The ICC Flowtech® Mound Component Manual

Version 1.2
May 25, 2010

TABLE OF CONTENTS

4640 Trueman Boulevard
Hilliard, Ohio 43026

This component manual is based upon the “Mound Component Manual For Private Onsite Wastewater Treatment Systems” Version 2.0, January 30, 2001 by the State of Wisconsin Department of Commerce Division of Safety and Buildings. This manual may be revised according to regulation or product changes.

I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for a mound component. However, these items must accompany a properly prepared and reviewed plan acceptable to the governing unit to help provide a system that can be installed and function properly. Violations of this manual constitute a violation of chs. Comm 83 and 84, Wis. Adm. Code. The mound component must receive influent flows and loads less than or equal to those specified in Table 1. When designed, installed and maintained in accordance with this manual, the mound component provides treatment and dispersal of domestic wastewater in conformance with ch. Comm 83 of the Wis. Adm. Code. Final effluent characteristics will comply with s. Comm 83.43 (8) and 83.44 (2), Wis. Adm. Code when inputs are within the range specified in Tables 1 to 3.

Note: Detailed plans and specifications must be developed, and submitted for reviewed and approved by the governing unit having authority over the plan for the installation. Also, a Sanitary Permit must be obtained from the department or governmental unit having jurisdiction. See Section XII for more details.

TABLE 1
INFLUENT FLOWS AND LOADS

Design Wastewater flow (DWF)	≤ 5000 gal/day
Monthly average value of Fats, Oil and Grease (FOG)	≤ 30 mg/L
Monthly average value of five day Biochemical Oxygen Demand (BOD_5)	≤ 220 mg/L
Monthly average value of Total Suspended Solids (TSS)	≤ 150 mg/L
Design loading rate of fill	≤ 1.0 gal/ft^2/day if BOD_5 or TSS > 30 mg/L or ≤ 2.0 gal/ ft^2/day if BOD_5 and TSS ≤ 30 mg/L
Volume of a single dose	≥ 5 times void volume of the distribution lateral (s)
Design daily wastewater flow (DWF) from One and two-family dwellings	≥ 150 gal/day/bedroom
Design daily wastewater flow (DWF) from public facilities	≥ 150% of estimated daily wastewater flow in accordance with Table 4 of this manual or s. Comm 83.43 (6), Wis. Adm. Code.
Linear loading rate for systems with in situ soils having an effluent application rate of ≤ 0.3 gal/ft^2/day within 12 inches of fill material	≤ 4.5gal/ft
Wastewater particle size	≤ 1/8 inch
Distribution cell area per orifice	≤ 12 ft^2

TABLE 2 SIZE AND ORIENTATION	
Distribution cell width (A)[a]	≤ 10 feet
Total distribution cell area (A x B)[a]	≥ Design wastewater flow rate ÷design loading rate of fill material
Orientation	Longest dimension parallel to surface grade contours on sloped sites.
Deflection of distribution cell on concave slopes	≤ 10%
Fill material depth (D) at up slope edge	1. ≥ 6 inches when fill is placed on of in situ soil listed in Table 83.44-3, Wis. Adm. Code, having fecal coliform treatment capabilities of ≤ 36 inches, or 2. ≥ 12 inches when fill is placed on < 12 inches in situ soil listed in Table 83.44-3, Wis. Adm. Code, having fecal coliform treatment capabilities of > 36 inches.
Distribution cell depth (F) [a]	= ICC Flowtech® bundle height of 12 inches
Depth of cover material at top center of distribution cell (H) [a]	≥ 12 inches and ≤ 24 inches
Depth of cover material at top outer edge of distribution cell (G) [a]	≥ 6 inches and ≤ 18 inches
Basal area	≥ Design wastewater flow rate ÷ design loading rate of basal area as specified in Table 1

[a] Note: Letter corresponds to letters referenced in figures, formulas and on worksheets.

TABLE 2b
Product Sizing Table

Product	Product width	Product height	Product length	Product rating
FTS 123 H-1 OC	36”	12”	5’	15 sf/unit
FTS 123 H-1 OC	36”	12”	10’	30 sf/unit
FTS 121 H-1 OC	12"	12"	5'	5 sf/unit
FTS 121 H-1 OC	12"	12"	10'	10 sf/unit
FTS 121	12"	12"	5'	5 sf/unit
FTS 121	12"	12"	10'	10 sf/unit
FTS 061	6"	6"	5'	2.5 sf/unit
FTS 061	6"	6"	10'	5 sf/unit
FTSG 123 H-1 OC	36”	12”	5’	15 sf/unit
FTSG 123 H-1 OC	36”	12”	10’	30 sf/unit
FTSG 121 H-1 OC	12"	12"	5'	5 sf/unit
FTSG 121 H-1 OC	12"	12"	10'	10 sf/unit
FTSG 121	12"	12"	5'	5 sf/unit
FTSG 121	12"	12"	10'	10 sf/unit
FTSG 061	6"	6"	5'	2.5 sf/unit
FTSG 061	6"	6"	10'	5 sf/unit

TABLE 3
OTHER SPECIFICATIONS

Slope of original grade	≤ 25% in area of mound
Depth of in situ soil to high groundwater elevation and bedrock under basal area	≥ 6 inches of which 4 inches is below an “A” horizon, if an “A” horizon exists.
Vertical separation between distribution cell and seasonal saturation defined by redoximorphic features, groundwater, or bedrock	≥ Equal to depth required by s. Comm 83 Table 83.44-3, Wis. Adm. Code
Horizontal separation between distribution cells	≥ 3 ft.
Fill material	Meets ASTM Specification C-33 for fine aggregate
Size for basal area (for level sites) (B x W) [a]	≥ The area measured from center of distribution cell and extends in all directions to create an area equal to the infiltrative rate of the in situ soil ÷ design daily flow rate
Size for basal area (for sloping sites) (B x {A +I})	≥ The area measured from up slope side of distribution cell and extends from end to end of distribution cell down slope to create an area equal to the infiltrative rate of the in situ soil ÷

	total design daily flow rate
TABLE 3 **OTHER SPECIFICATIONS** (continued)	
Effluent application	By use of pressure distribution network conforming to **sizing methods** contained in Small Scale Waste Management Project publication 9.6, entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems” and Dept. of Commerce publication SBD-10706-P, titled “Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems”
Piping Material	Meets requirements of s. Comm 84.30 (2), Wis. Adm. Code for its intended use
Distribution cell aggregate material	ICC Flowtech products as listed in Table 2b
Fabric cover over distribution cell	Geotextile fabric meeting s. Comm 84.30 (6) (g), Wis. Adm. Code
Number of observation pipes per distribution cell	≥ Two extending from distribution cell infiltrative surface and readily accessible from finished grade
Location of observation pipes	At opposite ends of the distribution cell at a distance approximately equal to 1/5 to 1/10 of the distribution cell length . Observation pipes shall be placed between adjacent cylinders, and shall not penetrate product cylinders.
Maximum final slope of mound surface	≤ 3:1
Cover material	Soil that will promote plant growth
Limited activities	Unless otherwise specifically allowed in this manual, vehicular traffic, excavation, and soil compaction are prohibited in the basal area and 15 feet down slope of basal area, if there is a restrictive horizon that effects treatment or dispersal
Erosion and frost protection	Graded to divert surface water around Component and sodded or seeded and mulched
Installation inspection	In accordance with ch. Comm 83, Wis. Adm. Code
Management	In accordance with ch. Comm 83, Wis. Adm. Code and this manual

[a] Note: Letter corresponds to letters referenced in figures, formulas and on worksheets.

II. DEFINITONS

Definitions not found in this section are located in ch. Comm 81 of the Wisconsin Administrative Code, or the terms use the standard dictionary definition.

A. "Basal Area" means the effective in situ soil surface area available for infiltration of partially treated effluent from the fill material.
B. "Deflection of distribution cell" means the ratio between the maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects the furthest points of the contour line along the down slope edge of the distribution cell.
C. "Distribution cell area" means the area within the mound where the effluent is distributed into the fill material.
D. "Fill Material" means sand that meets specifications of ASTM Standard C33 for fine aggregate and is used along the sides of and under the distribution cell to provide treatment of effluent.
E. "Limiting Factor" means high groundwater elevation or bedrock.
F. "Mound" means an onsite wastewater treatment and dispersal component. The structure contains a distribution cell area surrounded by, and elevated above, the original land surface by suitable fill material. The fill material provides a measurable degree of wastewater treatment and allows effluent dispersal into the natural environment under various soil permeability.
G. "Original Grade" means that land elevation immediately prior to the construction of the mound system.
H. "Parallel to surface grade contours on sloping sites" means the mound is on the contour except that a 1% cross slope is allowed, with appropriate design modifications, along the length of the mound. See Ch. Comm 83 Appendix A-83.44 ORIENTATION (6).
I. "Permeable Soil" means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resource Conservation Service, classification system of silt loam to gravelly medium sand.
J. "Slowly Permeable Soil" means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resources Conservation Service, classification system of clay loams and silty clay loams the exhibit a moderate grade of structure; and loams, silt loams, and silts with weak grades of structure; or soils with weak to moderate grades of platy structure.

