AT-GRADE USING PRESSURE DISTRIBUTION COMPONENT MANUAL

FOR PRIVATE ONSITE WASTEWATER TREATMENT SYSTEMS

(Version 2.0)

State of Wisconsin

Department of Safety & Professional Services

Division of Safety and Buildings

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FOR PRIVATE ONSITE WASTEWATER TREATMENT SYSTEMS

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Republished on January 2012 by Department of Safety & Professional Services
Published on March 01, 2007 by Dept. of Commerce
Division of Safety and Buildings
Safety and Buildings Publication SBD-10854-P (N. 03/07, R. 01/12)

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I. INTRODUCTION AND SPECIFICATIONS

This **P**rivate **O**nsite **W**astewater **T**reatment **S**ystem (**POWTS**) component manual provides design, construction, inspection, operation, and maintenance specifications for an at-grade component. Violations of this manual constitute a violation of chs. SPS 383 and 384, Wis. Adm. Code. The at-grade 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 at-grade component provides treatment and dispersal of domestic wastewater in conformance with ch. SPS 383 of the Wis. Adm. Code.

Note: Detailed plans and specifications must be developed and submitted for review and approval to the governing unit having authority over the plan review. In addition, a state 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)	In accordance with s. SPS 383.44(2)(a), Wis. Adm. Code
Monthly average value of five day Biochemical Oxygen Demand (BOD_5)	In accordance with s. SPS 383.44(2)(a), Wis. Adm. Code
Monthly average value of Total Suspended Solids (TSS)	In accordance with s. SPS 383.44(2)(a), Wis. Adm. Code
Volume of a single dose	≥ 5 times the void volume of distribution lateral(s) and < 20% of the design wastewater flow
Design wastewater flow (DWF) from one- and two-family dwellings	In accordance with s. SPS 383.43(2), (3), (4) and (5), Wis. Adm. Code
Design wastewater flow (DWF) from public facilities	≥ 150% of estimated wastewater flow in accordance with Table 4 of this manual or s. SPS 383.43(6), Wis. Adm. Code.
Linear loading rate for components with in situ soils having a soil application rate of ≤ 0.3 gal/ft^2/day within 12 inches of distribution cell	≤ 4.5 gal/ft
Wastewater particle size	≤ 1/8 inch
Distribution orifice spacing	≥ 1 orifice for every 2 linear feet of distribution cell

Table 2 **SIZE AND ORIENTATION**	
Total effective distribution cell area	≥ Design wastewater flow ÷ soil application rate for the most restrictive soil horizon that may affect treatment and dispersal. Soil application rates are listed in s. SPS 383 Table 383.44-1 or -2, Wis. Adm. Code.
Effective distribution cell credit width (A)	10 ft or width of distribution cell, whichever is less
Width of aggregate for level sites	≥ Effective distribution cell width
Width of aggregate for sloping sites	≥ Effective distribution cell width + 2 ft
Width of component area (W)	≥ Effective distribution cell width + 10 ft
Effective distribution cell length (B)	≥ Design wastewater flow (DWF) ÷ Design soil application rate (DAR) ÷ Distribution cell width (A)
Length of component area (L)	≥ Effective distribution cell length + 10 ft
Depth of aggregate distribution cell at distribution pipe	≥ 8 inches + nominal diameter of distribution pipe
Depth of aggregate distribution cell at edge	≥ 6 inches
Depth of soil cover over distribution cell	≥ 12 inches
Orientation	Longest dimension parallel to surface grade contours on sloping sites.
Deflection of distribution cell on concave slopes	≤ 10%

