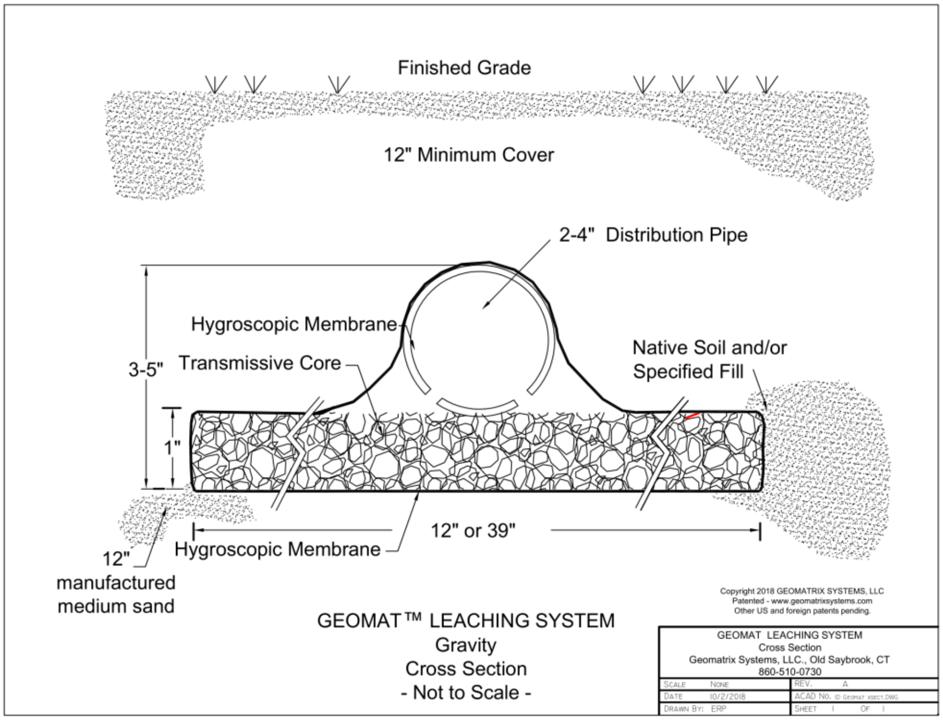


Figure 2: Gravity Cross Section



GeoMat Schematics (continued)

Figure 3: Pressure Dosed Plan View

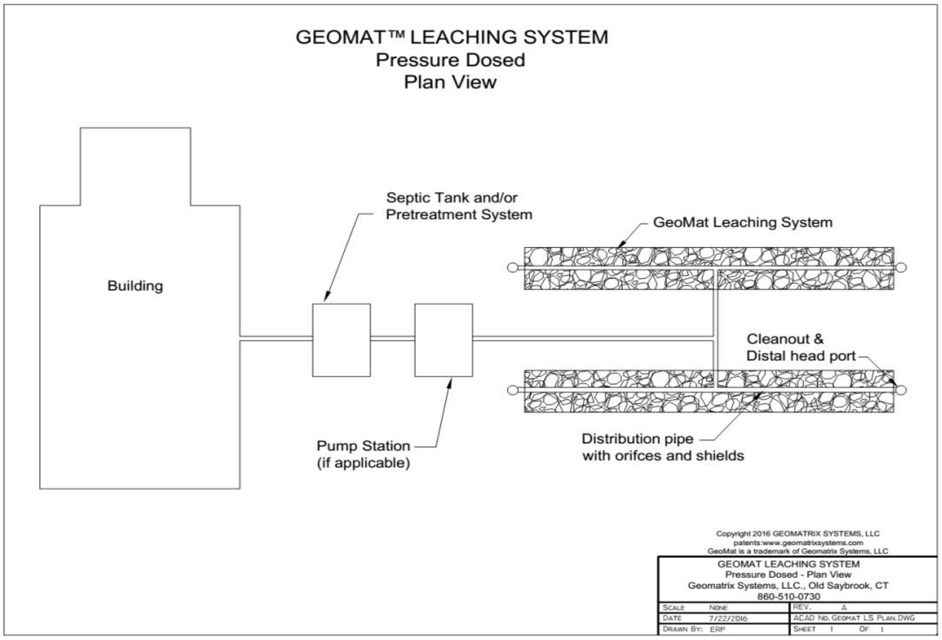
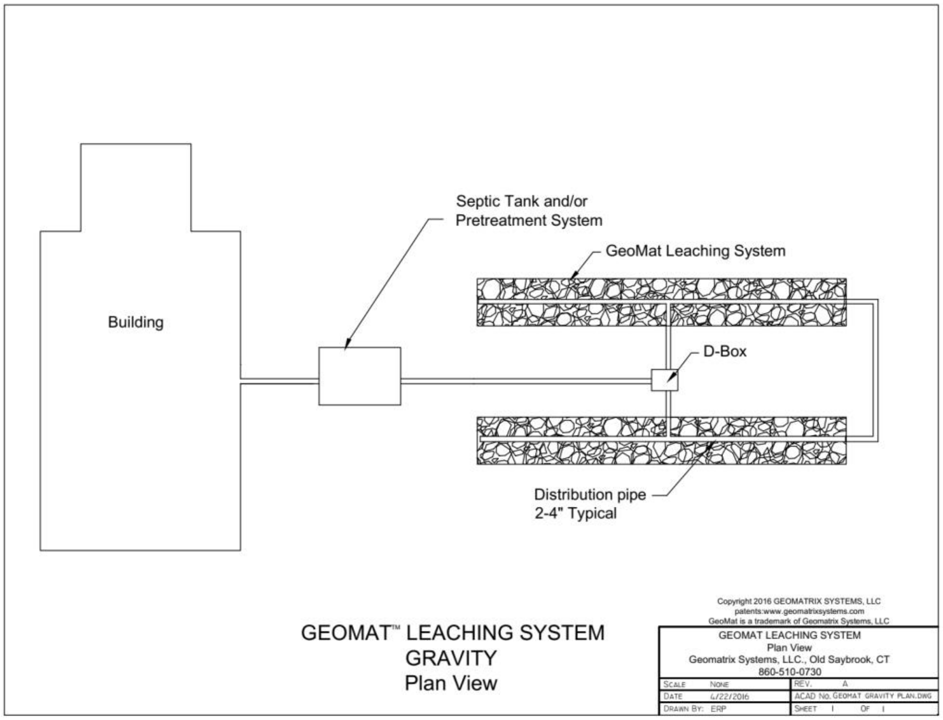


Figure 4: Gravity Plan View



GeoMat Schematics (continued)

Figure 5: Pressure Dosed Longitudinal Cross Section

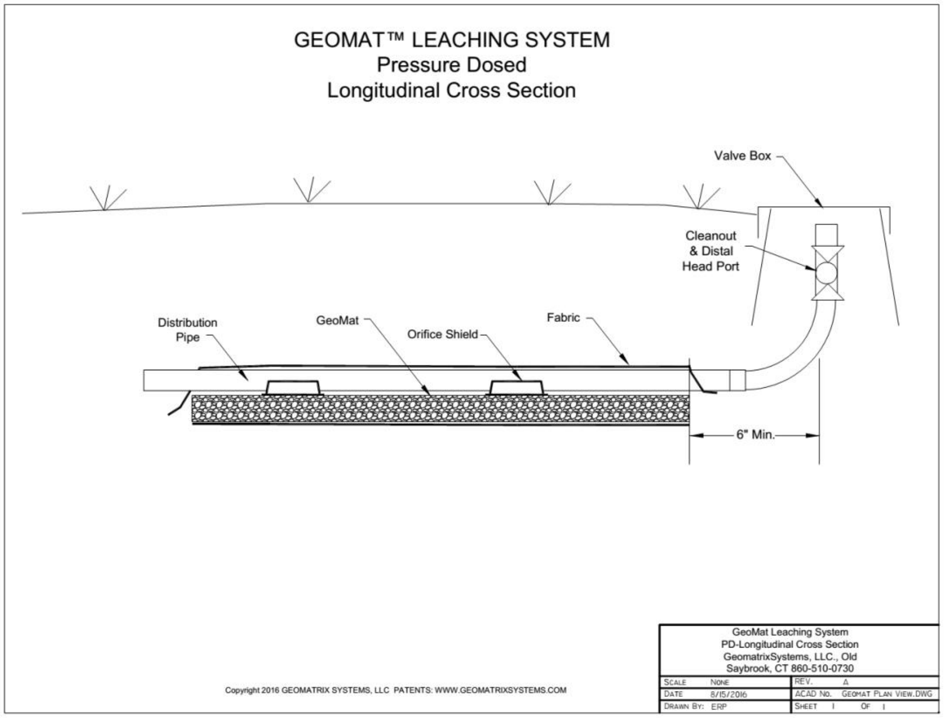
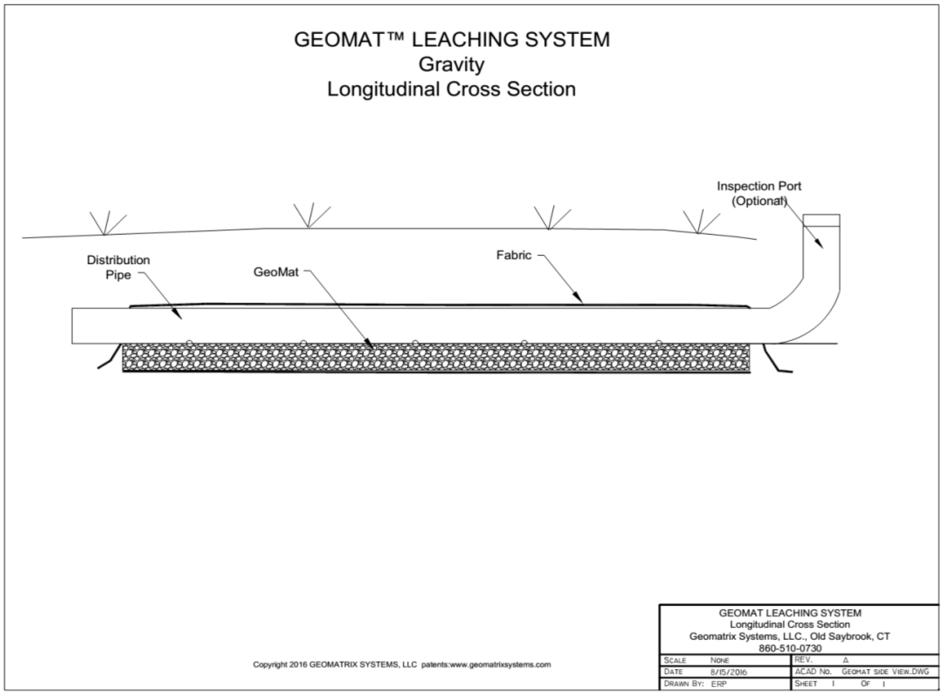
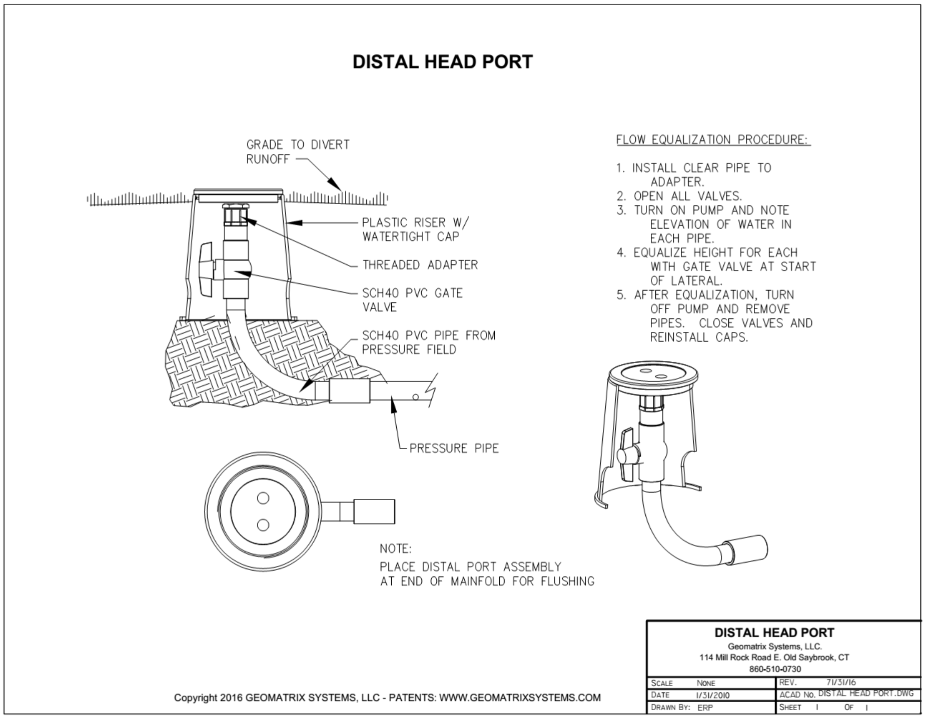