K. "Unsaturated flow" means liquid flow through a soil media under a negative pressure potential. Liquids containing pathogens and pollutants come in direct contact with soil/fill material microsites, which enhances wastewater treatment by physical, biological, and chemical means.
L. "Vertical Flow" means the effluent flow path downward through soil or fill material, which involves travel along soil surfaces, or through soil pores.
M. "Vertical Separation" means the total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell limiting factor (as by redoximorphic features, groundwater or bedrock).

III. DESCRIPTION AND PRINCIPLE OF OPERATION

POWTS mound component operation is a two-stage process involving both wastewater treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the fill material and in situ soil. The physical characteristics of the influent wastewater, influent loading rate, temperature, and the nature of the receiving fill material and in situ soil affect these processes.

Physical entrapment, increased retention time, and conversion of pollutants in the wastewater are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the wastewater are eventually deactivated through filtering, retention, and adsorptions by the fill material. In addition, many pollutants are converted to other chemical forms by oxidation processes.

Dispersal is primarily affected by the depth of the unsaturated receiving soils, their hydraulic conductivity, land slope, and the area available for dispersal.

The mound consists of fill material, a distribution cell, and cover material. Effluent is dispersed into the distribution cell where it flows through the fill material and undergoes biological, chemical and physical treatment and then passes into the underlying soil for further treatment and dispersal to the environment.

Cover material consisting of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange. See Figure 1, for a typical mound system.

The in situ soil serves in combination with the fill, as treatment media and it also disperses the treated effluent.

[See cross-sectional drawing of a Flowtech® mound system for POWTS in Figure 1 on page 36.].

IV. SOIL AND SITE REQUIREMENTS

Every ICC Flowtech® mound design should ultimately be matched to the given soil and site.

The design approach presented in this manual is based on criteria that all applied wastewater is successfully transported away from the system, that it will not affect subsequent wastewater additions, and that the effluent is ultimately treated.

A. Minimum Soil Depth Requirements – The minimum soil factors required for successful mound system performance are listed in the introduction and specification section of this package.

   Soil evaluations must be in accordance with ch. Comm 85 of the Wis. Adm. Code. In addition, soil application rates must be in accordance with ch. Comm 83 of the Wis. Adm. Code.

B. Other Site Considerations –

   Slopes – The slope on which a mound is to be installed may not indicate the direction of the groundwater movement. If there is documentation that the direction of groundwater movement is different than the slope of the land, the direction of groundwater movement must be considered during mound design.

On a crested site the fill can be situated such that the effluent can move laterally down both slopes. A level site allows lateral flow in all directions, but may present problems as the water table could rise higher beneath the fill in slowly permeable soils. The sloping site allows the liquid to move in one direction away from the fill. Figure 3 shows a cross-section of a mound and the effluent movement in a slowly permeable soil on a sloping site. Systems that are installed on a concave slope may have a deflection that does not exceed that allowed in Table 2.

Mound components rely on lateral effluent movement through the upper soil horizons. Lateral movement becomes more important as soil permeability decreases.

Mound location – In open areas, exposure to sun and wind increases the assistance of evaporation and transpiration in the dispersal of the wastewater.

Sites with trees and large boulders – Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing a mound system because of difficulty in preparing the surface and the reduced infiltration area beneath the mound. Areas that are occupied with rock fragments, tree roots, stumps and boulders reduce the amount of soil available for proper treatment. If no other site is available, trees in the basal area of the mound must be cut off at ground level. A larger fill area is necessary when any of the above conditions are encountered, to provide sufficient infiltrative area.

Setback distances – The setbacks specified in ch. Comm 83, Wis. Adm. Code for soil subsurface treatment/dispersal component apply to mound systems. The distances, except for wells, are measured from the up slope and end slope edge of the distribution cell and from the down slope toe of the mound. Distances for wells are measured from the perimeter of the mound toe. The down slope toe of a mound will be ≥ 15 feet from any slope > 35 percent.

V. FILL AND COVER MATERIAL

A. Fill Material – The fill material and its placement are one of the most important components of the mound system. Quality control of the fill material is critical to system performance, and each truckload of material must meet specifications for the fill.

Determining whether a proposed fill material is suitable or requires that a textural analysis be performed. The standard method to be used for performing this analysis conforms to ASTM C-136, Method for Sieve Analysis of Fine and Coarse Aggregates, and ASTM E-11, Specifications for Wire-Cloth Sieves for Testing Purposes, Annual Book of ASTM Standards, Volume 04.02. Information concerning these methods can also be obtained from Methods of Soils Analysis Part 1, C. A. Black, ed, ASA, Monograph #9, American Society of Agronomy, Inc., 1975.

B. Cover Material – The cover material is a soil that will allow air exchange while promoting plant growth. The gas exchange will increase the treatment performance of the system by providing oxygen to the wastewater to help ensure aerobic conditions in the mound system. The plant growth will provide frost protection in the winter season. Clays may not be used for cover material as they will restrict oxygen transfer. Often, excavated soil from the site can be used. Seeding or other means must be done to prevent erosion of the mound.

VI. DESIGN

A. Location, Size and Shape – Placement, sizing and shaping of the mound and the distribution cell within the mound must be in accordance with this manual. The means of pressuring the distribution network must provide equal distribution of the wastewater. A pressurized distribution network using a **method of sizing** as contained in Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank = Soil Absorption System" and Dept. of Commerce publication SBD-10706-P, titled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems".

B. Component Design – Design of the mound system is based upon the design wastewater flow and the soil characteristics. It must be sized such that it can accept the design wastewater flow without causing surface seepage or groundwater pollution. Consequently, the basal area, which is in the situ soil area beneath the fill, must be sufficiently large enough to absorb the effluent into the underlying soil. The system must also be designed to avoid encroachment of the water table into the required minimum unsaturated zone.

Design of the mound includes the following three steps: (A) calculating design wastewater flow, (B) design of the distribution cell within the fill, (C) design of the entire mound. This includes calculating total width, total length, system height, distribution lateral location and observation pipes. Each step is discussed below. A design example is provided in section XI of the manual. The letters for the various dimensions correlate with those in Figures 2 and 3.

Step A. Design Wastewater Flow Calculation

One and two-family dwellings. Distribution cell size for one and two-family dwelling application is determined by calculating the design wastewater flow (DWF). To calculate DWF use, Formulas 1, 2 or 3. Formula 1 is for combined wastewater flows, which consist of blackwater, clearwater and graywater. Formula 2 is for only clearwater and graywater. Formula 3 is blackwater only.

Formula 1	Formula 2	Formula 3
Combined wastewater	Clearwater and Graywater	Blackwater
DWF = 150 gal/day/bedroom	DWF = 90 gal/day/bedroom	DWF = 60 gal/day/bedroom

Public Facilities. Distribution cell size for public facilities application is determined by calculating the DWF using Formula 4. Only facilities identified in Table 4 are included in this manual. Estimated daily wastewater flows are determined in accordance with Table 4 or s. Comm 83.43(6), Wis. Adm. Code. Many commercial facilities have high BOD_5 TSS and FOG (fats, oils and grease), wich must be pretreated in order to bring their values down to an acceptable range before entering in the mound component described in this manual.

Formula 4

DWF = Sum of each estimated wastewater flow per source per day x 1.5

Where 1.5 = Conversion factor to convert estimated wastewater flow to design wastewater flow.

