Grand Traverse County Health Department
Environmental Health Division

Pressure Mound System (PMS)
Policy and Procedure Manual

This document is authorized under the authority of **Section 5.19 (Variations)** of the ***Environmental Health Regulations for Grand Traverse County Health Department*** as amended May 25, 1994.

Introduction

This manual applies to residential building sites requiring on-site wastewater treatment systems (OSWTS) to comply with the Grand Traverse County Health Department (GTCHD) Environmental Health Regulations. The provisions of the Pressure Mound System (PMS) Policy and Procedure Manual shall apply in the event a site does not meet the minimum requirements of Section 2.458 (Permit Denial) of the GTCHD Environmental Health Regulations. This PMS manual does not apply to subdivisions, site condominiums, and land divisions less than 1.0 acre. The Michigan Department of Environmental Quality (MDEQ) regulates these various types of land developments. Community systems may be installed using the standards set forth in this PMS manual on a case-by-case basis with careful consideration of the Michigan Criteria guidelines and the MDEQ Part 22 rules. Special consideration will be given to any parcel where a replacement on-site wastewater system is needed due to failure of the existing system.

Pressure mound systems, when properly sited, designed, constructed, operated and maintained, provide a proven and effective method of on-site wastewater treatment and disposal. A PMS is a viable option for sites not suitable for conventional septic systems. Pressure distribution and isolation of the final disposal media above restrictive and sensitive soil conditions minimize potential adverse impacts to public health and the environment. The GTCHD has developed this manual to clearly present the necessary requirements and steps to construct a PMS on an otherwise unsuitable site. Many of the design and construction requirements in this manual are directly from the MDEQ mound guidance document, “Pressure Mound Systems – Technical Guidance for Site Suitability, Design, Construction and Operation and Maintenance” (June 2003).

1) SITE EVALUATION

a) Prior to commencing with a PMS construction permit, a site evaluation (site survey) shall be conducted by the GTCHD to determine whether or not the parcel or site meets the minimum requirements to construct a PMS. The appropriate Site Survey fee will be applicable.
b) When the Environmental Health Staff determines the site meets the requirements of the PMS Manual, the permit applicant shall submit a complete application and permit fee to the GTCHD. The application shall be completed on a form provided by the GTCHD.

2) SITE SUITABILITY

a) Soils shall be evaluated to a minimum depth of 72 inches and recorded using the USDA soil classification system. Seasonal high water table shall be identified based on soil mottling or other indicators.
b) All components of the PMS shall meet all isolation requirements as described in Table 2 of Appendix A. Deviations from these isolation distances may be granted for replacement of existing OSWTS on a case-by-case basis.
c) The site of a PMS shall have a **minimum 30 inches of naturally occurring soils** below natural ground surface with suitable textures as listed in Table 1 of Appendix A. The 30 inches of suitable soil shall be above seasonal high groundwater elevation. The depth to high groundwater elevation shall be confirmed by a soil profile with 6 inches or more of soil without mottling below the "A" horizon (topsoil). The natural ground surface is that which is formed by the forces of nature and not through the activities of man. Any soils encountered over an organic muck or marl layer will be considered unnatural or "filled" and will not be considered suitable.

    1) The infiltrative surface of the final disposal media shall be separated from the seasonal high groundwater table or other restrictive soil layer by **no less than 48 inches** which includes appropriate fill material (over the minimum 30" of naturally occurring soils).

3) DESIGN PARAMETERS

a) The property owner shall retain the services of a State of Michigan Licensed Professional Engineer (P.E.) or State of Michigan or Nationally Registered Sanitarian (R.S.) competent in PMS design.
b) The PMS design shall incorporate the following design criteria recommended in the MDEQ mound guidance document:

    - **Design Flows** - For design purposes an allowance of 150 gallons per day per bedroom is suggested. This figure provides an adequate factor of safety necessary to promote satisfactory long-term function of the distribution cell and mound.

- **Distribution Cell Sizing** - The maximum loading rate should never exceed 1.0 gallon per day per square foot. More conservative loading rates will provide a higher factor of safety. Horizontal separation between distribution cells shall be based on allowable soil loading rate with a minimum of three feet.

- **Reserve Area** - Reserve area with suitable site conditions must be set aside and protected for future use. The reserve area shall include a basal area, sized in accordance with Table 1, which is totally separate from the basal area of the initial mound.