Figure 6: Gravity Longitudinal Cross Section



Distal Port & Flow Equalization Valve Schematics

Figure 7: Distal Head Port



FLOW EQUALIZATION PROCEDURE:

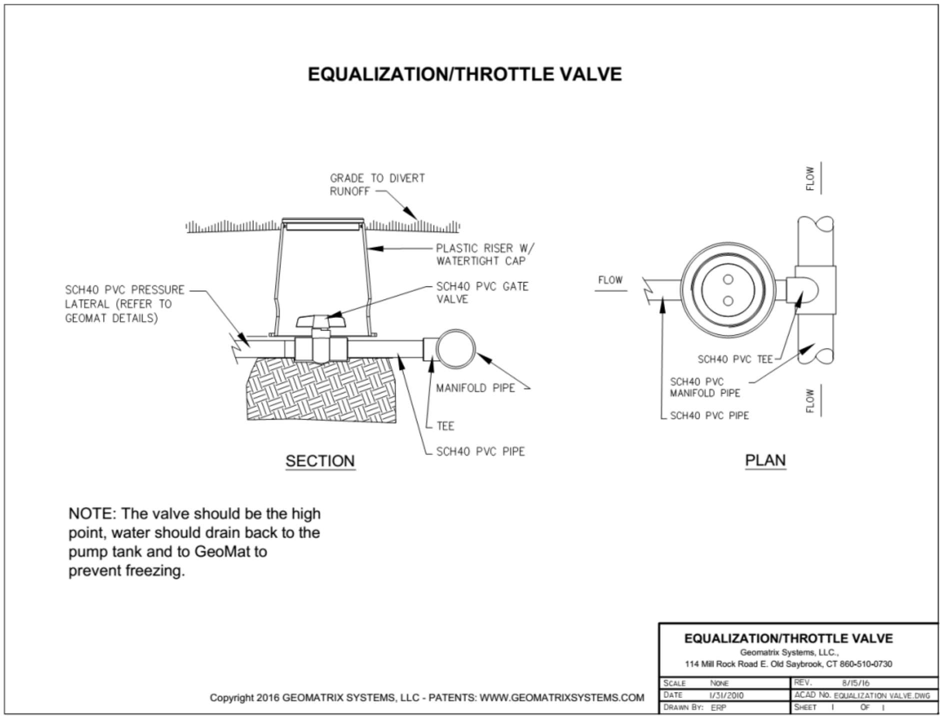
1. INSTALL CLEAR PIPE TO ADAPTER.
2. OPEN ALL VALVES.
3. TURN ON PUMP AND NOTE ELEVATION OF WATER IN EACH PIPE.
4. EQUALIZE HEIGHT FOR EACH WITH GATE VALVE AT START OF LATERAL.
5. AFTER EQUALIZATION, TURN OFF PUMP AND REMOVE PIPES. CLOSE VALVES AND REINSTALL CAPS.

NOTE:
PLACE DISTAL PORT ASSEMBLY AT END OF MAINFOLD FOR FLUSHING

DISTAL HEAD PORT
Geomatrix Systems, LLC.
114 Mill Rock Road E. Old Saybrook, CT
860-510-0730

SCALE	NONE	REV.	71/31/16
DATE	1/31/2010	ACAD No.	DISTAL HEAD PORT.DWG
DRAWN BY:	ERP	SHEET	1 OF 1

Figure 8: Equalization/Throttle Valve



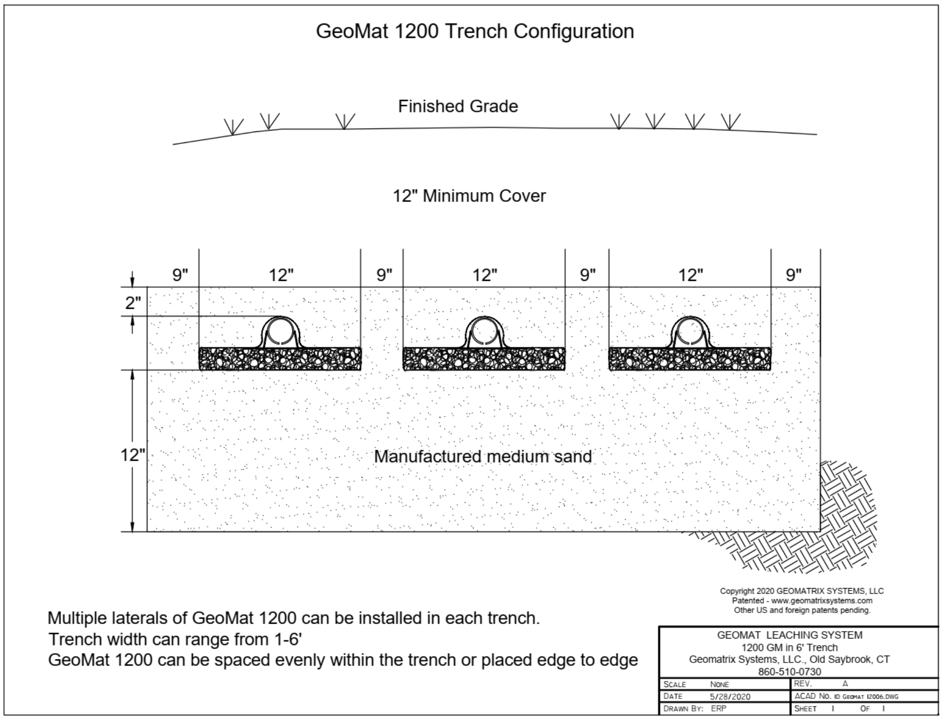
NOTE: The valve should be the high point, water should drain back to the pump tank and to GeoMat to prevent freezing.