TABLE 4 PUBLIC FACILITY WASTEWATER FLOWS		
Source	**Unit**	**Est. Waste-water Flow (gpd)**
Apartment or Condominium	Bedroom	100
Assembly hall (no kitchen)	Person (10 sq. ft./person)	1.3
Bar or cocktail lounge (no meals served)	Person (10 sq. ft./person)	4
Bar or cocktail lounge* (w/meals – all paper service)	Person (10 sq. ft./person)	8
Beauty salon	Station	90
Bowling alley	Bowling lane	80
Bowling alley (with bar)	Bowling lane	150
Camp, day and night	Person	25
Camp, day use only (no meals served)	Person	10
Campground or Camping Resort	Space, with sewer connection and/or service building	30
Campground sanitary dump station	Camping unit or RV served	25
Catch basin	Basin	65
Church (no kitchen)	Person	2
Church* (with kitchen)	Person	5
Dance hall	Person (10 sq. ft./person)	2
Day care facility (no meals prepared)	Child	12
Day care facility* (with meal preparation	Child	16
Dining hall* (kitchen waste only without dishwasher and/or food waste grinder)	Meal served	2
Dining hall* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Meal served	5
Dining hall* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Meal served	7
Drive-in restaurant* (all paper service with inside seating)	Patron seating space	10
Drive-in restaurant* (all paper service without inside seating)	Vehicle space	10
Drive-in theater	Vehicle space	3
Employees (total all shifts)	Employee	13
Floor drain (not discharging to catch basin)	Drain	25
Gas station/convenience store	Patron (min. 500 patrons)	3
Gas station (with service bay) Patron Service bay	 Patron Service bay	 3 50
Hospital*	Bed space	135
Hotel, motel or tourist rooming house	Room	65

TABLE 4 **PUBLIC FACILITY WASTEWATER FLOWS** (Continued)		
Source	**Unit**	**Estimated Wastewater Flow (gpd)**
Medical office building Doctors, nurses, medical staff Office personnel Patients	 Person Person Person	 50 13 6.5
Migrant labor camp (central bathhouse)	Employee	20
Mobile Home (Manufactured home) (served by its own POWTS)	Bedroom	100
Mobil home park	Mobile home site	200
Nursing, rest home, community based residential facility	Bed space	65
Outdoor sport facilities (toilet waste only)	Patron	3.5
Parks (toilets waste only)	Patron (75 patrons/acre)	3.5
Parks (toilets and showers)	Patron (75 patrons/acre)	6.5
Public shower facility	Shower taken	10
Restaurant*, 24-hr. (dishwasher and/or food waste grinder only)	Patron seating space	4
Restaurant*, 24-hr. (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	12
Restaurant*, 24-hr. (toilet waste)	Patron seating space	28
Restaurant*, 24-hr. (toilet and kitchen waste without dishwasher and/or food waste grinder only)	Patron seating space	40
Restaurant*, 24-hr. (toilet and kitchen waste with dishwasher and/or food waste grinder only)	Patron seating space	44
Restaurant* (dishwasher and/or food waste grinder only)	Patron seating space	2
Restaurant* (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	6
Restaurant* (toilet waste)	Patron seating space	14
Restaurant* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	20
Restaurant* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	22
Retail store	Patron (70% of total retail area ÷ 30 sq. ft. per patron)	1
School * (with meals and showers)	Classroom (25 students/classroom)	500
School * (with meals or showers)	Classroom (25 students/classroom)	400
School * (without meals or showers)	Classroom (25 students/classroom)	]300
Self-service laundry (toilet waste only)	Clothes washer	33
Self-service laundry (with only resident clothes washers)	Clothes washer	200
Swimming pool bathhouse	Patron	6.5

*May be high strength waste

Step B. Design of the Distribution Cell – This section determines the required infiltrative surface area of the distribution cell/fill interface, as well as the dimensions of the distribution network with the fill.

1. Sizing the Distribution Cell – the minimum bottom area of the distribution cell is determined by dividing the design wastewater flow per day by the design loading rate of the fill material. As specified in Table 1, the design loading rate of the infiltration surface of the distribution cell is

   $\leq$1.0 gal/ft^2/day if BOD_5 or TSS > 30 mg/L or

   $\leq$2.0 gal/ft^2/day if BOD_5 and TSS $\leq$ 30 mg/L or

   Using the above information, the infiltrative surface area of the distribution cell area is determined by using Formula 5.

   Formula 5
   Area = DWF ÷ design loading rate of the fill material

   [For concave systems the actual distribution cell length must be checked to determine if the cell area is sufficient. See Step B 3 below for further information.]

2. System Configuration – The distribution cell must be longer than it is wide. Maximum width of the distribution cell is 10 feet. The maximum length of the distribution cell is dependent on setback requirements and soil evaluation.

   The distribution cell is aligned with its longest dimension parallel to surface grade contours on sloping sites as required by the specifications of this package so as not to concentrate the effluent into a small area as it moves laterally down slope.

   The bottom of the distribution cell is level so one area of the distribution cell is not overloaded.

   The dimensions for the distribution cell are calculated using formulas 6 or 7. Formula 6 is used when the in situ soil has a soil application rate of greater then 0.3 gal/ft^2/day. Formula 7 must be used to check for linear loading rate for the system when the in situ soil within 12 inches of the fill material has a soil application rate of $\leq$ 0.3 gal/ft^2/day. When the in situ soil within 12 inches of the fill material has a soil application rate of $\leq$ 0.3 gal/ft^2/day the linear loading rate may not exceed 4.5 gal/ft/day.

   Formula 6

   Area of distribution cell = A x B.
   Where: A = Distribution cell width (Max. allowed is 10 ft.)
   B = Distribution cell length

   Formula 7

   Linear Loading Rate = DWF ÷ B
   Where: DWF = Daily wastewater flow
   B = Distribution cell length

[See detail cross-sectional ad plan view drawings of Flowtech® mound system for POWTS in Figures 2 & 3 on pages 36-37.].

3. Concave Mound Configuration – the maximum deflection of a concave distribution cell of a mound system is 10%. The percent of deflection of a distribution cell is determined by dividing the amount of deflection by the effective distribution cell length of the concave distribution cell. The deflection is the maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects furthest points of the contour line along the down slope edge of the distribution cell. The effective distribution cell length of the concave distribution cell is the distance between the furthest points along the contour line of the down slope edge of the concave distribution cell. See Figures 4 and 5. *[See plan view drawings of simple and complex concave distribution cells in Figures 4 & 5 on Pages 38-39.]*

The deflection of a distribution cell on concave slopes is calculated using Formula 8.

Formula 8
Percent of deflection = (deflection ÷ effective distribution cell length) x 100

Where: Deflection = Maximum distance between the down slope edge of a concave distribution cell to the length of a perpendicular line that intersects furthest points of the contour line along the down slope edge of the distribution cell

Effective distribution cell length = Distance between the furthest points along the contour line of the down slope edge of the concave distribution cell

100 = Conversion factor

The actual distribution cell length must be checked to determine if the cell area is sufficient. The actual distribution cell length is calculated using Formula 9.

Formula 9
Actual distribution cell length = [(% of deflection x 0.00265) + 1] x effective distribution cell length

Where % of deflection = Determined by Formula 8

0.00265 = Conversion factor from percent to feet

1 = Constant

Step C. Sizing The Mound

1. Mound Height – The mound height on sloping sites is calculated using Formula 10.

Formula 10
Mound Height = (D + E) ÷2 +F + H

Where: D = Sand fill depth
E = Down slope fill depth
F = distribution cell depth
H = Cover material depth

2. Fill Depth – the depth of fill under the distribution cell is based on the minimum depth of unsaturated soil required for treatment listed in Table 83.44-3, Wis. Adm. Code. The minimum fill depth is 6 inches, but not greater than 36 inches when the soil listed in Table 83.44-3, Wis. Adm. Code, is 36 inches or less. The minimum fill depth is 12 inches, but not greater than 36 inches when the soil listed in Table 83.44-3, Wis. Adm. Code, is greater than 36 inches. A minimum unsaturated flow depth required for proper treatment of the wastewater is as required by Table 83.44-3, Wis. Adm. Code.

   For sloping sites the fill depth below down slope edge of distribution cell (E) ≥ D + [% slope of original grade as a decimal x width of distribution cell (A)]

3. Distribution Cell Depth – the distribution cell depth (F) provides wastewater storage within the distribution cell.

   Formula 11
   Distribution cell depth (F) = ICC Flowtech® Cylinder Height = 12"

4. Cover Material – The cover material (G & H) provides frost protection and a suitable growth medium for vegetation. For design purposes, use a depth of 12 inches above the center of the distribution cell (H) and 6 inches above the outer edges of the distribution cell (G).

   Cover material depth at distribution cell center (H) ≥ 12 inches and ≤ 24 inches
   Cover material depth at distribution cell edges ≥ 6 inches and ≤ 18 inches

5. Fill Length and Width – The length and width of the fill are dependent upon the length and width of the distribution cell, fill depth and side slopes of the fill. Side slopes may not be steeper than 3:1 over the basal area, (i.e. 3 feet of run to every 1 foot of rise). Soil having textures other than those specified for the fill media may be used to make the slopes gentler than the required 3:1 slopes, once the 3:1 slope exists with the fill material. The distribution cell length is generally perpendicular to the direction of slope so the effluent is spread out along the contour.

   The fill length consists of the end slopes (K) and the distribution cell length (B). The fill width consists of the up slope width (J), the distribution cell width (A), and the down slope width (I). On sloping sites the up slope width (J) is less while the down slope width (I) is greater than on a level site to maintain the 3:1 side slope (See Fig. 2). To calculate the up slope and down slope widths when a 3:1 side slope is maintained, multiply the calculated width by the correction factor found by using the following equations or the correction factor listed in Table 5.