- **Mound Orientation** – The absorptive area should be long and narrow with the long dimension running parallel to the contour of a sloping site.

- **Soil Loading Rate** - The minimum mound basal area required for absorption of effluent is based upon soil texture for a given soil structure. Table 1 suggests recommended maximum soil loading rates based upon the most limiting soil texture and structure encountered in the upper 30 inches of the soil profile. The basal area for sloping sites (i.e., those with slopes > 2 percent) includes the area under the distribution cell and area down slope only. On flat sites (i.e., those with slopes < 2 percent) the minimum required basal area includes that under the distribution cell and either side of it. Generally, the minimum required basal area will be found to be less than the actual area filled after accounting for required depth of fill and side slopes.

- **Hydraulic Linear Loading Rate** - The hydraulic linear loading rate is the volume of effluent applied per day per linear foot of system along the natural ground contour. From a hydraulic standpoint, a long and narrow mound design is most efficient and better promotes aerobic conditions under the distribution cell. Table 1 suggests recommended maximum hydraulic linear loading rates based upon the most limiting soil texture and structure encountered in the upper 30 inches of the soil profile.

- **Depth of Fill** - The depth of fill must be such that the bottom of the distribution cell is isolated > 4 feet above established high ground water elevation or limiting layer. Limiting layer includes soils with an expected permeability above 60 minutes/inch based on soil texture and structure. The minimum depth of fill at the outer edge of the distribution cell area shall be 12 inches. The approved plan shall indicate the location of a suitable benchmark to be used by the contractor during construction to judge that the required depth of fill has been provided.

- **Final Cover** - The settled depth of final cover at the outer edge of the distribution cell should be a minimum of 12 inches and the top of the mound graded to promote positive drainage. Final cover over the mound should support the growth of a suitable vegetative cover while shedding rainfall and promoting aeration of the mound. Final cover should have a texture no heavier than sandy loam.

- **Side Slopes** - The final side slope of the mound surface should be 4:1 or flatter.

- **Greenbelt Area** - On sloping sites (i.e., those with slopes > 2 percent) it can be expected that flow will move laterally down gradient. So as to not to adversely impede this lateral movement, a suitable down slope greenbelt area shall be provided. The greenbelt area is to be measured from the toe of the mound and located within property boundaries. The minimum required greenbelt area varies based on soil texture as indicated in Table 1.

- **Sand Fill Requirements** - It is important that the specification of the sand fill material be closely controlled from both a performance and longevity standpoint. From a treatment standpoint, the mound functions in a similar fashion to a sand filter. Sand fill should be clean and meet the Michigan Department of Transportation 2NS gradation without excessive fines. A qualitative field check to assess the cleanliness of sand delivered to the construction site should be conducted (See Appendix A).

- **Observation Ports** - At least one observation port to gauge ponding depth in the distribution cell is necessary. Where the distribution cell is divided into multiple zones, at least one per zone is required.

- **Pressure Distribution System** - Pressure distribution of effluent is required in the distribution cell to promote maximum achievable treatment, and is critical from a hydraulic standpoint, especially where slowly permeable soils are encountered. Pressure distribution system design should generally comply with currently accepted design practice including the following features:

  - Septic tank effluent filters or screen pump vaults are necessary.

  - Small frequent doses to the mound by means of time dosing to promote unsaturated flow and enhanced treatment and hydraulics are required.

  - Design shall provide uniform doses with no more than 0.5 gallons per orifice per dose.

  - Distribution cell area per orifice shall not exceed 12 ft^2.

- To reduce orifice plugging, high head pumps are recommended.
- Orifice shields should be provided.
- Provisions for flushing must be incorporated at the ends of all laterals.
- Geotextile fabric which prevents the downward migration of fine materials but allows for free passage of air and water should be placed over the stone in the distribution cell prior to placement of final cover.

c) Design plans for a PMS shall be submitted to this Department for review prior to permit issuance. All design plans shall be completed and approved by a Professional Engineer or Registered Sanitarian. At least two (2) sets of design plans and specifications shall be provided. Plans and specifications shall be clear, legible, scaled, and permanent copies. The plans shall be signed with the Professional Engineer's License number or Registered Sanitarian's Registration number. The following are the minimum required elements of a complete design plan for a PMS:

- A minimum of two (2) soil evaluation/profile locations performed by a Professional Engineer or Registered Sanitarian. The soil profiles shall include depth of topsoil, soil texture, soil mottling, depth to seasonal high groundwater, and hydraulic loading capabilities of the soils. Soil profile evaluations shall be completed using either soil pits or borings.
- Detailed configuration layouts depicting how the design is to be constructed and how the design is to accomplish the absorption that is claimed. Cross-sections required with elevations of dispersal components.
- Inclusions of all system sizing calculations, dynamic head calculations, pump selection details, and any other calculations performed for the design of the system.
- Specifications, including a description of the materials for the project and the installation or construction practices and methods to be employed.
- A site plan with a benchmark delineating and detailing all PMS components and their relationship to minimum isolation distance requirements as stated in Table 2 of Appendix A.
- The location of all of the following, either existing or proposed, within or adjacent to the PMS:

    1. Buildings or other structures

2. Water bodies
3. Wetlands
4. Property lines
5. Road right of ways
6. Utility easements
7. Water wells
8. On-site wastewater systems
9. High risk erosion areas
10. Natural Rivers Act designation areas
11. Underground utilities
12. Driveway and parking area
13. Drainage easements
14. Storm water collection basins
15. Other factors that may affect location of the PMS

d) The Professional Engineer or Registered Sanitarian shall inspect and certify the construction of the PMS as approved by the GTCHD and provide such certification to the GTCHD prior to system start-up.

4) SITE PREPARATION AND CONSTRUCTION

Ultimate success or failure of a mound also relies on a clear communication and understanding of basic site preparation and construction principles. Critical issues include:

- Proper procedures must be followed to protect the mound area including required greenbelt area during and after construction. After establishing a suitable location for the mound and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the mound that is isolated from other anticipated home construction activities is encouraged.

- Soil smearing and compaction, which can reduce infiltration capacity will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a 1/4 inch or smaller “wire” it is considered too wet and should be allowed to dry before preparing.

- Excess vegetation should be removed from the mound basal area. Trees should be cut flush to the ground and other vegetation over six inches in length should be mowed and cut vegetation removed. Where an excessive number of stumps and large boulders are encountered, the absorption area should be enlarged or an alternate site should be selected.

- The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.

- Cleanliness of sand fill should be field checked prior to installation. Placement of fill material then is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travel over the mound basal area and downslope greenbelt area. Total depth of fill shall be established based on a benchmark provided by the design consultant on the approved plan.

- Final grading of the mound area should divert surface water drainage away from the mound. Sod the entire mound area or seed and mulch.

5) OPERATION AND MAINTENANCE

The system owner is responsible for assuring the continuous operation and maintenance of the system. Deed advisories need to be recorded to communicate to the system owner and subsequent future owners the importance of routine and regular maintenance activities. It is suggested that a maintenance inspection be conducted on an annual basis by a trained maintenance provider. In such cases, the operator must be responsible for the continuous operation and maintenance of the system and must submit appropriate records routinely to the health department.

Routine and preventative maintenance aspects are:

- Scum and sludge levels in the septic tank as well as the pump chamber need to be inspected routinely on an annual basis and tanks pumped as necessary. Depending on tank size and usage, pumping will typically be required at intervals exceeding every 3 to 5 years.

- Periodic inspections of system performance are required. Liquid levels in the observation ports should be checked and examinations made for any seepage around the toe of the mound. The pressure distribution system should be assessed and laterals flushed as necessary. It is recommended that mounds be visited at least once per year.

- A good water conservation plan within the house or establishment will help assure that the mound system will not be hydraulically overloaded.

- Avoid traffic in the initial and replacement mound areas and downslope greenbelt area. No vehicular traffic or livestock should be permitted. With lawn care equipment, such as a riding lawn mowers or tractor, it is important not to travel on the mound or the downslope area when the soil is saturated. Winter traffic on the mound should be avoided to minimize frost penetration in colder climate areas and to minimize compaction in other areas.

Owner's Manual - A user's manual needs to supplement the construction plan and must be submitted to the health department for final approval. A copy of this manual must be provided to the property owner after completion of the mound system. The manual needs to contain the following as a minimum:

1. As-built drawings of all system components and their location are to be provided. The location of the reserve area also needs to be clearly defined and its importance communicated to the owner.

2. Specifications for all electrical and mechanical components.

3. Names and phone numbers of the health department, component manufacturer, or management entity to be contacted in the event of an alarm, or other problems, or failure.