EQUALIZATION/THROTTLE VALVE
Geomatrix Systems, LLC.,
114 Mill Rock Road E. Old Saybrook, CT 860-510-0730

SCALE	NONE	REV.	8/15/16
DATE	1/31/2010	ACAD No.	EQUALIZATION VALVE.DWG
DRAWN BY:	ERP	SHEET	1 OF 1

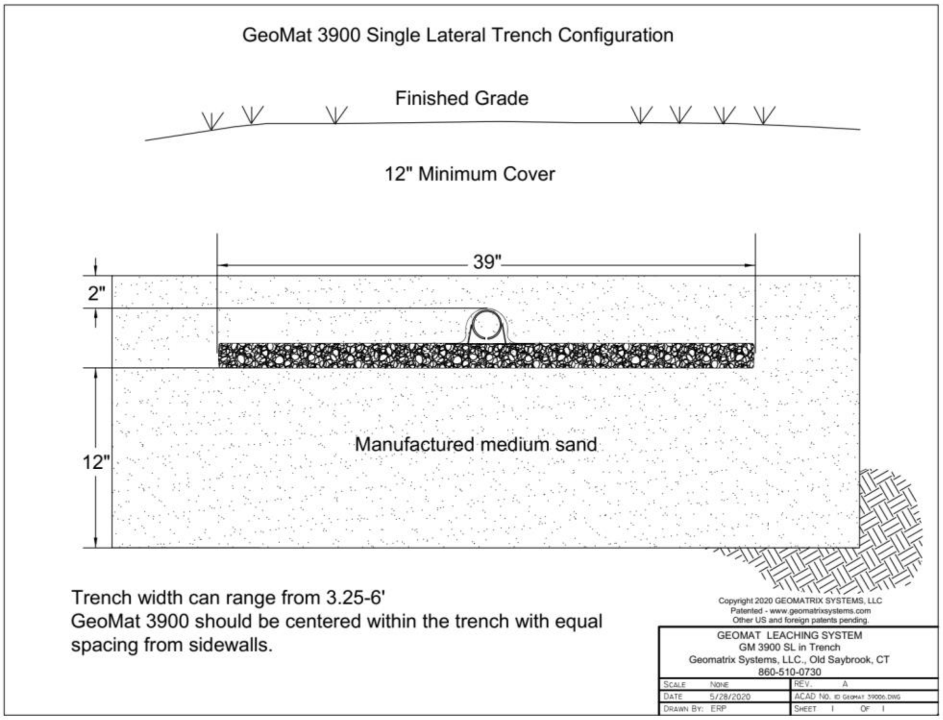
Typical GeoMat System Design Examples

Figure 9: GeoMat 1200 Trench Configuration



Multiple laterals of GeoMat 1200 can be installed in each trench.
Trench width can range from 1-6'
GeoMat 1200 can be spaced evenly within the trench or placed edge to edge

Figure 10: GeoMat 3900 Single Lateral Trench Configuration



Trench width can range from 3.25-6'
GeoMat 3900 should be centered within the trench with equal spacing from sidewalls.

Typical GeoMat System Design Examples (continued)

Figure 11: GeoMat 3900 Two Laterals Trench Configuration

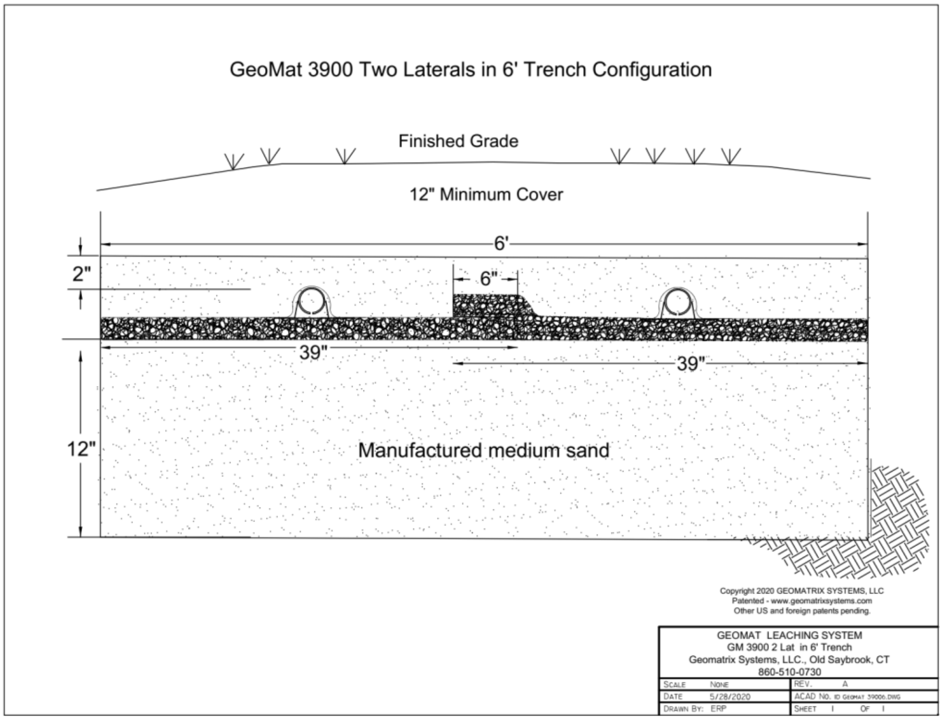
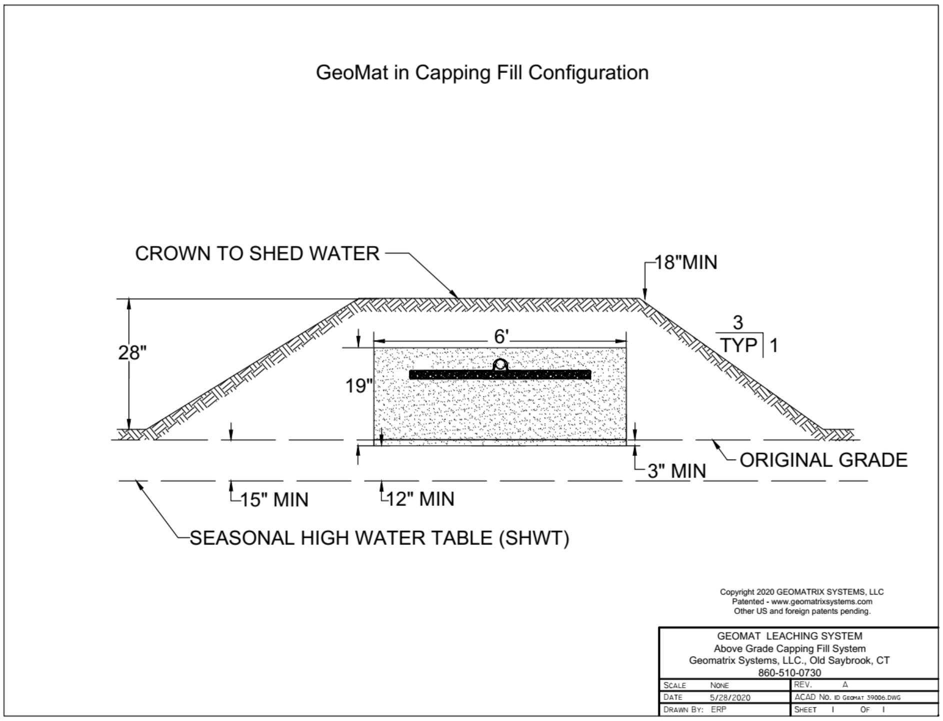


Figure 12: Capping Fill Configuration



Typical GeoMat System Design Examples (continued)

Figure 13: Pressure Dosed Single Zone Design Example

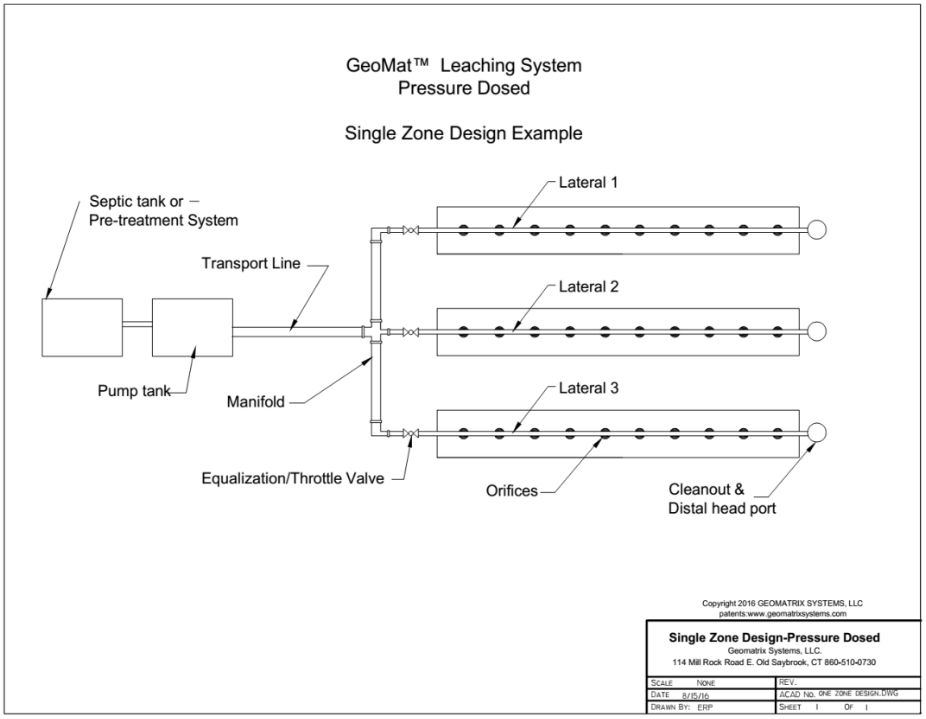
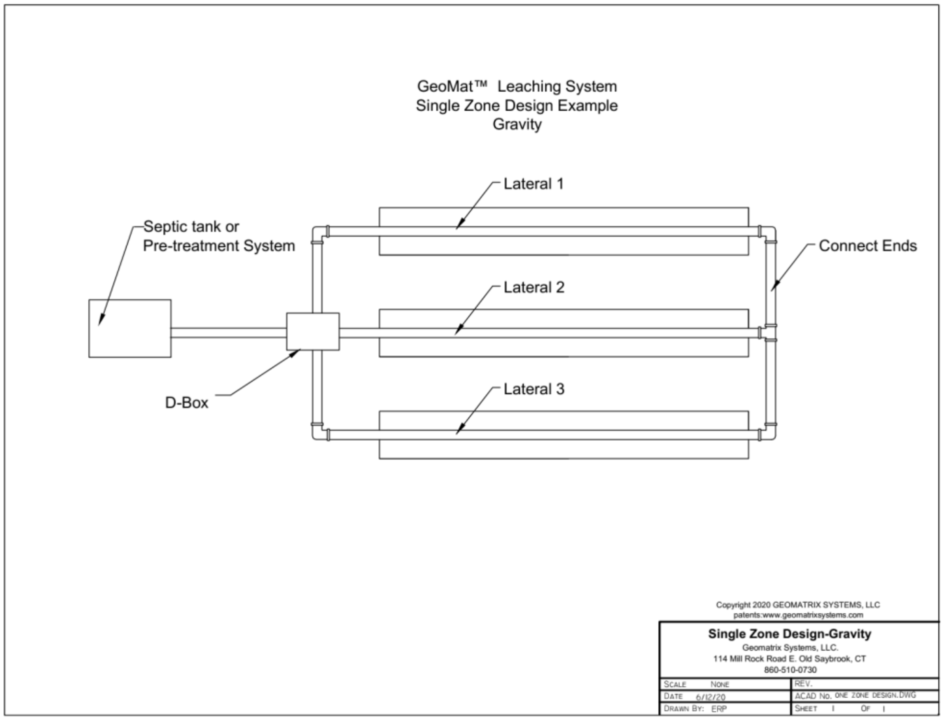