   Up slope correction factor = 100 ÷ [100 + (3 x % of slope)]
   Down slope correction factor = 100 ÷ [100 - (3 x % of slope)]

TABLE 5 DOWN SLOPE AND UP SLOPE WIDTH CORRECTION FACTORS		
Slope %	**Down Slope Correction Factor**	**Up Slope Correction Factor**
0	1.00	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.915
4	1.14	0.89
5	1.18	0.875
6	1.22	0.85
7	1.27	0.83
8	1.32	0.81
9	1.37	0.79
10	1.43	0.77
11	1.49	0.75
12	1.56	0.735
13	1.64	0.72
14	1.72	0.705
15	1.82	0.69
16	1.92	0.675
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.625
21	2.70	0.61
22	2.94	0.60
23	3.23	0.59
24	3.57	0.58
25	4.00	0.57

The most critical dimensions of the fill are: fill depths (D) & (E), distribution cell length (B), distribution cell width (A), and the down slope width (I).

End Slope Width (K) + total fill at center of distribution cell {[(D + E) ÷ 2] + F + H} x horizontal gradient of selected side slope (3 if 3:1 side-slope)

Fill Length (L) = Distribution cell length (B) + 2 x end slope width (K)

Up Slope Width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 + (3 x % of slope)] if 3:1}

Down Slope Width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 – (3 x % of slope)] if 3:1}

Fill Width (W) = Up slope width (J) + down slope width (I) + width of distribution cell (A)

These calculations result in the fill material extending at least 6 inches horizontally from the top edges of the distribution cell as noted in Figure 6. *[See cross-sectional drawing of Flowtech® Mound in Figure 6 on Page 38.]*

6. Basal Area – The basal area is the in situ soil/fill interface between the soil and the fill material. Its function is to accept the effluent from the fill, assist the fill in treating the effluent, and transfer the effluent to the subsoil beneath the fill or laterally to the subsoil outside of the fill.

   The soil infiltration rate of the in situ soil determines how much basal area is required. When the wastewater applied to the mound has values for BOD_5 and TSS of ≤ 30 mg/L or if there is at least 12 inches of fill material beneath the distribution cell the soil application rates for the basal area may be those specified in Table 83.44-1 or -2 for maximum monthly average BOD_5 and TSS of ≤ 30 mg/L.

   For level sites, the total basal area, excluding end slope area [length of distribution cell (B) x width of fill and cover (W)] beneath the fill and soil cover is available for effluent absorption into the soil (see Figure 7a). For sloping sites, the available basal area is the area down slope of the up slope edge of the distribution cell to the down slope edge of the fill and soil cover or (A + I) times the length of the distribution cell (B) (see Figure 7b). The up slope width and end slopes are not included as part of the total basal area.

   It is important to compare the required basal area to the available basal area. The available basal area must equal or exceed the required basal area.

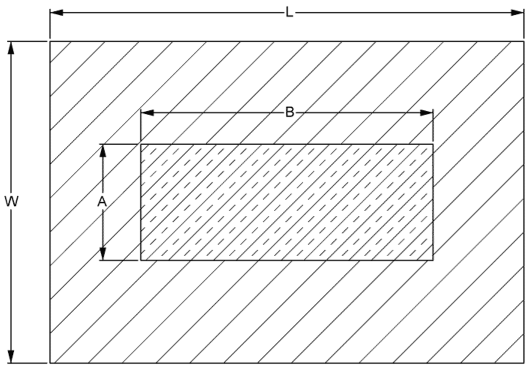


Figure 7a – Level Site

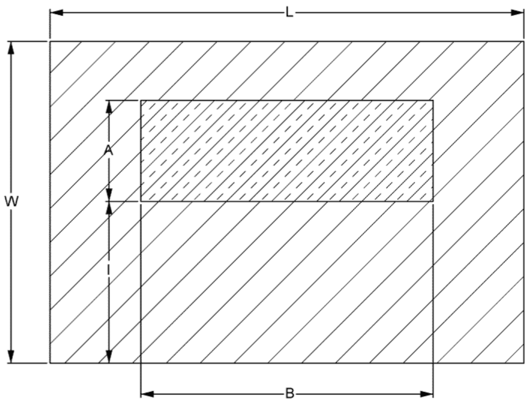


Figure 7b – One Direction Slope

   Basal area available = B x W on a level site or = B x (A + I) on a sloping site.

   If insufficient area is not available for the given design and site conditions, corrective action is required to increase (J) and (I) on level sites or (I) on sloping sites.

7. Location of the Observation Pipes
   Each distribution cell using leaching chambers has two observation pipes located approximately 1/5 to 1/10 of the distribution cell length from each end of the cell. Observation pipes shall not penetrate product bundle.

Step D. Distribution Network and Dosing System **-** A pressurized distribution network based on a method of sizing contained in Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" and Dept. of Commerce publication SBD-10706-P, titled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems".

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of a mound system are just as critical as the design of the system. A good design with poor construction results in system failure. It is emphasized that the soil only be tilled when it is not frozen and the moisture content is low to avoid compaction and puddling. The construction plan to be followed includes:

A. Equipment – Proper equipment is essential. Track type tractors or other equipment that will not compact the mound area or the down slope area are required.

B. Sanitary Permit – Prior to the construction of the system, a sanitary permit, obtained for the installation must be posted in a clearly visible location on the site. Arrangements for inspection(s) must also be made with the department or governmental unit issuing the sanitary permit.

C. Construction Procedures

1. Check the moisture content of the soil to a depth of 8 inches. Smearing and compacting of wet soil will result in reducing the infiltration capacity of the soil. Proper soil moisture content can be determined by rolling a soil sample between the hands. If it rolls into a ¼-inch wire, the site is to wet to prepare. If it crumbles, site preparation can proceed. If the site is too wet to prepare, do not proceed until it dries.

2. Lay out the fill area on the site so that the distribution cell runs perpendicular to the direction of the slope.

3. Establish the original grade elevation (surface contour) along the up slope edge of the distribution cell. This elevation is used throughout the mound construction as a reference to determine the bottom of the distribution cell, lateral elevations, etc., and is referenced to the permanent bench mark for the project. A maximum of 4 inches of sand fill may be tilled into the surface.

4. Determine where the force main from the dosing chamber will connect to the distribution system in the distribution cell. Place the pipe either before tilling or after placement of the fill. If the force main is to be installed in the down slope area, the trench for the force main may not be wider than 12 inches.

5. Cut trees flush to the ground and leave stumps, remove surface boulders that can be easily rolled off, remove vegetation over 6 inches long by mowing and removing cut vegetation. Prepare the site by breaking up, perpendicular to the slope, the top 7-8 inches so as to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. When using a mold board plow, it should have as many bottoms as possible to reduce the number of passes over the area to be tilled and minimize compaction of the subsoil. Tilling with a mold board plow is done along contours. Chisel type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil, including use of backhoe teeth, is not acceptable. The important point is that a

rough, unsmeared surface be provided at the sand fill interface. The sand fill will intermingle between the clods of soil, which improves the infiltration rate into the natural soil.

Immediate application of at least 6 inches of fill material is required after tilling. All vehicular traffic is prohibited on the tilled area. For sites where the effluent may move laterally, vehicle traffic is also prohibited for 15 ft. down slope and 10 ft. on both sides of level sites. If it rains after the tilling is completed, wait until the soil dries out before continuing construction, and contact the local inspector for a determination on the damage done by rainfall.

6. Place the approved sand fill material, around the edge of the tilled area being careful to leave adequate perimeter area, not covered by the sand fill, or which to place the soil cover. There should be approximately two feet of basal area adjacent to the mound perimeter that is not covered by the sand fill. This area serves to tie the soil cover into the natural surface material that has been tilled and helps seal the toe from leakage. Work from the end and up slope sides. This will avoid compacting the soils on the down slope side, which, if compacted, affects lateral movement away from the fill and could cause surface seepage at the toe of the fill on slowly permeable soils.

7. Move the fill material into place using a small track type tractor with a blade or a large backhoe that has sufficient reach to prevent compaction of the tilled area. Do not use a tractor/backhoe having tires. Always keep a minimum of 6 inches of fill material beneath tracks to prevent compaction of the in situ soil.

8. Place the fill material to the required depth.

9. Form the distribution cell. Hand level the bottom of the distribution cell.

10. Install the ICC Flowtech® product and pressure pipe per instructions. The distribution pipe should be sleeved inside the 4” corrugated pipe located within the ICC Flowtech® Bundle.

11. Install observation pipes to the infiltrative surface between cylinders of the ICC Flowtech® rows as per the design. *[See Figure 8 on Page 39.]* It is preferable for the observation pipes to be placed between cylinders that do not carry distribution pipes whenever possible. Observation pipes should be slotted for six-inches (6”) at the distal end and extend to the infiltrative surface.