Table 3 **OTHER SPECIFICATIONS**	
Slope of original grade	≤ 25% within the component area.
Vertical depth of in situ soil between bottom of distribution cell and seasonal saturation defined by redoximorphic features, groundwater, or bedrock	≥ To depth required by s. SPS 383 Table 383.44-3, Wis. Adm. Code.
Effluent application	By use of a pressure distribution network conforming to Department of Commerce publications SBD-10573-P or SBD-10706-P, entitled “Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems” and based on pipe sizing methods contained in Small Scale Waste Management Project publication 9.6 entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems”.
Piping Material in the distribution system	Meets requirements of s. SPS 384.30(2), Wis. Adm. Code for its intended use.
Piping material for observation and vent pipes	Meets requirements of s. SPS 384.30, Table 384.30-1 Wis. Adm. Code.
Distribution cell aggregate material	Meets requirements of s. SPS 384.30(6)(i) & (k), Wis. Adm. Code.
Fabric cover of distribution cell when aggregate is used	Geotextile fabric meeting s. SPS 384.30(6)(g), Wis. Adm. Code.
Location of distribution lateral(s) (for level sites)	Equally spaced from the center of the distribution cell.
Location of distribution lateral(s) (for sloping sites)	Most up slope lateral at 2 feet from up slope edge of distribution cell. If more than one, no lateral may be installed in the lower half of distribution cell.
Number of observation pipes per distribution cell	≥ Two extending from distribution cell infiltrative surface to finished grade.
Location of observation pipes for level components Location of observation pipes for components on a slope	Observation pipes will be installed in each distribution cell so as to be representative of a cell’s hydraulic performance. be located such that there are a minimum of two installed in each dispersal cell at opposite ends from one another be located near the dispersal cell ends be at least 6 inches from the end wall and sidewall be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell. Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers’ installation instructions.

Table 3 **OTHER SPECIFICATIONS** (continued)	
Cover material	Fertile soil material (i.e., topsoil) containing less than 15% gravel by volume and no rock fragments greater than 3 inches diameter. The texture and structure of the soil cover provides adequate water holding capacity to sustain grasses to prevent erosion, promotes runoff from precipitation events, and allows atmospheric diffusion to the distribution cell below the soil cover. Soil finer than silt loam is not recommended.
Limited activities during component construction	Unless, otherwise specifically allowed in this manual, vehicular traffic, excavation, and soil compaction are prohibited in: The plowed area, and For sloping sites - 15 feet down slope of component area. For level sites – 10 feet on both sides of component area.
Erosion and frost protection	Graded to divert surface water around the component and sodded or seeded and mulched.
Installation inspection	In accordance with ch. SPS 383, Wis. Adm. Code.
Management	In accordance with ch. SPS 383, Wis. Adm. Code, and this manual.

II. DEFINITIONS

Definitions not found in this section are located in ch. SPS 381 of the Wisconsin Administrative Code or the terms use the standard dictionary definition.

A. ”At-grade” means an on-site wastewater treatment and distribution component. The component contains a distribution cell consisting of aggregate and a distribution network on top of the plowed in situ soil and is covered by soil.

B. “Component Area” means the effective in situ soil surface area available for infiltration of effluent from the distribution cell, and the surrounding cover material.

C. “Concave Site” means a slope shape where surface drainage may converge into a limited area.

D. "Distribution cell" means a layer of stone aggregate or synthetic aggregate that receives effluent from a distribution network and distributes that effluent onto a plowed in situ soil dispersal area.

E. "Slowly Permeable Soil" means soil with textural classifications of clay loams and silty clay loams that 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 according to the US Department of Agriculture, Natural Resource Conservation Service classification system.

F. "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 or fill material microsites that enhance wastewater treatment by physical, biological, and chemical means.

G. "Vertical Flow" means the downward flow of water or effluent through soil that involves travel along soil surfaces or through soil pores.

III. DESCRIPTION AND PRINCIPLE OF OPERATION

The operation of the at-grade component is a two-stage process involving both wastewater treatment and dispersal into the underlying soil. Treatment is accomplished predominately by physical and biochemical processes within the soil. These processes are affected by the physical characteristics of the effluent wastewater, influent application rate, temperature, and the nature of the receiving soil.

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 adsorption by the soil. In addition, many pollutants are converted to other chemical forms by oxidation processes.

The at-grade component contains a distribution cell consisting of stone aggregate and a distribution network on top of the plowed in situ soil dispersal area and is covered by soil. Effluent is distributed into the distribution cell where it flows into the soil where it undergoes biological, chemical, and physical treatment and dispersal into the environment. See Figures 1, 2 and 3 for examples of a typical at-grade component.