Figure 14: Gravity Single Zone Design Example



Typical GeoMat System Design Examples (continued)

Figure 15: Pressured Dosed Center Feed Design Example

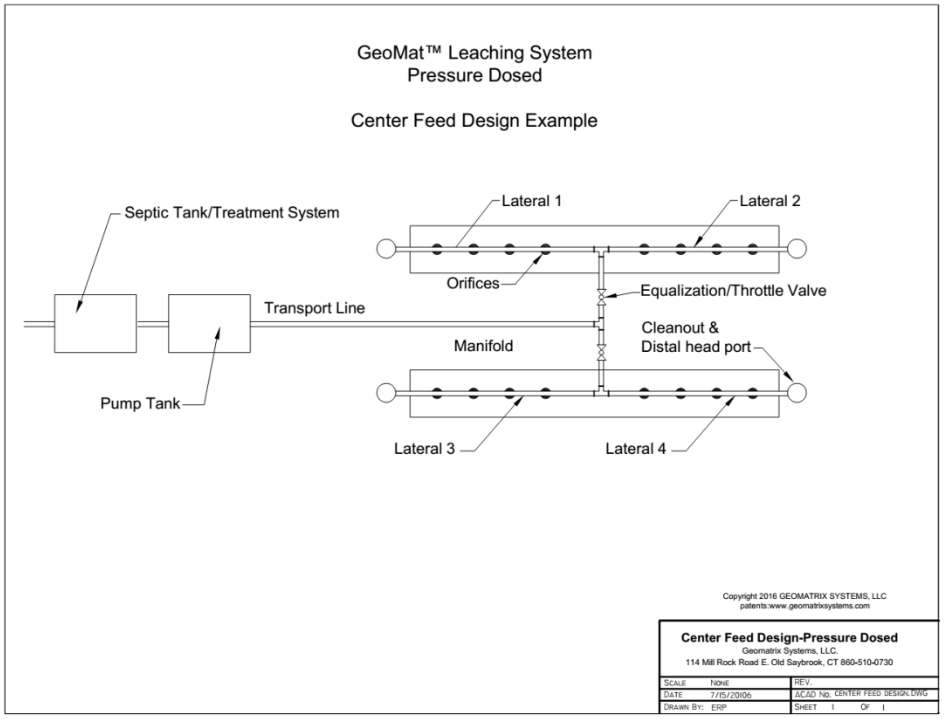
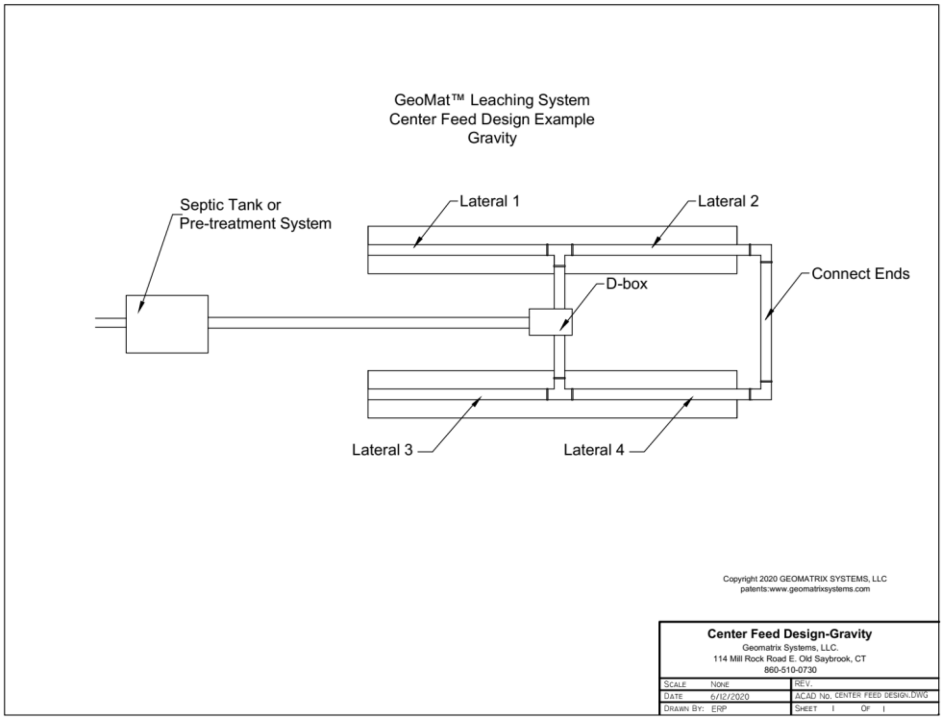


Figure 16: Gravity Center Feed Design Example



Typical GeoMat System Design Examples (continued)

Figure 17: Pressure Dosed Two Zone Design Example

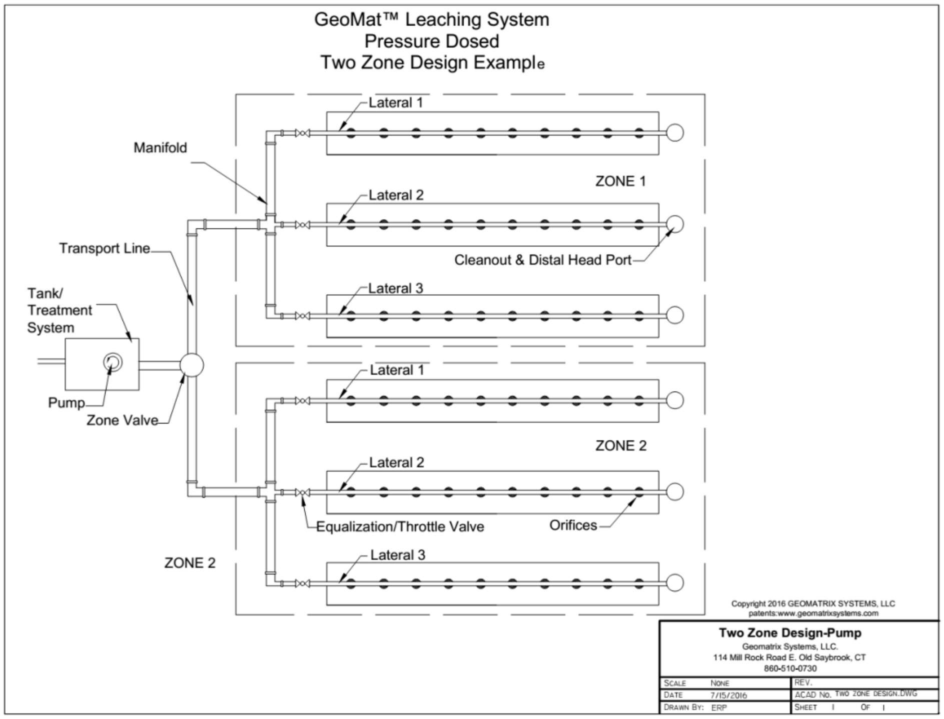
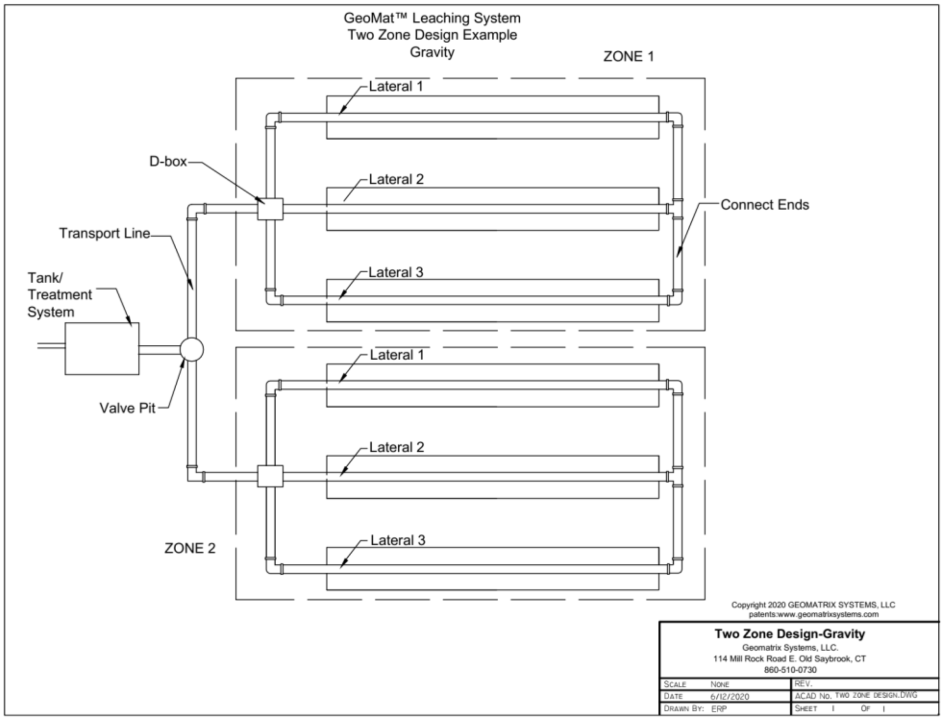


Figure 18: Gravity Two Zone Design Example



Appendix:

Design Examples

Example 1: Two bedroom in B-1 soils

Step 1. Determine Minimum Trench[8] Bottom Area by referring to Table 1.