12. Place a cleanout at the end of each lateral. *[See Figure 9 on Page 39.]*

13. Place final cover material over ICC Flowtech® system and entire mound component.

14. Complete final grading, make sure to divert any surface water away from system. Place sod or seed and mulch the entire mound component to prevent erosion.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The component owner is responsible for the operation and maintenance of the component. The county, department or POWTS service contractor may make periodic inspections of the components, checking for surface discharge, treated effluent levels, etc. The owner or owner's agent is required to submit necessary maintenance reports to the appropriate jurisdiction and/or the department.

B. Design approval and site inspections before, during, and after the construction are accomplished by the county or other appropriate jurisdictions in accordance to ch. Comm 83 of the Wis. Adm. Code.

C. Routine and preventative maintenance aspects:

   1. Treatment and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.

   2. Inspections of the mound component performance are required at least once every three years. These inspections include checking the liquid levels in the observation pipes and examination for any seepage around the mound component.

   3. Winter traffic on the mound is not permitted to avoid frost penetration and to minimize compaction.

   4. A good water conservation plan and plumbing appurtenance maintenance within the house or establishment will help assure that the mound component will not be overloaded.

D. User's Manual: A user's manual is to accompany the component. The manual is to contain the following as a minimum:

   1. Diagrams of all components and their location. This should include the location of the reserve area, if one is provided.

   2. Names and phone numbers of local health authority, component manufacturer or POWTS service contractor to be contacted in the event of component failure or malfunction.

   3. Information on periodic maintenance of the component, including electrical/mechanical components.

   4. Information on limited activities on reserve area if provided.

E. Performance monitoring must be performed on mound systems installed under this manual.

   1. The frequency of monitoring must be:

      a. At least once every three years following installation and,

      b. At time of problem, complaint, or failure.

   2. The minimum criteria addressed in performance monitoring of mound systems are:

      a. Type of use.
      b. Age of system.
      c. Nuisance factors, such as odors or user complaints.
      d. Mechanical malfunction within the system including problems with valves or other mechanical or plumbing components
      e. Material fatigue or failure, including durability or corrosion as related to construction or structural design.
      f. Neglect or improper use, such as exceeding the design rate, poor maintenance of vegetative cover, inappropriate cover over the mound, or inappropriate activity over the mound.
      g. Installation problems such as compaction or displacement of soil, improper orientation or location.
      h. Pretreatment component maintenance, including dosing frequency, structural integrity, groundwater intrusion or improper sizing.
      i. Dose chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.
      j. Distribution piping network, including improper maintenance (lateral flushing once every three years) or improper sizing.
      k. Ponding in distribution cell, prior to the pump cycle, is evidence of development of a clogging mat or reduced infiltration rates.

l. Siphon or pump malfunction including dosing volume problems, pressurization problems, breakdown, burnout, or cycling problems.
m. Overflow/seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.

3. Reports are to be submitted in accordance with ch. Comm 83, Wis. Adm. Code.

IX. REFERENCES

"Wisconsin Mound Soil Absorption System: Siting, Design and Construction." Converse, J.C., and E.J. Tyler. Publication 15.22, Small Scale Waste Management Project., 1 Agriculture Hall, University of Wisconsin, Madison, WI.

"Mound Component Manual For Private Onsite Wastewater Treatment Systems" State of Wisconsin Department of Safety and Buildings. Version 2.0, January 30, 2001.

X. ICC FLOWTECH MOUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and set backs.

Slope - ____%

Occupancy – One or Two-Family Dwelling - ____ (# of bedrooms)

Public Facility - _____ gal/day (Estimated wastewater flow)

Depth to limiting factor - ____inches

Minimum depth of unsaturated soil required by Table 83.44-3, Wis. Adm. Code - ____inches

Soil application rate of in situ soil used - ____ gal/ft^2/day

BOD_5 value of effluent applied to component - ____ mg/L

TSS value of effluent applied to component - ____ mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100 - ___Yes _____No

Type of distribution cell - ____ Flowtech® EPS aggregate

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling.

Combined wastewater flow:

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x ____# of bedrooms

= _____ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ____# of bedrooms

= _____ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ____# of bedrooms

= _____ gal/day

Public Facilities.

DWF = Estimated wastewater flow x 1.5

= __________ gal/day x 1.5

= __________ gal/day

C. DESIGN OF THE DISTRIBUTION CELL

1. Total size of the Distribution Cell(s) area
   a. Loading rate of fill material = $\leq$ 1.0 gal/ft^2/day if BOD_5 or TSS $\leq$ 30 mg/L
      = $\leq$ 2.0 gal/ft^2/day if BOD_5 and TSS $\leq$ 30 mg/L

   b. Bottom area of distribution cell = Design wastewater flow ÷ loading rate of fill as determined in C.1.a.

      Distribution cell area = ______ gal/day ÷ ______ gal/ft^2/day

      Distribution cell area = ______ ft^2

2. Distribution Cell Configuration

   a. Distribution cell width(s) (A) = ____ feet ($\leq$ 10 ft.) (See Table 2b to determine width).

      ______ rows of 12" wide Flowtech® FTSG 121 cylinders;

      ______ rows of 36" wide Flowtech® FTSG 123 H-1 OC cylinders; and/or

      ______ rows of 6" wide Flowtech® FTSG 060 cylinders.

b. Distribution cell length (B) = Bottom area of distribution cell ÷ width of distribution cell (see Table 2b to determine bundle length).

B = ______ ft^2 (Distribution cell area required) ÷ ft (A)

B = ______ ft

Number of bundles required = distribution Cell Length (B) / Bundle length.

Bundle length is either 5 feet or 10 feet (see Table 2b).

c. Check Distribution Cell Length (B)

For linear loading rate:
Linear Loading Rate ≤ Design Wastewater Flow ÷ Cell length (B) or effective cell length for a concave mound)

Linear Loading Rate ≤ ______ gal/day ÷ feet

Linear Loading Rate ≤ ______ gal/ft/day

Linear loading rate for systems with in situ soils having a soil application rate of ≤ 0.3 gal/ft^2/day with 12 inches of fill must be less than or equal to 4.5 gal/ft/day.

Is the linear loading rate ≤ what is allowed ____ yes ____ no? If no, then the length and width of the distribution cell must be changed so it does.

Distribution cell length (B) = Design Wastewater Flow ÷ Maximum Linear Loading Rate

Distribution cell length (B) = _____gal/day ÷ ____gal/ft/day

Distribution cell length (B) = ____ ft

Distribution cell width (A) = ____ ft^2 (Distribution cell area) ÷ ____ ft (B)

Distribution cell width (A) = ____ ft^2

d. Check percent of deflection and actual length of concave distribution cell length

Percent of deflection = Deflection ÷ Effective distribution cell length x 100

Percent of deflection = ___ ft ÷ ___ ft x 100

Percent of deflection = ___ % (≤ 10%)

Actual distribution cell length = {(% of deflection x 0.00265) + 1] x effective distribution cell length

Actual distribution cell length = [(___ % x 0.00265) + 1] x ___ ft

Actual distribution cell length = ___ ft

D. DESIGN OF ENTIRE FILL

1. Fill Depth

a. Fill depth below distribution cell at least 6 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 83.44-3, Wis. Adm. Code, that requires a minimum depth of 36 inches or less. At least 12 inches, but not greater than 36 inches, if the in situ soil beneath the tilled area is a soil listed in Table 83.44-3, Wis. Adm. Code, that requires a depth greater than 36 inches.)

1) Depth at up slope edge of distribution cell (D) = distance required by Table 83.440-3 minus distance in inches to limiting factor

D = ____ inches - ____ inches
D = ____ inches (at least ≥ 6 or 12 inches; but not greater than 36 inches in accordance with Table 2)

2) Depth at down slope edge of distribution cell (E)
E = Depth at up slope edge of distribution cell (D) + (% natural slope expressed as a decimal x distribution cell width (A))

E = D + (% natural slope expressed as decimal x A)

E = ____ inches + (____x ____ feet x 12 inches/ft)

E = ____ inches

b. Distribution Cell Depth for ICC Flowtech® Distribution Cell.
Distribution cell depth (F) for ICC Flowtech® see Table 2b

F = total height of ICC Flowtech®
F = see Table 2b

c. Cover material

1) Depth at distribution cell center (H) ≥ 12 inches
2) Depth at distribution cell edges (G) ≥ 6 inches

2. Mound Length

a. End slope width (K)= Total fill at center of distribution cell x horizontal gradient of side slope

K = {([(D + E) ÷ 2] + F + H) x horizontal gradient of side slope} ÷ 12 inches/foot

K = {([_____ inches + _____ inches) ÷ 2] + _____inches + _____inches) x _____ } ÷ 12 inches/ft

K = ______ft

b. Mound length (L) = Distribution cell length + (2 x end slope width)

L = B + 2K

L = ___ ft + (2 x ___ ft)

L = ___ feet

3. Mound Width

   a. Up slope width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x Horizontal gradient of side slope x Slope correction factor {100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]}

      J = (D + F + G) x horizontal gradient of side slope x slope correction factor 100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]}

      J = (____ in + ____ in + ____ in) ÷ 12 in/ft x ____ x 100 ÷ [100 + (____ x ____)] or [____]

      J = ___ in ÷ 12 in/ft x 3 x 100 ÷ ___

      J = ____ feet

   b. Down slope width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (____ in + ____ in + ____ in) ÷ 12 in/ft x ____ x 100 ÷ [100 - (____ x ____)] or [____]

      I = ____ in ÷ 12 in/ft x 3 x 100 ÷ ______

      I = ____feet

   c. Mound width (W) = Up slope width (J) + Distribution cell width (A) + Down slope width (I)

      W = J + A + I

      W = ____ ft + _____ ft + _____ ft

      W = _____feet

4. Check the basal area

   a. Basal area required = Daily wastewater flow ÷ soil application rate of in situ soil (The soil application rte may be that which is listed for BOD_5 and TSS > or ≤ 30 mg/L depending on wastewater characteristics or fill depth below distribution cell. See Table 1.)