4. Information on the periodic maintenance of the mound system, including electrical/mechanical components.

5. Information on what activities can or cannot occur on and around the mound, reserve area, and greenbelt area.

6. A standard homeowner "Do's and Don'ts" list for proper system operation.

7. Information regarding suitable landscaping and vegetation for the mound and surrounding areas.

6) Deed Advisory

a) Prior to the operation of a PMS, the owner of the PMS shall record an advisory attached to the deed of the property where the system is located. The deed advisory shall be recorded with the Grand Traverse County Register of Deeds and a copy submitted to the GTCHD complete with the assigned "Document Number."
b) The format for the deed advisory will be provided by the GTCHD.

APPENDIX A

Figure 1
Typical Mound System Components

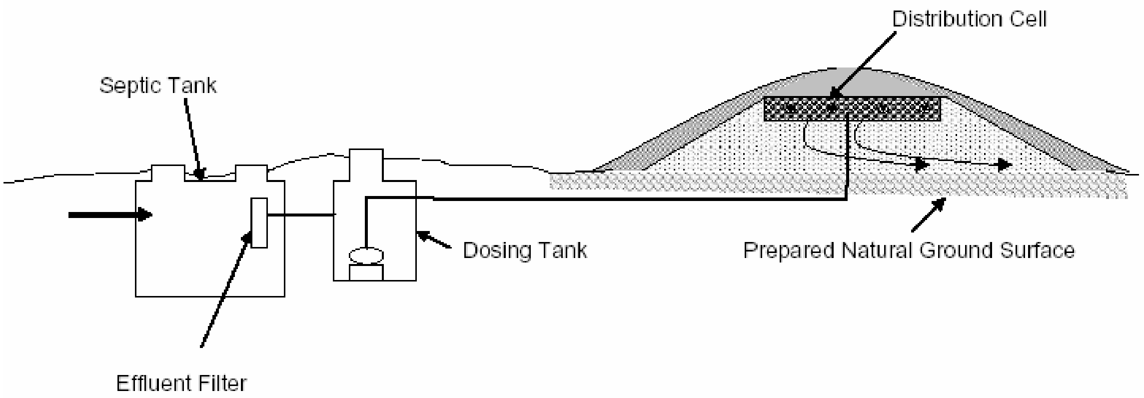


Figure 2
Typical Site Plan

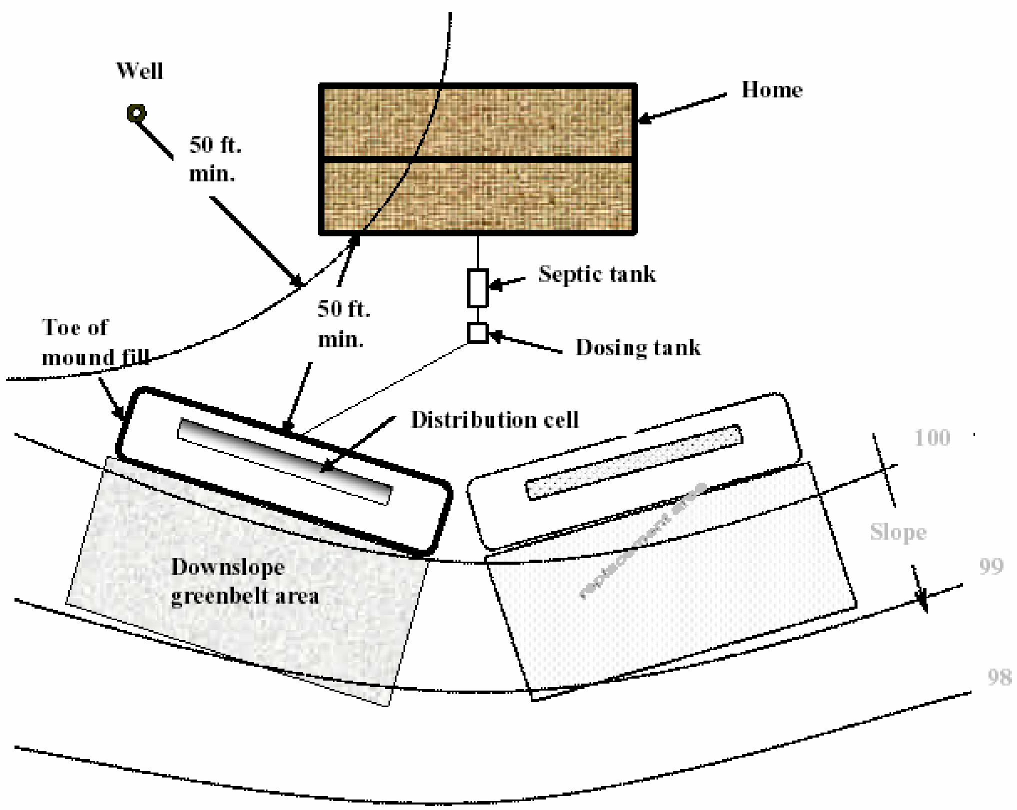
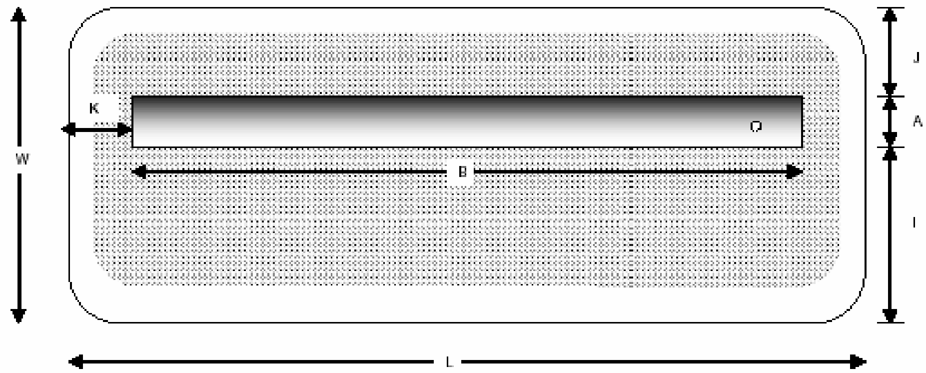
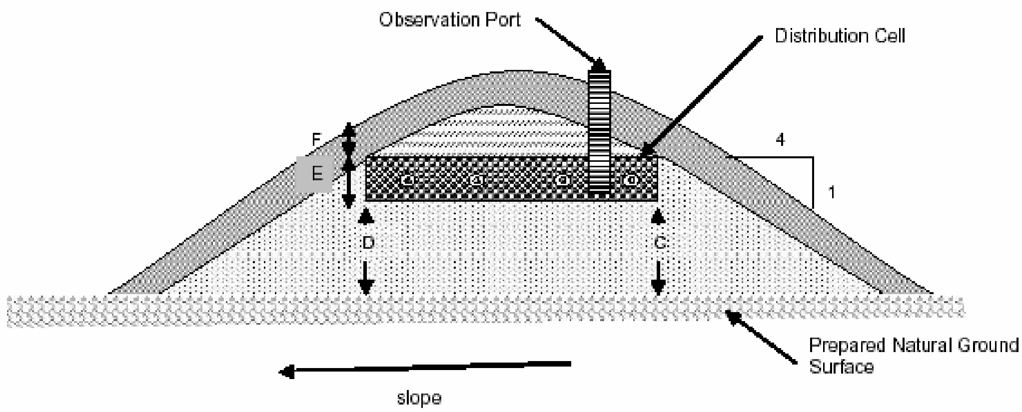


Figure 3
Mound Plan View and Cross Section



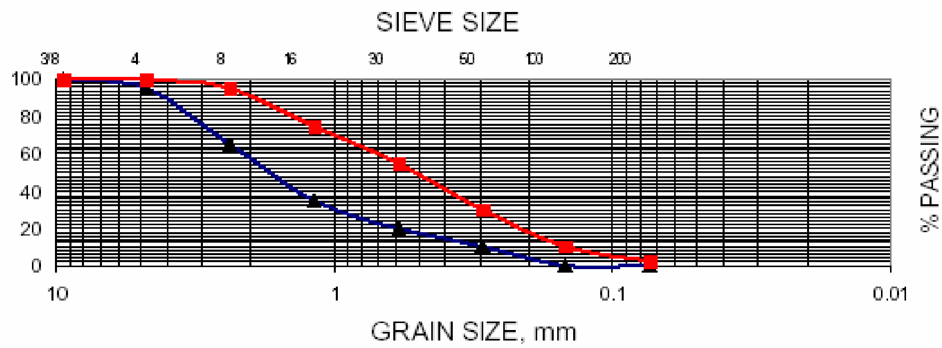


<u>Legend</u>

A - Distribution cell width
B - Distribution cell length
C - Up slope fill depth under distribution cell
D - Downslope fill depth under distribution cell
E - Distribution cell depth
F - Depth of final cover
I - Distance from edge of distribution cell to downslope edge of fill
J - Distance from edge of distribution cell to up slope edge of fill
K - Distance from end of distribution cell to edge of fill
L - Overall mound fill length
W - Overall mound fill width