Table 1
Minimum Bottom Area Required for Trench and Bed Configuration

	Application Rate (GPD/sq. ft) / Soil Design Subgroup						
	1.7/A-1	**1.2/A-2a**	**1.0/A-2b**	**0.8/B-1**	**0.6/B-2**	**0.4/C-1**	**0.3/C-2**
Bedrooms	**Minimum Surface Area Required (sq. ft)**						
1	89	125	150	188	250	375	500
2	118	167	200	250	334	500	667
3	148	209	250	313	417	625	834
4	177	250	300	375	500	750	1000
5	206	292	350	438	584	875	1167
Each Additional	30	42	50	63	84	125	167

Minimum bottom area required: 250

In this step we are calculated the total trench bottom area required by State regulations.

Step 2. Determine width of each trench and total length of trench required:

Divide required trench bottom area from Step 1 by desired trench width to determine the total length that is required among all trenches.

250	÷	6	=	42
Required area from step 1		Trench width (any width, 1-6')		Total trench length required

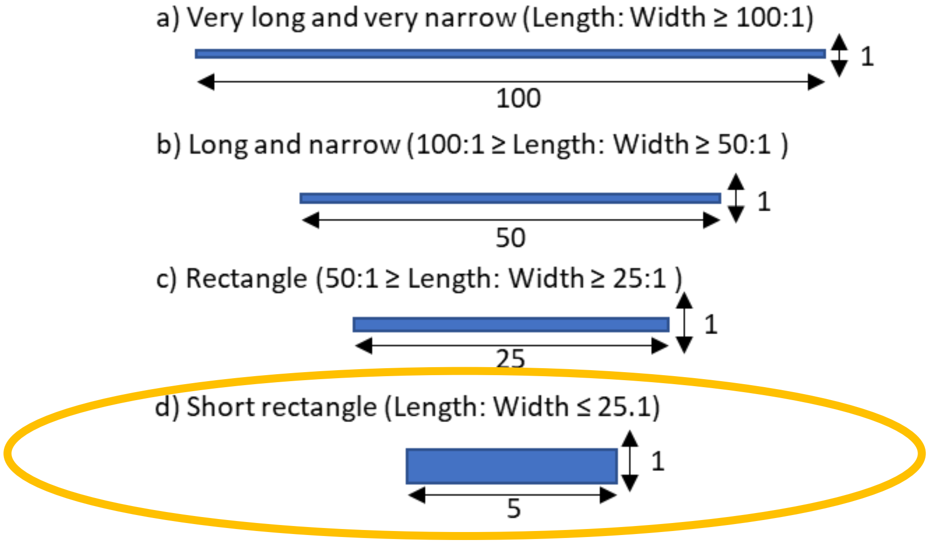
GeoMat systems may be designed in a single trench or in multiple equal length trenches

---

[8] When trenches cannot fit on a site, the designer may request approval from the approving health district to design a bed system. Using area from Step 1, repeat Steps 3 through 6 with excavation widths greater than 6 feet. GeoMat laterals in bed designs can be spaced no more than 6 feet on center and no more than 3 feet from the sidewall.

with 6 feet of undisturbed soil between adjacent trenches (Step 3). In this step we are calculating the total length of trench which may be split evenly between multiple trenches if multiple trenches are required/desired.

Design tip: *If you do not know how wide you want the trench(es), start with the narrowest trench possible. The narrowest trench possible is 1 foot with one GeoMat 1200 lateral. Also consider the basic desired trench width to length ratio from the following*[9]*:*



If you want to consider other dimensions, use the space below to alter trench width and determine alternate lengths. Repeat with various trench widths up to 6 feet until the dimensions are suitable for the site.

250		3		83.5
Required area from step 1	÷	Trench width (any width, 1-6')	=	Total trench length required
250		2		125
Required area from step 1	÷	Trench width (any width, 1-6')	=	Total trench length required
250		5.5		45.5

---

[9] Based on site constraints including usable lot space, existing infrastructure/obstacles, distance to groundwater, contour direction, and soil type. In soils with low acceptance ratings, longer narrower soil treatment areas, designed parallel to contours, have a larger groundwater acceptance window and increased hydraulic performance relative to short and wide systems

_______________ ÷ _______________ = _______________

Required area from step 1 ÷ Trench width (any width, 1-6’) = Total trench length required

Step 3. Determine number and length of trenches: GeoMat systems may be designed in multiple equal length trenches. If a single trench is too long with the widest allowable or if the user prefers, the required bottom area can be divided among multiple trenches[10].

Divide the total trench length from Step 2 by desired number of trenches to determine each trench length.

42 ÷ 1 = 42

Total trench length from Step 2 ÷ # of trenches = Length of each trench

Step 4. Select GeoMat lateral type and determine number of laterals: The GeoMat can be designed with GeoMat 1200s (1 foot wide) or GeoMat 3900 (3.25 feet wide) laterals. Determine the number of GeoMat 1200s that will fit in your selected trench width in Step 4a and the number of GeoMat 3900s that will fit in your selected trench width in Step 4b. Select type of GeoMat that will work best for your site in step 4c.

Step 4a. Determine how many GeoMat 1200 laterals will fit in each trench by dividing trench width from Step 2 by GeoMat 1200 width (1 foot):

6 ÷ 1 foot = 6

Trench width from Step 2 ÷ GeoMat width = # of GeoMat laterals per trench

If your result from Step 4a was a whole number it is the maximum number of GeoMat laterals that will fit. If your result was not a whole number, round down to determine maximum number of GeoMat laterals that will fit in a trench.

6 Geo 1200 laterals

Step 4b. Determine how many GeoMat 3900 laterals will fit in trench by dividing trench width from Step 2 by GeoMat 3900 width (3.25 foot):

Can use two GeoMat 3900 laterals overlapping

6 ÷ 3.25 feet = 1.8

Trench width from Step 2 ÷ GeoMat width = # of GeoMat laterals per trench

If your result from Step 4b was less than 0.8 use GeoMat 1200s. If your answer to 4b was between 0.9 and 1.4 center 1 lateral in the trench. If your result was equal to or

---

[10] A minimum of 6 feet of undisturbed soil is required between each adjacent trench.

greater than 1.5 overlap 2 GeoMat 3900 laterals (Figure 11).

Step 4c. Based on your results from steps 4a and 4b, select type of GeoMat and number of laterals that will maximize performance and cost effectiveness:

Type of GeoMat (circle one): GeoMat 1200 [✓ GeoMat 3900]

Number of laterals per trench[11]: 2

Step 5. Ensure design meets minimum GeoMat required: Geomatrix requires a minimum length of GeoMat per bedroom to ensure adequate sizing for long-term hydraulic performance.

Step 5a. Multiply trench length from Step 2 by the number of trenches from Step 4 and the number of laterals in each trench from Step 5d to get total GeoMat length.

42	x	2	=	84
Total trench/bed length from Step 2		# of GeoMat laterals per trench/bed from Step 4c		Total GeoMat length in system

GeoMat meets min. length requirements. Reducing to one lateral does not meet requirements, but could reduce to one lateral and increase GeoMat/trench length to 48'

Step 5b. Compare total GeoMat length from Step 5a to values in Table 2 meets minimum for bedrooms in design.

Table 2: Minimum required GeoMat length (linear feet) required

	Min Required feet of GeoMat 1200 (linear feet)	Min Required feet of GeoMat 3900 (linear feet			
# of bedrooms	Any lateral # All trench widths*	One lateral All trench widths	Two laterals 5' trench*	Two laterals 5.5' trench*	Two laterals 6' trench*
1	78	24	36	34	30
2	156	48	52	55.5	59
3	234	72	89	83	77.5
4	312	96	103.5	111	118.5
5	390	120	129.5	138.5	148
Each Add'l	78	24	36	34	30

If area meets the minimum, continue to next step. ✓ Whoo! Move to Step 6!

If minimum length of required GeoMat from Table 2 is not met:

---

[11] You may reduce the number of GeoMat laterals in the trench as long as the amount of GeoMat required in Step 5 is met. In this case, provide equal spacing between laterals and between laterals and the sidewalls.

Divide the minimum required GeoMat length from Table 2 by desired number of laterals per trench.

_______________ ÷ _______________ = _______________
Min. GeoMat (ft) per bedroom from Table 2 ÷ # of laterals = New total trench length

If using multiple trenches, divide new trench length by the number of trenches.

_______________ ÷ _______________ = _______________
New total trench length ÷ # of trenches = Each trench length

-OR-

Revisit steps 2 and 4 to increase GeoMat in excavation by increasing trench width and adding additional laterals. Repeat until the minimum GeoMat needed per Table 2 is met.

If increasing trench length and/or width does will not work for this design and multiple trenches are not an option, restart from Step 1[12] using the minimum GeoMat area per bedroom from Table 3 below as the minimum bottom area required and fill the entire bottom area with GeoMat.