      = _____ gal/day ÷ ____ gal/ft^2/day

      = ______ ft^2

b. Basal area available

1) Sloping site = Cell length (B) x (A + I)
= ____ ft x (____ ft + _____ft)
= ____ ft x _____ ft
= ____ ft^2

2) Level site = Cell length (B) x total mound width (W)
= ______ ft x ______ ft
= ________ ft^2

Is available basal area sufficient? ____ yes _____ no

c. Basal area required ≤ Basal area available

____ ft^2 ≤ ____ ft^2 (if NOT, see "d." below for recalculation of basal area)

d. Basal area available (recalculation of basal area)

1) Sloping site = Cell length (B) x (A + I)
= ____ ft x (____ ft + _____ft)
= ____ ft x _____ ft
= ____ ft^2

2) Level site = Cell length (B) x total mound width (W)
= ______ ft x ______ ft
= ________ ft^2

5. Determine the location of observation pipes along the length of distribution cell

Approximate distance from end of distribution cell to end observation pipes = B x 1/5 to 1/10

Approximate distance from end of distribution cell to end observation pipes = ____ft x 1/5 to 1/10

Approximate distance from end of distribution cell to end observation pipes = _____ ft.

XI. EXAMPLE WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and set backs.

Slope - __6__%

Occupancy – One or Two-Family Dwelling - __3__ (# of bedrooms)

Public Facility - __0__ gal/day (Estimated wastewater flow)

Depth to limiting factor - __25__inches

Minimum depth of unsaturated soil required by Table 83.44-3, Wis. Adm. Code - __36__inches

Soil application rate of in situ soil used - __0.6__ gal/ft^2/day

BOD_5 value of effluent applied to component - __180__ mg/L

TSS value of effluent applied to component - __50__ mg/L

Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 cfu/100 - __X__Yes _____No

Type of distribution cell - ICC Flowtech

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling:

Combined wastewater flow:
DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x __3__# of bedrooms

= __450__ gal/day

Clearwater and graywater only:

DWF = 90 gal/day/bedroom x # of bedrooms

= 90 gal/day/bedroom x ____# of bedrooms

= _____ gal/day

Blackwater only:

DWF = 60 gal/day/bedroom x # of bedrooms

= 60 gal/day/bedroom x ____# of bedrooms

= _____ gal/day

Public Facilities.
DWF = Estimated wastewater flow x 1.5

= __________ gal/day x 1.5

= __________ gal/day

C. DESIGN OF THE DISTRIBUTION CELL

1. Total size the Distribution Cell(s) area

   a. Loading rate of fill material = __X___ ≤ 1.0 gal/ft^2/day if BOD_5 or TSS ≤ 30 mg/L
      = ______ ≤ 2.0 gal/ft^2/day if BOD_5 and TSS ≤ 30 mg/L

   b. Bottom area of distribution cell = Design wastewater flow ÷ loading rate of fill as determined in C.1.a.
      Distribution cell area = __450___ gal/day ÷ __1.0___ gal/ft^2/day
      Distribution cell area = __450__ ft^2

2. Distribution Cell Configuration

   a. Distribution cell width(s) (A) = __6__ feet (≤ 10 ft.). This will be comprised of:
      __0___ rows of 12" wide Flowtech® 121 cylinders;
      __2___ rows of 36" wide Flowtech® 123 H-1 OC bundles; and/or
      __0___ rows of 6" wide Flowtech® 060 cylinders.

   b. Distribution cell length (B) = Bottom area of distribution cell ÷ width of distribution cell.

      B = __450__ ft^2 (Distribution cell area required) ÷ 6 ft (A)

      B = __75__ ft

      Number of bundles required = distribution Cell Length (B) / Bundle length

      Bundle length is either 5 feet or 10 feet (see sizing Table 2b).

      75 feet / 10 foot bundle length = 7 bundles at 10' in length and 7 bundles 5' in length

   c. Check distribution cell length (B) for linear loading rate:

      Linear Loading Rate ≤ Design Wastewater Flow ÷ Cell length (B) or effective cell length for a concave mound)

      Linear Loading Rate ≤ __450___ gal/day ÷ __75__ feet

      Linear Loading Rate ≤ __6.0___ gal/ft/day

      Linear loading rate for systems with in situ soils having a soil application rate of ≤ 0.3 gal/ft^2/day with 12 inches of fill must be less than or equal to 4.5 gal/ft/day.

      Is the linear loading rate ≤ what is allowed __X__ yes ____ no? If no, then the length and width of the distribution cell must be changed so it does.

      Distribution cell length (B) = Design Wastewater Flow ÷ Maximum Linear Loading Rate

      Distribution cell length (B) = __450__gal/day ÷ ____gal/ft/day

      Distribution cell length (B) = ____ ft

      Distribution cell width (A) = ____ ft^2 (Distribution cell area)____ ft (B)

      Distribution cell width (A) = ____ ft^2

d. Check percent of deflection and actual length of concave distribution cell length

Percent of deflection = Deflection ÷ Effective distribution cell length x 100

Percent of deflection = ___ ft ÷ ___ ft x 100

Percent of deflection = ___ % (≤ 10%)

Actual distribution cell length = {(% of deflection x 0.00265) + 1] x effective distribution cell length

Actual distribution cell length = [(___ % x 0.00265) + 1] x ___ ft

Actual distribution cell length = ___ ft

D. DESIGN OF ENTIRE FILL

1. Fill Depth

a. Fill depth below distribution cell at least 6 inches, but not greater than 36 inches if the in situ soil beneath the tilled area is a soil listed in Table 83.44-3, Wis. Adm. Code, that requires a minimum depth of 36 inches or less. At least 12 inches, but not greater than 36 inches, if the in situ soil beneath the tilled area is a soil listed in Table 83.44-3, Wis. Adm. Code, that requires a depth greater than 36 inches.)

(1) Depth at up slope edge of distribution cell (D) = distance required by Table 83.440-3 minus distance in inches to limiting factor

D = 36 inches - 25 inches
D = 11 inches (at least ≥ 6 or 12 inches; but not greater than 36 inches in accordance with Table 2)

(2) Depth at down slope edge of distribution cell (E)

E = Depth at up slope edge of distribution cell (D) + (% natural slope expressed as a decimal x distribution cell width (A))
E = D + (% natural slope expressed as decimal x A)
E = 11 inches + (0.06 x 4 feet x 12 inches/ft)
E = 13.9 inches

b. Distribution cell depth for ICC Flowtech® distribution cell.

Distribution cell depth (F) for ICC Flowtech® see Table 2b

123 ICC Flowtech® = 12 inches
F = 12 inches

c. Cover material

(1) Depth at distribution cell center (H) ≥ 12 inches and ≤ 24inches
(2) Depth at distribution cell edges (G) ≥ 6 inches and ≤ 18 inches

2. Mound Length

   a. End slope width (K) = Total fill at center of distribution cell x horizontal gradient of side slope

      K = {([(D + E) ÷ 2] + F + H) x horizontal gradient of side slope} ÷ 12 inches/foot

      K = {([_11_ inches + _13.9_ inches) ÷ 2] + _12_ inches + _12_ inches) x _3_ } ÷ 12 inches/ft

      K = _9.1_ ft

   b. Mound length (L) = Distribution cell length + (2 x end slope width)

      L = B + 2K

      L = 75 ft + (2 x 9.1 ft)

      L = 93.2 feet

3. Mound Width

   a. Up slope width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x Horizontal gradient of side slope x Slope correction factor {100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]}

      J = (D + F + G) x horizontal gradient of side slope x slope correction factor 100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]}

      J = (_11_ in + _12_ in + _6_ in) ÷ 12 in/ft x _3_ x 100 ÷ [100 + (_3_ x _6_)] or [____]

      J = (29 in ÷ 12 in/ft) x 3 x (100 ÷ 118)

      J = _6.1_ feet

   b. Down slope width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 **-** (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 **-** (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (_13.9_ in + _12_ in + _6_ in) ÷ 12 in/ft x _3_ x 100 ÷ [100 - (_3_ x _6_)] or [____]

      I = _31.9_ in ÷ 12 in/ft x 3 x 100 ÷ _82_

      I = _9.7_ feet

   c. Mound width (W) = Up slope width (J) + Distribution cell width (A) + Down slope width (I)

      W = J + A + I

      W = _6.1_ ft + _6_ ft + _9.7_ ft

      W = _21.8_ feet

4. Check the basal area

   a. Basal area required = Daily wastewater flow ÷ soil application rate of in situ soil (The soil application rte may be that which is listed for BOD_5 and TSS > or ≤ 30 mg/L depending on wastewater characteristics or fill depth below distribution cell. See Table 1.)