Figure 4
MDOT 2NS Sand Specification

Sieve Size	Grain Size (mm)	Percent Passing %	Percent Passing %
3/8	9.52	100	100
4	4.76	95	100
8	2.38	65	95
16	1.19	35	75
30	0.59	20	55
50	0.297	10	30
100	0.149	0	10
200	0.074	0	3



Procedure for Qualitative Field Test of Sand Cleanliness

Sand fill materials for mound construction should be obtained from a supplier that has documented through sieve analysis that the 2NS specification is met. As results of sieve analyses will typically vary over time, it is recommended that a qualitative field assessment of the cleanliness of the sand delivered to the construction site also be conducted. The following procedure is suggested:

1. Fill a quart jar one half full of the sand fill material to be tested.
2. Add water to fill the jar.
3. Shake the jar contents vigorously after which it should be allowed to settle for 30 minutes.
4. If after settling a perceptible layer of fines greater than 1/8 inch in thickness has accumulated on the surface, the fill material should not be considered clean enough and an alternate source should be explored.

Figure 5 – Observation Port Example Details

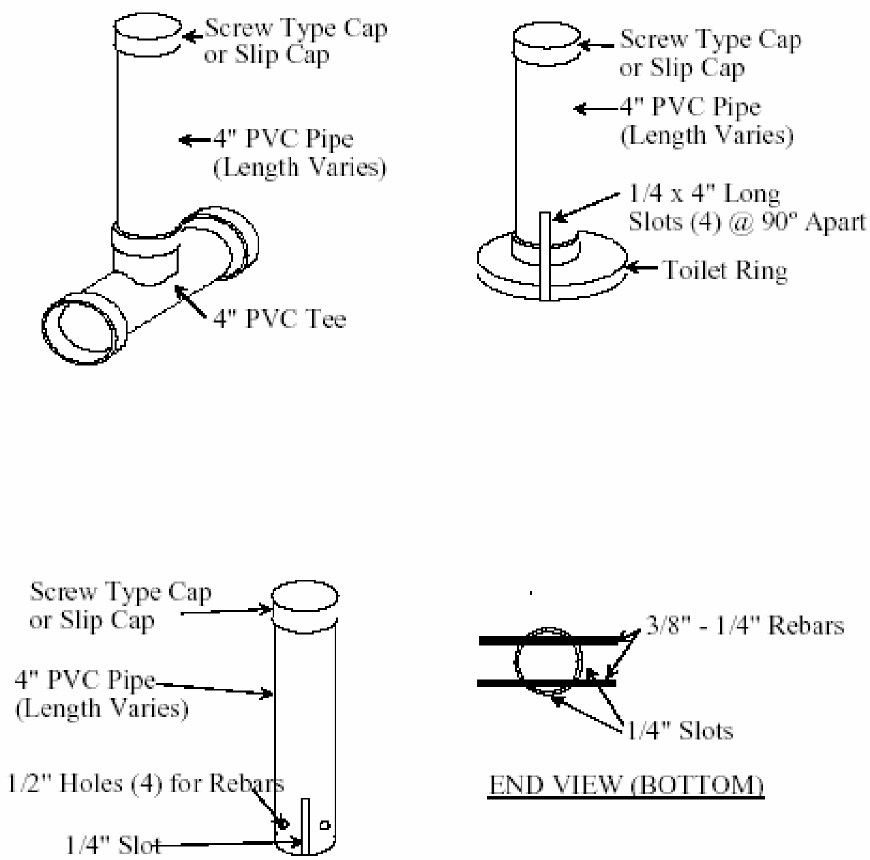


Table 1
Allowable Soil Loading Rates

	MAXIMUM SOIL LOADING RATE GPD/FT²					MAX. HYDRAULIC LINEAR LOADING RATE, GPD/LF					REQUIRED DOWNSLOPE GREENBELT** (SLOPE > 2%, FEET)
	BK/GR					BK/GR					
SOIL STRUCTURE* → / SOIL TEXTURE* ↓	1	2	3	PL	M	1	2	3	PL	M	
COARSE SAND / MEDIUM SAND	1.0	1.0	1.0	0.5	0.5	5.0	5.0	5.0	2.5	2.5	NR
FINE SAND / LOAMY SAND	0.4	0.5	0.6	0.4	0.4	3.5	4.0	4.5	2.0	2.0	10
VERY FINE SAND / SANDY LOAM	0.3	0.4	0.5	U	0.2	3.0	3.5	4.0	U	1.0	20
LOAM / SANDY CLAY LOAM	0.2	0.25	0.3	U	0.2	2.5	3.0	3.5	U	U	30
CLAY LOAM / SILTY CLAY LOAM	0.15	0.2	0.25	U	U	1.8	2.5	3.0	U	U	40
SILTY CLAY/ SANDY CLAY / CLAY	UNSUITABLE										

* MOST LIMITING LAYER IN UPPER 18 INCHES
** MEASURED FROM TOE OF MOUND FILL

TABLE LEGEND

BK = BLOCKY	1 = WEAK
GR = GRANULAR	2 = MODERATE
PL = PLATY	3 = STRONG
M = MASSIVE	U = UNSUITABLE

Table 2
Minimum Horizontal Isolation Distances

From Toe of Mound Fill To:	Minimum Horizontal Isolation Distance (feet)
Private individual well	50
Surface waters	100
Basement foundation walls	50*
Top of drop-off	20
Property lines	10
Footing drains installed in water table without direct connection to surface water	25
Footing drains installed in water table with direct connection to surface water	50
Drains designed to lower the water table	100

*The downslope edge of the greenbelt area may be located within 25 feet of the foundation walls.

APPENDIX B

Mound Design Worksheet

Site Criteria