Table 3:
Minimum required GeoMat area required per bedroom

# of bedrooms:	Min Required area (square feet)
1	78 ft^2
2	156 ft^2
3	234 ft^2
4	312 ft^2
5	390 ft^2
Each Add'l	78 ft^2

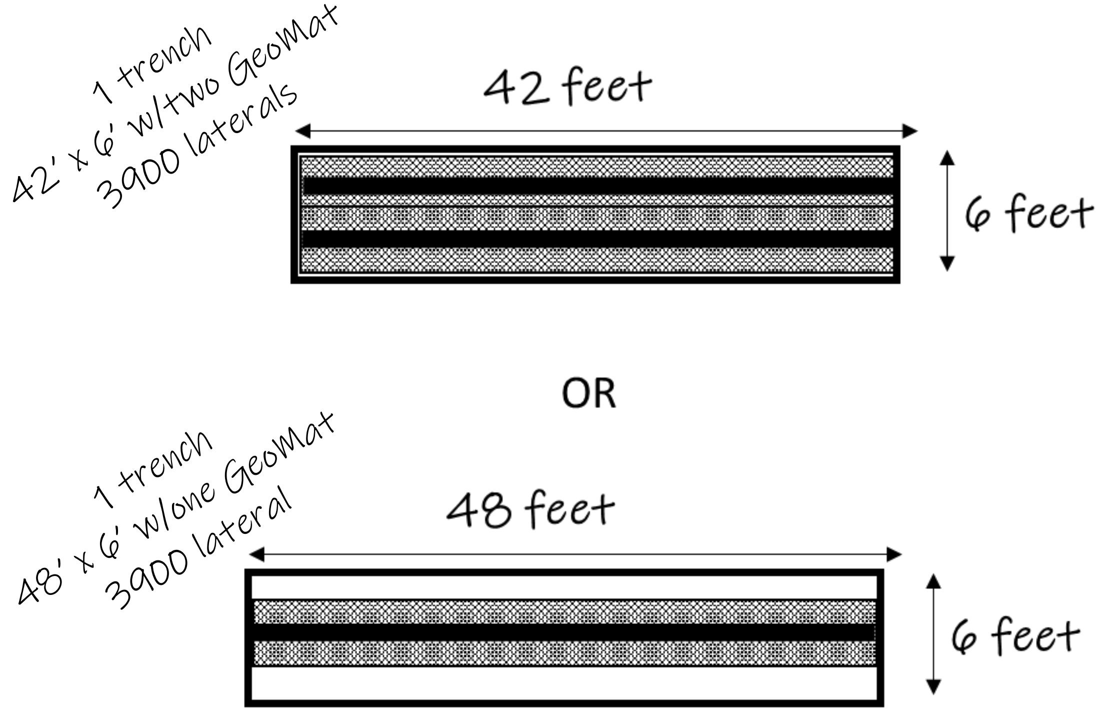
---

[12] If using area from Table 3 to design bottom area, ensure this area is enough to meet minimums required by Idaho State Regulations from Table 1.

Step 6: Complete the design by filling in the following information and doing a rough sketch of the design. Remember to design at least 6 feet of undisturbed soil between each adjacent trench or bed.

TRENCH OR BED WIDTH: 6’
EACH TRENCH OR BED LENGTH: 42’
 # OF TRENCHES OR BEDS: 1
TYPE OF GEOMAT: GeoMat 3900
 # OF LATERALS PER TRENCH: 1 OR 2

Sketch Design



GeoMat systems are incredibly flexible and there are many more configurations possible given the example parameters.

Example 2**:** Four bedroom in C-1 soils

Step 1. Determine Minimum Trench[13] Bottom Area by referring to Table 1.

Table 1
Minimum Bottom Area Required for Trench and Bed Configuration

	Application Rate (GPD/sq. ft) / Soil Design Subgroup						
	1.7/A-1	**1.2/A-2a**	**1.0/A-2b**	**0.8/B-1**	**0.6/B-2**	**0.4/C-1**	**0.3/C-2**
Bedrooms	**Minimum Surface Area Required (sq. ft)**						
1	89	125	150	188	250	375	500
2	118	167	200	250	334	500	667
3	148	209	250	313	417	625	834
4	177	250	300	375	500	750	1000
5	206	292	350	438	584	875	1167
Each Additional	30	42	50	63	84	125	167

Minimum bottom area required: 750

In this step we are calculated the total trench bottom area required by State regulations.

Step 2. Determine width of each trench and total length of trench required:

Divide required trench bottom area from Step 1 by desired trench width to determine the total length that is required among all trenches.

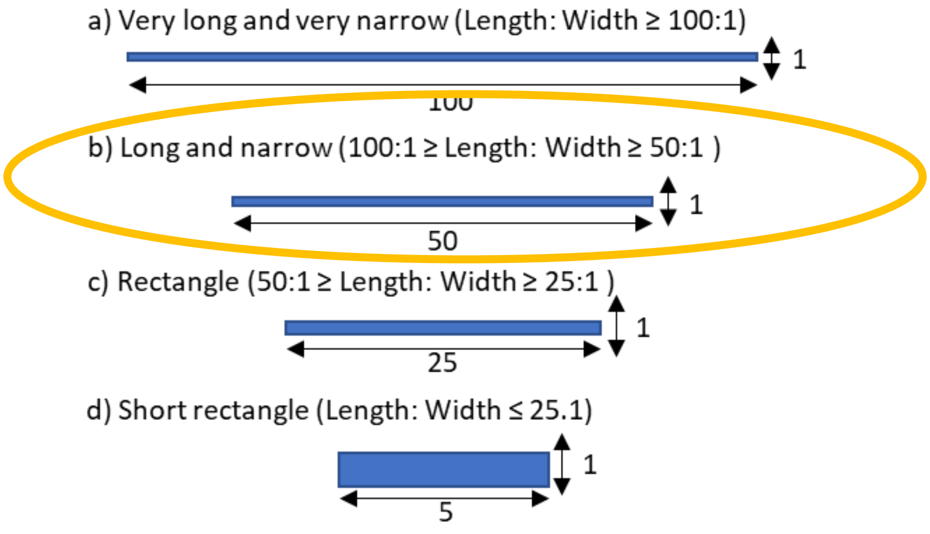
750	÷	2	=	375
Required area from step 1		Trench width (any width, 1-6’)		Total trench length required

GeoMat systems may be designed in a single trench or in multiple equal length trenches with 6 feet of undisturbed soil between adjacent trenches (Step 3). In this step we are calculating the total length of trench which may be split evenly between multiple trenches if multiple trenches are required/desired.

---

[13] When trenches cannot fit on a site, the designer may request approval from the approving health district to design a bed system. Using area from Step 1, repeat Steps 3 through 6 with excavation widths greater than 6 feet. GeoMat laterals in bed designs can be spaced no more than 6 feet on center and no more than 3 feet from the sidewall.

Design tip: *If you do not know how wide you want the trench(es), start with the narrowest trench possible. The narrowest trench possible is 1 foot with one GeoMat 1200 lateral. Also consider the basic desired trench width to length ratio from the following*[14]*:*



If you want to consider other dimensions, use the space below to alter trench width and determine alternate lengths. Repeat with various trench widths up to 6 feet until the dimensions are suitable for the site.

750 Required area from step 1 ÷ 3 Trench width (any width, 1-6’) = 250 Total trench length required

750 Required area from step 1 ÷ 4 Trench width (any width, 1-6’) = 187.5 Total trench length required

750 Required area from step 1 ÷ 5 Trench width (any width, 1-6’) = 150 Total trench length required

---

[14] Based on site constraints including usable lot space, existing infrastructure/obstacles, distance to groundwater, contour direction, and soil type. In soils with low acceptance ratings, longer narrower soil treatment areas, designed parallel to contours, have a larger groundwater acceptance window and increased hydraulic performance relative to short and wide systems

Step 3. Determine number and length of trenches: GeoMat systems may be designed in multiple equal length trenches. If a single trench is too long with the widest allowable or if the user prefers, the required bottom area can be divided among multiple trenches[15].

Divide the total trench length from Step 2 by desired number of trenches to determine each trench length.

375	÷	3	=	125
Total trench length from Step 2		# of trenches		Length of each trench

Step 4. Select GeoMat lateral type and determine number of laterals: The GeoMat can be designed with GeoMat 1200s (1 foot wide) or GeoMat 3900 (3.25 feet wide) laterals. Determine the number of GeoMat 1200s that will fit in your selected trench width in Step 4a and the number of GeoMat 3900s that will fit in your selected trench width in Step 4b. Select type of GeoMat that will work best for your site in step 4c.

Step 4a. Determine how many GeoMat 1200 laterals will fit in each trench by dividing trench width from Step 2 by GeoMat 1200 width (1 foot):

2	÷	1 foot	=	2
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

If your result from Step 4a was a whole number it is the maximum number of GeoMat laterals that will fit. If your result was not a whole number, round down to determine maximum number of GeoMat laterals that will fit in a trench. 2 Geo 1200 laterals

Step 4b. Determine how many GeoMat 3900 laterals will fit in trench by dividing trench width from Step 2 by GeoMat 3900 width (3.25 foot):

2	÷	3.25 feet	=	0.6
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

---

[15] A minimum of 6 feet of undisturbed soil is required between each adjacent trench.

If your result from Step 4b was less than 0.8 use GeoMat 1200s. If your answer to 4b was between 0.9 and 1.4 center 1 lateral in the trench. If your result was equal to or greater than 1.5 overlap 2 GeoMat 3900 laterals (Figure 11).

Trench too narrow for GeoMat 3900, use GeoMat 1200

Step 4c. Based on your results from steps 4a and 4b, select type of GeoMat and number of laterals that will maximize performance and cost effectiveness:

Type of GeoMat (circle one): [✓ GeoMat 1200] GeoMat3900

Number of laterals per trench[16]: 2

Step 5. Ensure design meets minimum GeoMat required: Geomatrix requires a minimum length of GeoMat per bedroom to ensure adequate sizing for long-term hydraulic performance.

Step 5a. Multiply trench length from Step 2 by the number of trenches from Step 4 and the number of laterals in each trench from Step 5d to get total GeoMat length.

375	X	2	750
Total trench length from Step 2		# of GeoMat laterals per trench from step 4d	Total GeoMat length in system

Step 5b. Compare total GeoMat length from Step 5a to values in Table 2 an meets minimum for bedrooms in design.

Plenty of GeoMat! Could reduce to one lateral.

Table 2: Minimum required GeoMat length (linear feet) required

	Min Required feet of GeoMat 1200 (linear feet)	Min Required feet of GeoMat 3900 (linea			
# of bedrooms	Any lateral # All trench widths*	One lateral All trench widths	Two laterals 5' trench*	Two laterals 5.5' trench*	wo laterals 6' trench*
1	78	24	36	34	30
2	156	48	52	55.5	59
3	234	72	89	83	77.5
4	312	96	103.5	111	118.5
5	390	120	129.5	138.5	148
Each Add'l	78	24	36	34	30

If area meets the minimum, continue to next step. ✓ Whoo! Move to Step 6!

---

[16] You may reduce the number of GeoMat laterals in the trench as long as the amount of GeoMat required in Step 5 is met. In this case, provide equal spacing between laterals and between laterals and the sidewalls.