      = _450_ gal/day ÷ _0.6_ gal/ft²/day
      = _750_ ft²

   b. Basal area available

      (1) Sloping site = Cell length (B) x (A + I)
          = _75_ ft x (_6_ ft + _9.7_ ft)
          = _75_ ft x _15.7_ ft
          = _1177.5_ ft²

      (2) Level site = Cell length (B) x total mound width (W)
          = ______ ft x ______ ft
          = ________ ft²

   c. Is available basal area sufficient? _X_ yes _____ no

      Basal area required ≤ Basal area available

      _700_ ft² ≤ _1177.5_ ft²

      (if NOT, See "d." below for recalculation of basal area)

   d. Basal area available (recalculation of basal area)

      (1) Sloping site = Cell length (B) x (A + I)

          = ____ ft x (____ ft + _____ft)
          = ____ ft x _____ ft
          = ____ ft²

      (2) Level site = Cell length (B) x total mound width (W)

          = ______ ft x ______ ft
          = ________ ft²

5. Determine the location of observation pipes along the length of distribution cell

   Approximate distance from end of distribution cell to end observation pipes = B x 1/5 to 1/10

   Approximate distance from end of distribution cell to end observation pipes = _75_ft x 1/5 to 1/10

   Approximate distance from end of distribution cell to end observation pipes = _15 - 7.5_ ft.

XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal

In order to install a system correctly, it is important to develop plans that will be used to install the system correctly the first time. The following checklist may be used when preparing plans for review. The checklist is intended to be a **general guide**. Not all needed information may be included in this list. Conformance to the list is not a guarantee of plan approval. Additional information may be needed or requested to address unusual or unique characteristics of a particular project. Contact the reviewing agent for specific plan submittal requirements, which the agency may require that are different than the list included in this manual.

General Submittal Information

- Photocopies of soil reports forms, plans, and other documents are acceptable. However, an original signature is required on certain documents.
- Submittal of additional information requested during plan review or and questions concerning a specific plan must be referenced to the Plan Identification indicator assigned to that plan by the reviewing agency.
- Plans or documents must be permanent copies or originals.

Product Information

- Copy of Flowtech® product brochure or manual.
- Copy of Flowtech® approval letter.

Forms and Fees

- Application form for submittal, provided by reviewing agency along with proper fees set by reviewing agent.
- Application for Development of Floodplain, if any portion of the system is in a floodplain.

Soils Information

- Complete Soils and Site Evaluation Report (form # SBD-8330) for each backhoe pit described; signed and dated by a certified soil tester, with license number.
- Separate sheet showing the location of all borings. The location of all borings and backhoe pits must be able to be identified on the plot plan.

Documentation

- Architects, engineers or designers must sign, seal and date each page of the submittal or provide an index page, which is signed, sealed and dated.
- Master Plumbers must sign, date and include their license number on each page of the submittal or provide an index page, which is signed, sealed and dated.
- Three completed sets of plans and specifications (clear, permanent and legible); submittals must be on paper measuring at least 8-1/2 by 11 inches.
- Designs that are based on department approved component manual(s) must be include reference to the manual by name, publication number and published date.

Plot Plan

- Dimensioned plans or plans drawn to scale (scale indicated on plans) with parcel size or all property boundaries clearly marked.
- Slope directions and percent in system area.
- Benchmark and north arrow.
- Setbacks indicated as per appropriate code.
- Two-foot contours or other appropriate contour interval within the system area.
- Location information; legal description of parcel must be noted.
- Location of any nearby existing system or well.

Plan View

- Dimensions for distribution cell(s).
- Location of observation pipes.
- Dimensions of mound.
- Pipe lateral layout, which must include the number of laterals, pipe material, diameter and length; and number, location and size of orifices.
- Manifold/force main locations, with materials, length and diameter of each.

Cross Section of System

- Include tilling requirement, distribution cell details, percent slope, side slope, and cover material.
- Lateral elevation, position of observation pipes, dimensions of distribution cell, and type of cover material such as geotextile fabric, and depth, if applicable.

System Sizing

- For one and two-family dwellings, the number of bedrooms must be included.
- For public buildings, the sizing calculations must be included.

Tank And Pump/Siphon Information

- All construction details for site-constructed tanks.
- Size and manufacturer information for prefabricated tanks.
- Notation of high water alarm manufacturer and model number.
- Cross section of dose tank/chamber to include storage volumes; connections for piping, vents, and power; pump “off” setting; dosing cycle and volume, high water alarm setting, and storage volume above the high water alarm; and location of vent and manhole.
- Cross section of two compartments tanks or tanks installed in a series must include information listed above.

B. Inspections.

Inspection shall be made in accordance with ch. 145.20, Wis. Stats and s. Comm 83.26, Wis. Adm. Code. The inspection form on the following two pages may be used. The inspection of the system installation and/or plans is to verify that the system at least conforms to specifications listed in Tables 1 - 3 of this manual.

XIII. POWTS INSPECTION REPORT

(ATTACH TO PERMIT)

GENERAL INFORMATION

Permit Holder's Name	☐ City ☐ Village ☐ Town of	County	Sanitary Permit No.
State Plan ID. No.	Tax Parcel No.	Property Address if Applicable	

TREATMENT COMPONENT INFORMATION			SETBACKS (FT)				
TYPE	MANUFACTURER AND MODEL NUMBER	CAPACITY	P/L	WELL	WATER LINE	BLDG.	VENT
SEPTIC							
DOSING							
AERATION							
HOLDING							
FILTER							

PUMP/SIPHONE INFORMATION

Manufacturer:	Model No.	Demand in GPM	TDH-Design

FORCE MAIN INFORMATION			FRICTION LOSS (FT)			
Length	Diameter	Dist. To Well	Component Head	Force Main Losses	Vert. Lift	TDH-As Built

SOIL ABSORPTION COMPONENT

TYPE OF COMPONENT:			COVER MATERIAL:			
Cell Width	Cell Length	Cell Depth	Cell Spacing	No. Cells		
ICC Flowtech			Manufacturer		Model No.	
SETBACK INFO. (FT)		Property Line	Bldg.	Well	Water Line	OHWM

DISTRIBUTION COMPONENT

Elevation data on back of form

Header/Manifold		Distribution Lateral(s)			Orifice Size	Orifice Spacing	Obs. Pipes Inst. & No.
Length	Dia.	Length	Dia.	Spacing			

SOIL COVER

Depth over center of cell:	Depth over edge of cell:	Depth of cover material:	Texture	Seeded/Sodded	Mulched

DEVIATIONS FROM APPROVED PLAN

DATE OF INST. DIRECTIVE:	DATE OF ENFORCEMENT ORDER:
DATE OF REFERRAL TO LEGAL COUNCIL:	

COMMENTS (Persons present, discrepancies, etc.)

COMPONENTS NOT INSPECTED

Plan Revision Required ☐ Yes ☐ No	Date:	Signature of Inspector:	Cert. Number

Sketch on other side

ELEVATION DATA

Point	Back Sight	Height of Instrument	Foresight	Elevation	Comments
Bench mark					
Bld. sewer					
Tank inlet					
Tank outlet					
Dose tank inlet					
Bottom of dose tank					
Dist. lateral 1					
System elev. 1					
Dist. lateral 2					
System elev. 2					
Dist. lateral 3					
System elev. 3					
Grade elev. 1					
Grade elev. 2					
Grade elev. 3					

XIV. SKETCH OF COMPONENT & ADDITIONAL COMMENTS

XV. Appendix I

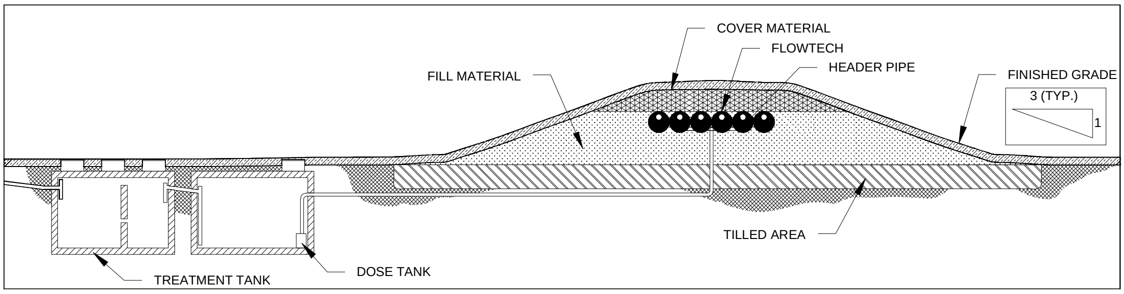


Figure 1 – A cross-section of a mound system for POWTS.