Cover material, consisting of soil provides frost protection and moisture retention sufficient to maintain a good vegetative cover. The insitu soil serves as the treatment medium and disperses the effluent into the environment.

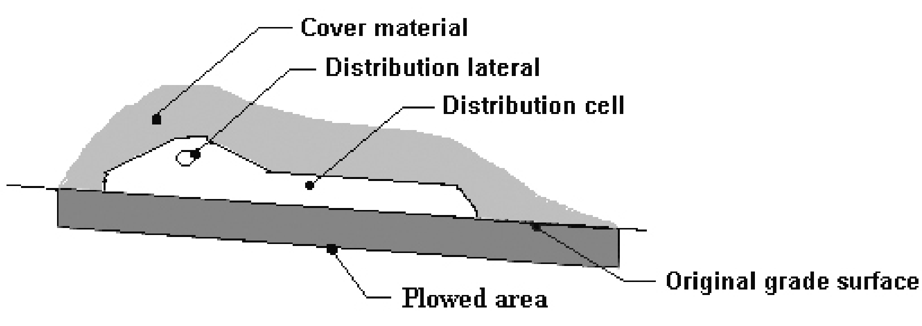


Figure 1 - A cross-section of a POWTS at-grade component

Figure 2 - Level Site At-Grade

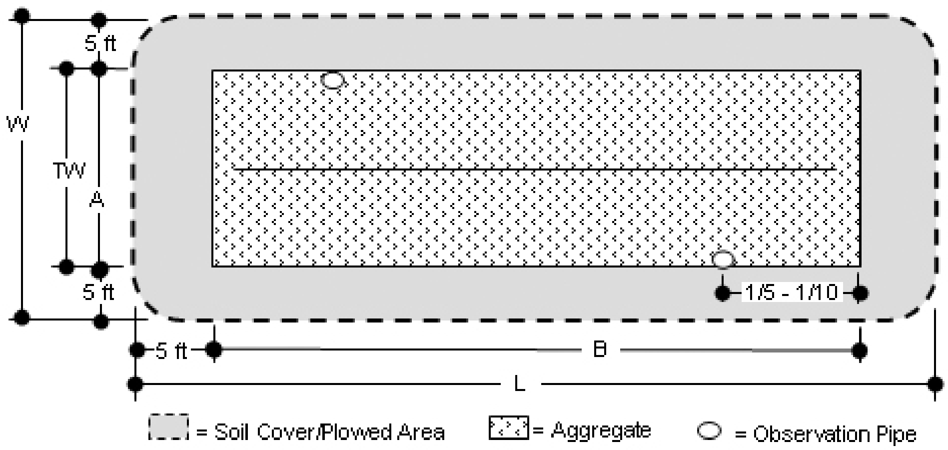
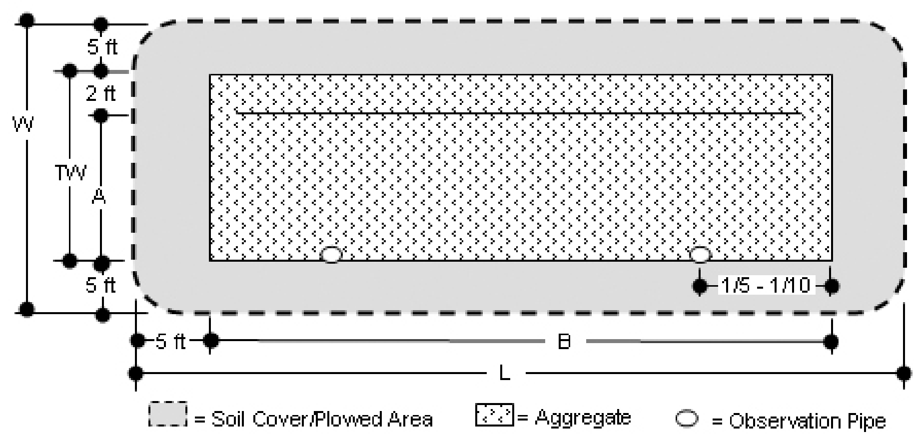


Figure 3 - Sloping Site At-Grade



This manual specifies site characteristics, design criteria and construction techniques for an at-grade component to provide treatment and dispersal of domestic wastewater meeting the standards of s. SPS 383.44 (2) Wis. Adm. Code.