1. Soil Profile
   ____
   ____
   ____

2. Slope: __________%

3. This is a site for a proposed _______ bedroom home.

Step 1. Evaluate the quantity and quality of wastewater generated.

Daily Flow = # of bedrooms x 150 gpd/bedroom
= (______ x 150) gpd
= ______ gpd

Step 2. Evaluate the soil profile and site description for maximum soil loading rate and hydraulic linear loading rate.

Seasonal High Groundwater Elevation = ______ inches

Depth to Limiting Layer = ______ inches

Limiting Layer texture, structure, grade ______, ______, ______

Using Table 1 the soil loading rate (SLR) and linear loading rate (LLR) are selected.

Soil Loading Rate (SLR) = ______ gpd/ft^2

Linear Loading Rate (LLR) = ______ gpd/lineal foot

Step 3. Select the sand fill loading rate and calculate the distribution cell width (A).

The maximum sand fill loading rate for septic tank effluent is 1.0 gpd/ft2. For this design the following rate will be used ______ gpd/ft^2. The width of the distribution cell (A) can then be calculated as follows:

A = Linear Loading Rate ÷ Sand Fill Loading Rate
= ______ gpd/ft. ÷ ______ gpd/ft^2
= ______ ft.

Step 4. Determine the distribution cell length (B).

B = Design Flow ÷ Linear Loading Rate
= ______ gpd ÷ ______ gpd/ft.
= ______ ft.

Step 5. Determine the soil infiltration area width (IW).

The soil infiltration width represents the width required to absorb the effluent into the natural soil. To provide a factor of safety it is based on the most limiting horizon in the upper 30 inches. For this design the most limiting horizon is ______ with a ______, which has a maximum soil loading rate of ______ gpd/ft^2.

IW = Design flow ÷ (soil loading rate x B)
= ______ ÷ ______
= ______ ft.

For situations where the most limiting horizon is slowly permeable it will be found that the infiltration width will exceed width of the distribution cell. The infiltration width is important when evaluating the adequacy of the overall mound fill area and horizontal spacing when using multiple distribution cells.

Step 6. Determine mound fill depth (C) at the upslope edge of the distribution cell.

In this case, the depth of fill (C) at the upslope edge of the distribution cell will be the fill required to elevate the stone four feet above high groundwater elevation or limiting layer, which is ______ feet.

Step 7. Determine the mound fill depth (D) at the downslope edge of the distribution cell.

For a given slope, the following can be used:

D = C + (slope x A) Note: express slope as decimal, i.e., 4% = 0.04
= ______ + (______ x ______)
= ______ ft.