If minimum length of required GeoMat from Table 2 is not met:

Divide the minimum required GeoMat length from Table 2 by desired number of laterals per trench.

________________	÷	________________	=	________________
Min. GeoMat (ft) per bedroom from Table 2		# of laterals		New total trench length

If using multiple trenches, divide new trench length by the number of trenches.

________________	÷	________________	=	________________
New total trench length		# of trenches		Each trench length

-OR-

Revisit steps 2 and 4 to increase GeoMat in excavation by increasing trench width and adding additional laterals. Repeat until the minimum GeoMat needed per Table 2 is met.

If increasing trench length and/or width does will not work for this design and multiple trenches are not an option, restart from Step 1[17] using the minimum GeoMat area per bedroom from Table 3 below as the minimum bottom area required and fill the entire bottom area with GeoMat.

Table 3:
Minimum required GeoMat area required per bedroom

# of bedrooms:	Min Required area (square feet)
1	78 ft^2
2	156 ft^2
3	234 ft^2
4	312 ft^2
5	390 ft^2
Each Add’l	78 ft^2

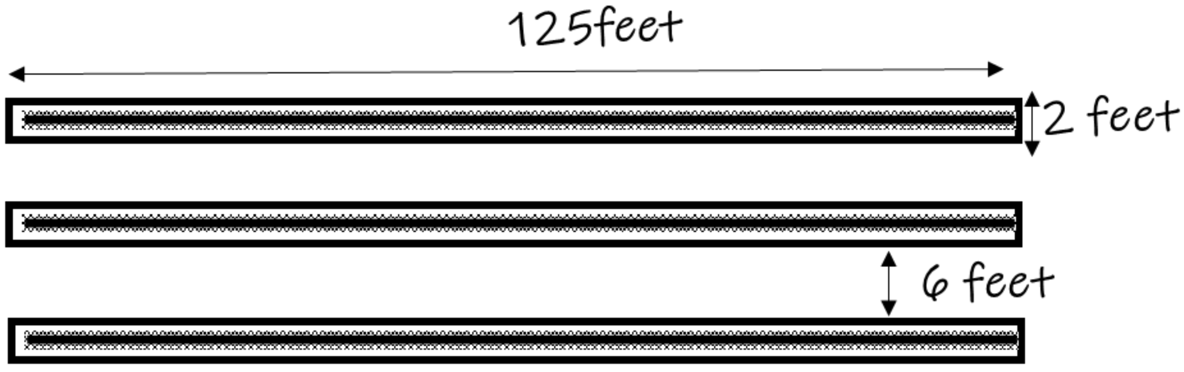
---

[17] If using area from Table 3 to design bottom area, ensure this area is enough to meet minimums required by Idaho State Regulations from Table 1.

Step 6: Complete the design by filling in the following information and doing a rough sketch of the design. Remember to design at least 6 feet of undisturbed soil between each adjacent trench or bed.

TRENCH OR BED WIDTH: 2’
EACH TRENCH OR BED LENGTH: 125’
 # OF TRENCHES OR BEDS: 3
TYPE OF GEOMAT: GeoMat 1200
 # OF LATERALS PER TRENCH: 1

Sketch Design



3 trenches
125’ x 2’ w/two GeoMat
1200 laterals (1 or 2
laterals per trench meets
minimum required GeoMat)

GeoMat systems are incredibly flexible and there are many more configurations possible given the example parameters.

Example 3: Three bedroom in A-1 soils

Step 1. Determine Minimum Trench[18] Bottom Area by referring to Table 1.

Table 1
Minimum Bottom Area Required for Trench and Bed Configuration

	Application Rate (GPD/sq. ft) / Soil Design Subgroup						
	1.7/A-1	**1.2/A-2a**	**1.0/A-2b**	**0.8/B-1**	**0.6/B-2**	**0.4/C-1**	**0.3/C-2**
Bedrooms	**Minimum Surface Area Required (sq. ft)**						
1	89	125	150	188	250	375	500
2	118	167	200	250	334	500	667
3	148	209	250	313	417	625	834
4	177	250	300	375	500	750	1000
5	206	292	350	438	584	875	1167
Each Additional	30	42	50	63	84	125	167

Minimum bottom area required: 148

In this step we are calculated the total trench bottom area required by State regulations.

Step 2. Determine width of each trench and total length of trench required:

Divide required trench bottom area from Step 1 by desired trench width to determine the total length that is required among all trenches.

148	÷	4	=	37
Required area from step 1		Trench width (any width, 1-6')		Total trench length required

GeoMat systems may be designed in a single trench or in multiple equal length trenches with 6 feet of undisturbed soil between adjacent trenches (Step 3). In this step we are calculating the total length of trench which may be split evenly between multiple trenches if multiple trenches are required/desired.

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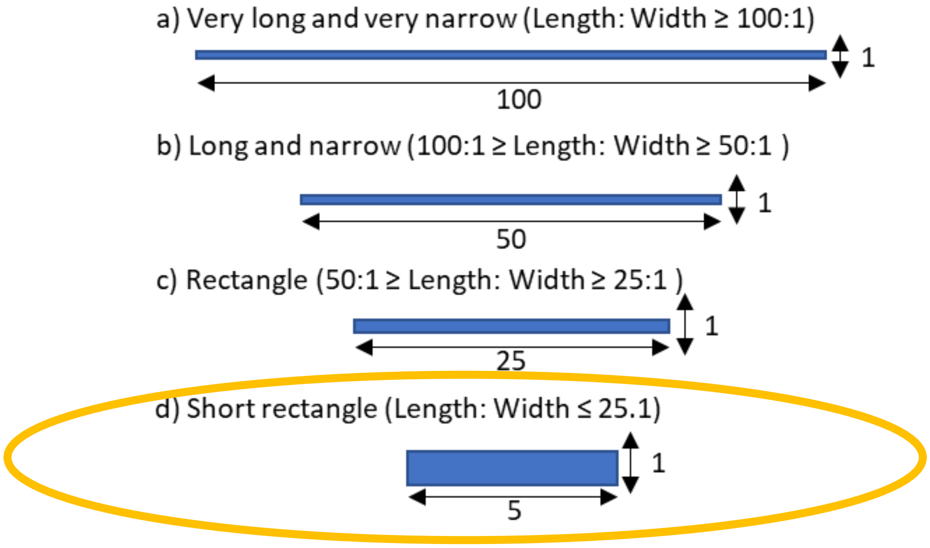
[18] When trenches cannot fit on a site, the designer may request approval from the approving health district to design a bed system. Using area from Step 1, repeat Steps 3 through 6 with excavation widths greater than 6 feet. GeoMat laterals in bed designs can be spaced no more than 6 feet on center and no more than 3 feet from the sidewall.

Design tip: *If you do not know how wide you want the trench(es), start with the narrowest trench possible. The narrowest trench possible is 1 foot with one GeoMat 1200 lateral. Also consider the basic desired trench width to length ratio from the following*[19]*:*



If you want to consider other dimensions, use the space below to alter trench width and determine alternate lengths. Repeat with various trench widths up to 6 feet until the dimensions are suitable for the site.

148 Required area from step 1	÷	2 Trench width (any width, 1-6’)	=	74 Total trench length required
148 Required area from step 1	÷	3 Trench width (any width, 1-6’)	=	49.33 Total trench length required
148 Required area from step 1	÷	6 Trench width (any width, 1-6’)	=	24.6 Total trench length required

---

[19] Based on site constraints including usable lot space, existing infrastructure/obstacles, distance to groundwater, contour direction, and soil type. In soils with low acceptance ratings, longer narrower soil treatment areas, designed parallel to contours, have a larger groundwater acceptance window and increased hydraulic performance relative to short and wide systems

Step 3. Determine number and length of trenches: GeoMat systems may be designed in multiple equal length trenches. If a single trench is too long with the widest allowable or if the user prefers, the required bottom area can be divided among multiple trenches[20].

Divide the total trench length from Step 2 by desired number of trenches to determine each trench length.

148	÷	1	=	148
Total trench length from Step 2		# of trenches		Length of each trench

Step 4. Select GeoMat lateral type and determine number of laterals: The GeoMat can be designed with GeoMat 1200s (1 foot wide) or GeoMat 3900 (3.25 feet wide) laterals. Determine the number of GeoMat 1200s that will fit in your selected trench width in Step 4a and the number of GeoMat 3900s that will fit in your selected trench width in Step 4b. Select type of GeoMat that will work best for your site in step 4c.

Step 4a. Determine how many GeoMat 1200 laterals will fit in each trench by dividing trench width from Step 2 by GeoMat 1200 width (1 foot):

4	÷	1 foot	=	4
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

If your result from Step 4a was a whole number it is the maximum number of GeoMat laterals that will fit. If your result was not a whole number, round down to determine maximum number of GeoMat laterals that will fit in a trench. 4 Geo 1200 laterals

Step 4b. Determine how many GeoMat 3900 laterals will fit in trench by dividing trench width from Step 2 by GeoMat 3900 width (3.25 foot):

4	÷	3.25 feet	=	1.2
Trench width from Step 2		GeoMat width		# of GeoMat laterals per trench

---

[20] A minimum of 6 feet of undisturbed soil is required between each adjacent trench.

If your result from Step 4b was less than 0.8 use GeoMat 1200s. If your answer to 4b was between 0.9 and 1.4 center 1 lateral in the trench. If your result was equal to or greater than 1.5 overlap 2 GeoMat 3900 laterals (Figure 11). 1 GeoMat 3900

Step 4c. Based on your results from steps 4a and 4b, select type of GeoMat and number of laterals that will maximize performance and cost effectiveness:

Type of GeoMat (circle one): GeoMat 1200 [✓ GeoMat3900]
Number of laterals per trench[21]: 1

Step 5. Ensure design meets minimum GeoMat required: Geomatrix requires a minimum length of GeoMat per bedroom to ensure adequate sizing for long-term hydraulic performance. In some cases, your design will meet State regulations but need more GeoMat per the manufacturer's requirement. This is common if your design included lots of bottom area not covered by GeoMat or if you are designing a large home with high application rates.