In an at-grade component design using pressure distribution, the effluent enters the more permeable topsoil over a large area, where it can move laterally until absorbed by the less permeable subsoil.

IV. SOIL AND SITE REQUIREMENTS

Every at-grade design is ultimately matched to the given soil and site characteristics.

The design approach is based on criteria that all applied wastewater is successfully transported away from the component, in a manner that will not influence later wastewater additions, and that the effluent is ultimately treated.

A. Minimum Soil Depth Requirements

The minimum soil factors required for successful at-grade component performance are listed in Tables 1, 2 and 3.

Soil evaluations must be in accordance with ch. SPS 385, Wis. Adm. Code. In addition, soil application rates must be in accordance with ch. SPS 383, Wis. Adm. Code.

B. Other Site Considerations

1. Slopes: On a crested site the distribution cell 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 may rise higher beneath the distribution cell in slowly permeable soils. Sloping sites allow the liquid only to move in one direction away from the distribution cell.

   On sloping sites and sites with slowly permeable soils, at-grade components rely on lateral effluent movement through the upper soil horizons. Lateral movement becomes more important as soil permeability decreases.

   Concave sloping sites are sites that have convergence of surface and subsurface drainage. Landscape topography that retains or concentrates subsurface flows; such as swales, depressions or potholes, is considered an unacceptable at-grade location. The maximum deflection allowed, as listed in Table 2 is 10%. Over land surface flow is to be diverted from the site or other methods employed to allow surface flow around the component.

2. At-grade location: Open areas and exposure to sun and wind increase the assistance of evaporation and transpiration in the dispersal of wastewater.

3. Sites with trees and large boulders: Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing an at-grade component. These sites create difficulty in preparing the surface and reduce the infiltration area beneath the at-grade. Rock fragments, tree roots stumps and boulders occupy an area, thus reducing the amount of soil available for proper treatment. If no other site is available, trees in the component area of the at-grade must be cut off at ground level and boulders that are setting on the ground surface removed. A larger infiltrative area is necessary when any of the above conditions are encountered, to provide sufficient effective distribution cell area.

4. Setback distances: The setbacks specified in ch. SPS 383, Wis. Adm. Code for soil subsurface treatment and distribution components apply to at-grade components. The distances are measured from the perimeter of the effective distribution cell area.

V. COVER MATERIAL

The cover material (above the distribution cell and absorption area) means fertile soil material (i.e. topsoil) containing less than 15% gravel by volume and no rock fragments greater than 3 inches diameter. The texture and structure of the soil cover provides adequate water holding capacity to sustain grasses to prevent erosion, promotes runoff from precipitation events, and allows atmospheric diffusion to the distribution cell below the soil cover. Soil finer than silt loam is not recommended.

VI. DESIGN:

A. Location, Size and Shape:

Placement, sizing and shaping of the at-grade must be in accordance with this manual. The means of pressurizing the distribution network must provide equal distribution of effluent along the length of the distribution cell. A pressure distribution network conforming to Department of Safety & Professional Services (formerly the Department of Commerce) publications SBD-10573-P or SBD-10706-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" and based on pipe sizing methods contained in Small Scale Waste Management Project publication 9.6 entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" must be used.

B. Component Design:

Detailed plans and specifications must be developed and then reviewed and approved by the governing unit having authority over plan review.

Design of the at-grade component is based on the design wastewater flow and soil characteristics. It must be sized such that it can accept the daily flows and loads without causing surface seepage or groundwater pollution. Consequently, the effective distribution cell area must be sufficiently large enough to absorb the effluent into the underlying soil.

Design of the at-grade includes the following three steps, (1) calculating the design wastewater flow, (2) design of the distribution cell and (3) design of the entire at-grade component. Each step is discussed. A design example is included at the end of this manual.