Step 8. Determine mound depths (E) and (F).

E = ______ ft. (total depth of stone)
F = ______ ft. (amount of final cover)

Step 9. Determine the downslope width (I).

Using a recommended side slope of 4:1 the calculations is as follows:

Downslope correction factor = 100 ÷ [100-(side slope x % ground slope)]
= 100 ÷ [100-(4 x ______ % slope)]
= 100 ÷ [100-(4 x ______)]
= ______

I = 4(D+ E+ F) x downslope correction factor
= 4(______ +______ + ______)(______)
= ______ ft.

Step 10. Determine the upslope width (J).

Using a recommended side slope of 4:1 the calculations is as follows:

Upslope correction factor = 100 ÷ [100+(side slope x % slope)]
= 100 ÷ [100+(4 x ______% slope)]
= 100 ÷ [100+(4 x ______)]
= ______

J = 4(C+ E+ F) x upslope correction factor
= 4(______+______+______)(______)
= ______ ft.

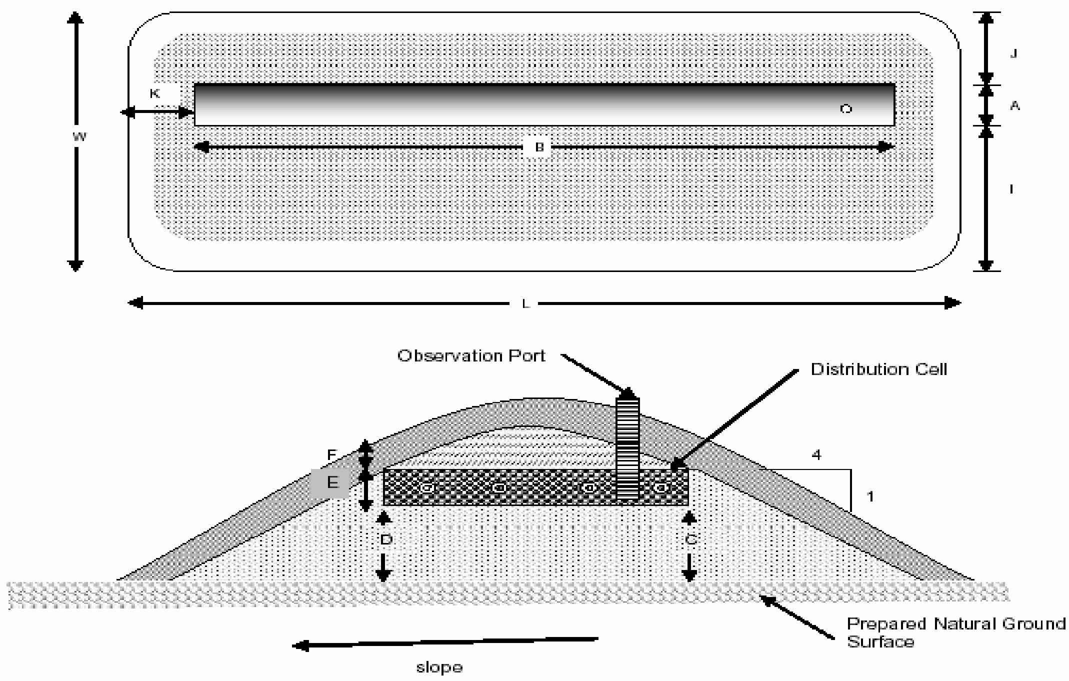
Step 11. Determine the end slope length (K).

Using a recommended side slope of 4:1 the calculations is as follows:
K = 4[(C+D)/2 +E +F]
= 4[(______+______)/2 +______+______]
= ______ ft.

Step 12. Determine the overall width (W) and length (L) of the mound fill.

W = A + I + J
= ______ + ______+ ______
= ______ft.

L = B + 2K
= ______ + 2(______)
= ______ ft.



Mound Component Dimensions

A	Distribution cell width	
B	Distribution cell length	
C	Up slope fill depth under distribution cell	
D	Downslope fill depth under distribution cell	
E	Distribution cell depth	
F	Depth of final cover	
I	Distance from edge of distribution cell to downslope edge of fill	
J	Distance from edge of distribution cell to up slope edge of fill	
K	Distance from end of distribution cell to edge of fill	
L	Overall mound fill length	
W	Overall mound fill width	