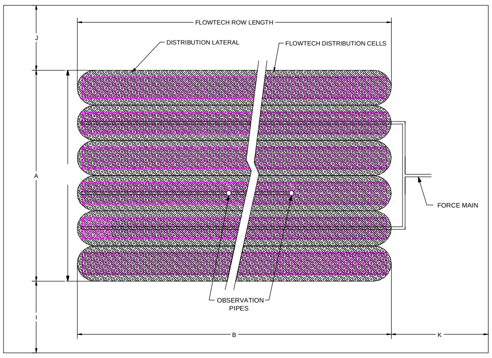


Figure 2 – Detailed plan view of a mound.

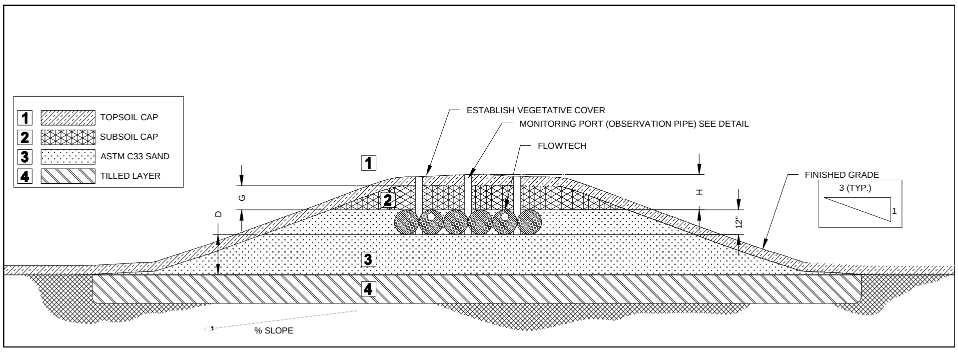
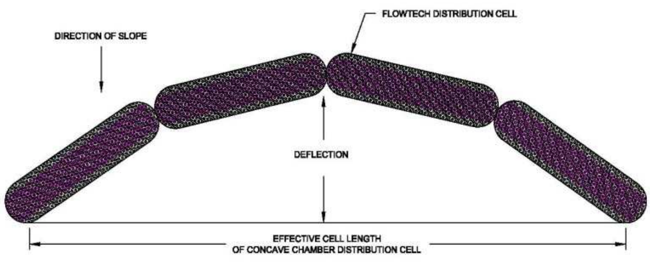


Figure 3 – Detailed cross-section of a mound.



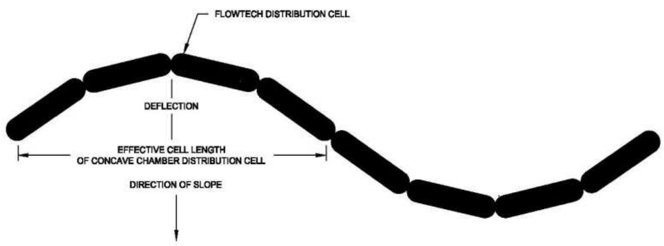


Figure 4 – Simple Concave Distribution Cell

Figure 5 – Complex Concave Distribution Cell

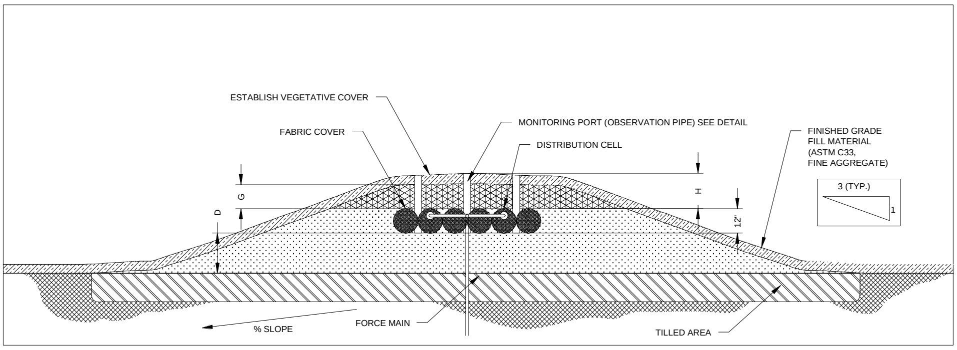


Figure 6 - Cross-section of a Mound System

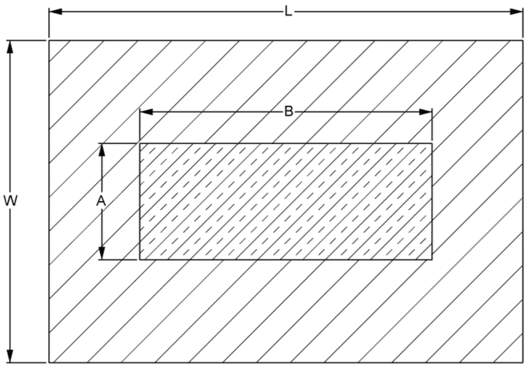


Figure 7a – Level Site

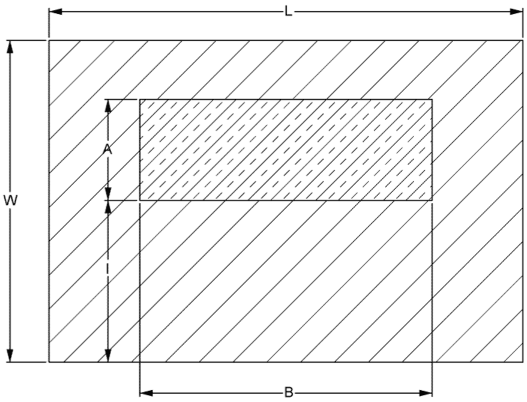


Figure 7b – One Direction Slope

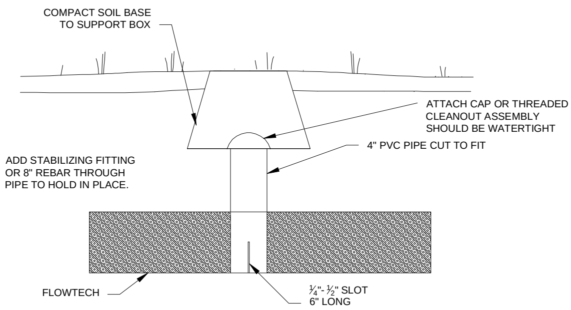


Figure 8 – Observation Pipe

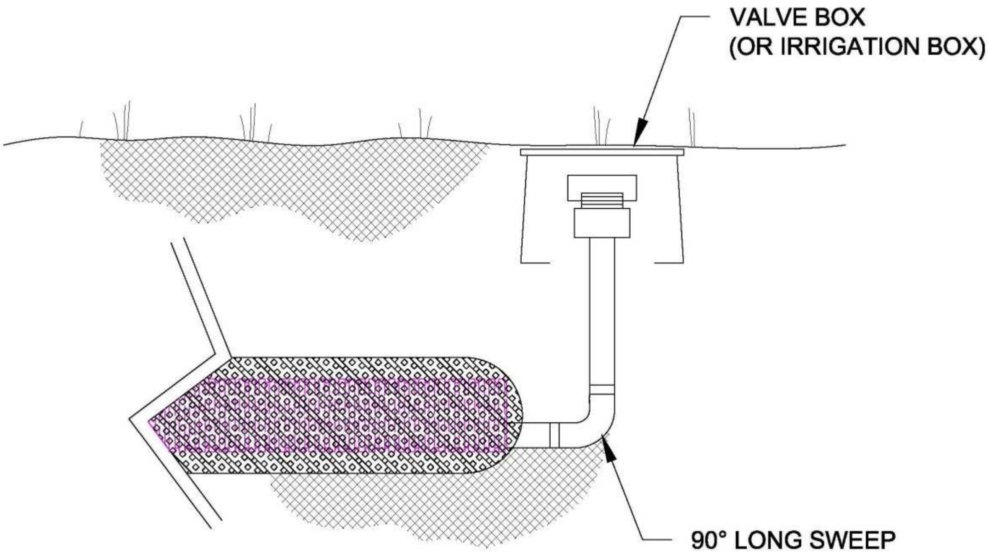


FIGURE 13

Figure 9 – Pressure Value Box