Step 5a. Multiply trench length from Step 2 by the number of trenches from Step 4 and the number of laterals in each trench from Step 5d to get total GeoMat length.

37	X	1		37
Total trench length from Step 2		# of GeoMat laterals per trench from step 4d		Total GeoMat length in system

Not enough GeoMat!

Step 5b. Compare total GeoMat length from Step 5a to values in Table 2 and ensure it meets minimum for bedrooms in design.

Table 2: Minimum required GeoMat length (linear feet) required per bedro

	Min Required feet of GeoMat 1200 (linear feet)	Min Required feet of GeoMat 3900 (linear feet)			
# of bedrooms	Any lateral # All trench widths*	One lateral All trench widths	Two laterals 5' trench*	Two laterals 5.5' trench*	Two [illegible] 6' trench*
1	78	24	36	34	30
2	156	48	52	55.5	59
3	234	72	89	83	77.5
4	312	96	103.5	111	118.5
5	390	120	129.5	138.5	148
Each Add'l	78	24	36	34	30

If area meets the minimum, continue to next step.

---

[21] You may reduce the number of GeoMat laterals in the trench as long as the amount of GeoMat required in Step 5 is met. In this case, provide equal spacing between laterals and between laterals and the sidewalls.

If minimum length of required GeoMat from Table 2 is not met:

Divide the minimum required GeoMat length from Table 2 by desired number of laterals per trench.

72	÷	1	=	72
Min. GeoMat (ft) per bedroom from Table 2		# of laterals		New total trench length

If using multiple trenches, divide new trench length by the number of trenches.

72	÷	1	=	72
New total trench length		# of trenches		Each trench length

-OR-

Revisit steps 2 and 4 to increase GeoMat in excavation by increasing trench width and adding additional laterals. Repeat until the minimum GeoMat needed per Table 2 is met.

Using alternative dimension from Step 2 and changing type/number of GeoMat laterals still do not have enough GeoMat to meet minimum, but if we increase the width of the trench to 6' and install two GeoMat 3900 laterals the length only needs to be increased to 39'

If increasing trench length and/or width does will not work for this design and multiple trenches are not an option, restart from Step 1[22] using the minimum GeoMat area per bedroom from Table 3 below as the minimum bottom area required and fill the entire bottom area with GeoMat.

Table 3:
Minimum required GeoMat area required per bedroom

# of bedrooms:	Min Required area (square feet)
1	78 ft^2
2	156 ft^2
3	234 ft^2
4	312 ft^2
5	390 ft^2
Each Add'l	78 ft^2

Using 234 ft^2 as the bottom area. Can do an excavation that is 4' x 59' with 4 GeoMat 1200 laterals covering the entire bottom area. Making these two 2' x 59' trenches with two GeoMat 1200 in each trench is also an option

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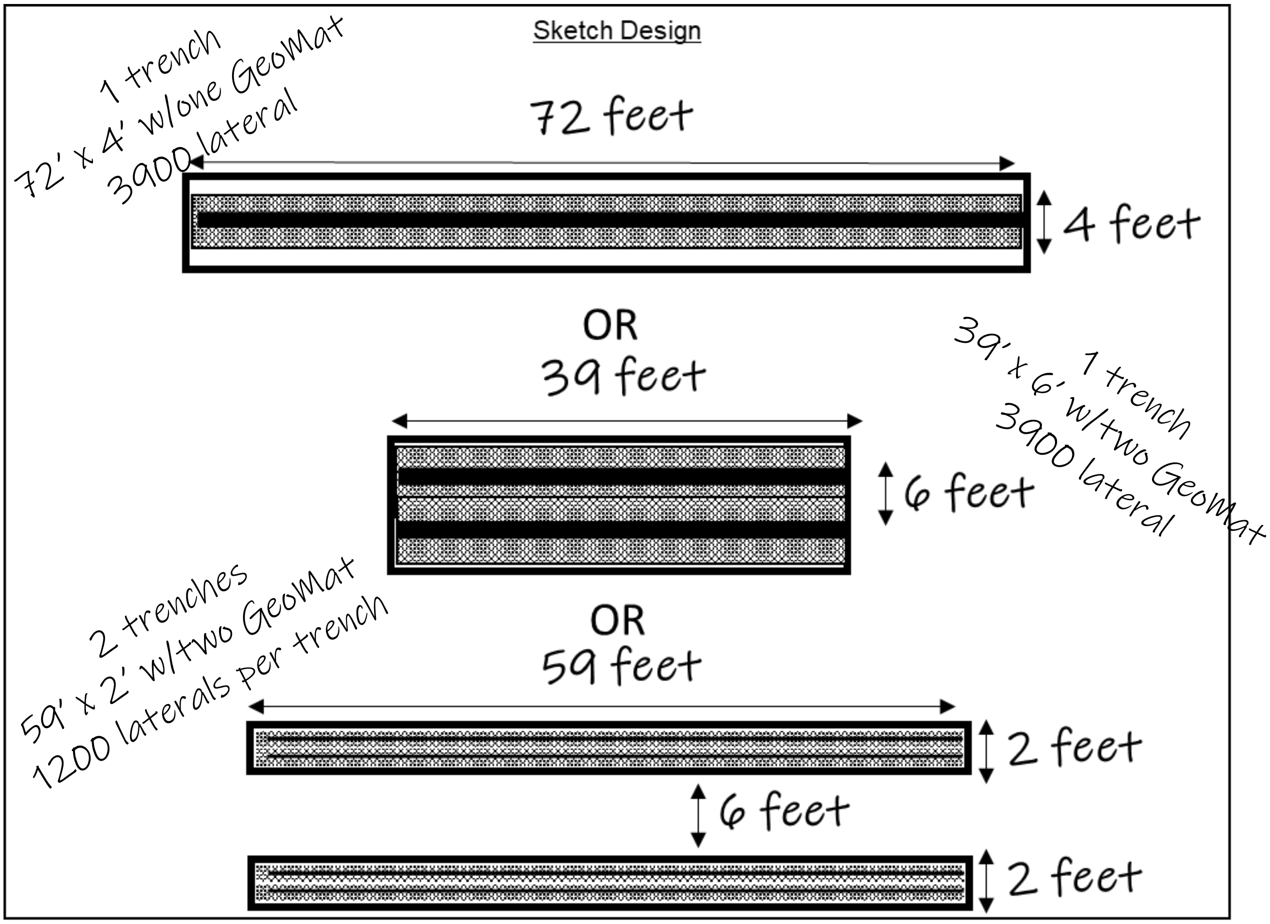
[22] If using area from Table 3 to design bottom area, ensure this area is enough to meet minimums required by Idaho State Regulations from Table 1.

Step 6: Complete the design by filling in the following information and doing a rough sketch of the design. Remember to design at least 6 feet of undisturbed soil between each adjacent trench or bed.

TRENCH OR BED WIDTH: 4' OR 6' OR 2'
TRENCH OR BED LENGTH: 72' OR 37' OR 59'
TYPE OF GEOMAT: GeoMat 3900 or GeoMat 1200
 # OF LATERALS PER TRENCH: 1 OR 2
 # OF TRENCHES OR BEDS: 1 OR 2



GeoMat systems are incredibly flexible and there are many more configurations possible given the example parameters.

Trench Sizing Steps: Experienced users guide

Step 1. Determine Minimum Trench[23] Bottom Area by referring to Table 1:

Table 1
Minimum Bottom Area Required for Trench and Bed Configuration

	Application Rate (GPD/sq. ft) / Soil Design Subgroup						
	1.7/A-1	**1.2/A-2a**	**1.0/A-2b**	**0.8/B-1**	**0.6/B-2**	**0.4/C-1**	**0.3/C-2**
Bedrooms	**Minimum Surface Area Required (sq. ft)**						
1	89	125	150	188	250	375	500
2	118	167	200	250	334	500	667
3	148	209	250	313	417	625	834
4	177	250	300	375	500	750	1000
5	206	292	350	438	584	875	1167
Each Additional	30	42	50	63	84	125	167

Minimum bottom area required: ____________________

Step 2. Determine width of each trench and total length of trench required: Divide required trench bottom area from Step 1 by desired trench width to determine the total trench length required.

Step 3. Determine number and length of trenches: Divide the total trench length from Step 2 by desired number of trenches to determine the length of each trench.

Step 4. Select GeoMat lateral type and determine number of laterals:

Step 4a: Select type of GeoMat (circle one): GeoMat 1200 GeoMat 3900

Step 4b: Determine how many GeoMat laterals will fit in trench by dividing trench width from Step 2 by GeoMat width (GeoMat 1200 = 1 foot; GeoMat 3900 = 3.25 feet).[24,25]

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[23] Bed systems cannot be designed without the approval of the local health department

[24] You may reduce the number of GeoMat laterals in the trench from Step 4b as long as the amount of GeoMat required in Step 5 is met. In this case, equally space laterals within the trench(es) and from sidewalls.

[25] Two 3900 laterals can be installed in trenches with overlap between the two mats (Figure 11)

Step 5. Ensure design meets minimum GeoMat required from Table 2: If minimum length of required GeoMat from Table 2 is not met, alter design to meet minimum by increasing trench length or width or by increasing the number of trenches.

Table 2: Minimum required GeoMat length (linear feet) required per bedroom

	Min Required feet of GeoMat 1200 (linear feet)	Min Required feet of GeoMat 3900 (linear feet)			
# of bedrooms	Any lateral # All trench widths*	One lateral All trench widths	Two laterals 5’ trench*	Two laterals 5.5’ trench*	Two laterals 6’ trench*
1	78	24	36	34	30
2	156	48	52	55.5	59
3	234	72	89	83	77.5
4	312	96	103.5	111	118.5
5	390	120	129.5	138.5	148
Each Add’l	78	24	36	34	30

*The amount of GeoMat required when using multiple laterals in the same trench is divided by the number of total laterals. This will often result in a shorter system, depending on required trench length, while providing more GeoMat surface area within the required trench.

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