1. Design Wastewater Flow Calculations

   a) One and two-family dwellings: Effective distribution cell size for one- and two-family dwelling application is determined by first calculating the design wastewater flow (DWF). To calculate DWF use Formula 1.

Formula 1

DWF = 150 gallons/day/bedroom

   b) Public Facilities: Effective distribution cell size for public facilities application is determined by calculating the DWF using Formula 2. Public facility estimated daily wastewater flows are listed in Table 4, at the end of this manual. Facilities that are not listed in Table 4 are not included in this manual. Many commercial facilities have high BOD_5, TSS and FOG (fats, oils and grease), which must be pretreated in order to bring their values down to an acceptable range before entering into the at-grade component described in this manual.

Formula 2

DWF = Sum of each estimated wastewater flow per source per day (from Table 4) x 1.5

2. Design of the Distribution cell; This section determines the required effective cell area of the distribution cell as well as the dimensions for the soil cover material.

a) Determine the design-loading rate (DLR) for the site.

The design-loading rate equals the soil application rate of the soil horizon in contact with the distribution cell. Use ch. SPS 383 Table 383.44-1 or -2, Wis. Adm. Code, to determine the soil application rate. Note that s. Comm 83.44(4)(c), Wis. Adm. Code, requires designers to consider more restrictive subsoil horizons.

b) Determine the effective area of the distribution cell.

The effective area of the distribution cell is calculated by dividing design wastewater flow (DWF) by the design-loading rate (DLR).

c) Choose an effective distribution cell credit width

The effective credit width can not exceed 10 ft.

Determine the distribution cell length (B).

The distribution cell length (B) is calculated by dividing the effective area of the distribution cell by the effective width (A) of the distribution cell.

d) Determine the linear loading rate (LLR).

The linear loading rate is calculated dividing the design wastewater flow (DWF) by the distribution cell length (B). For systems that have in situ soil having a soil application rate ≤ 0.3 gal/ft2/day that are within 12 inches below the distribution cell, the linear loading rate (LLR) can not exceed 4.5 gal/ft/day.

If the LLR exceeds 4.5 gal/ft/day for such soils, the component must be lengthened to reduce the LLR to 4.5 gal/ft/day or less.

e) Concave at-grade configuration

The maximum deflection of a concave distribution cell of an at-grade 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 Figure 4.

The deflection of a distribution cell on concave slopes is calculated using Formula 3.

Formula 3

f) 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 4.

Formula 4

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

Where: % of deflection = Determined by Formula 3

0.00265 = Conversion factor from percent to feet

1 = Constant

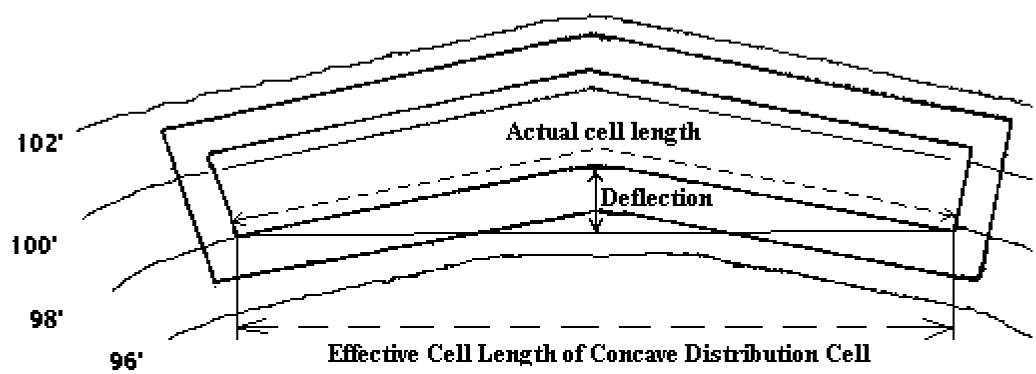


Figure 4 – Concave At-grade and Distribution Cell

3. <u>Design of the entire at-grade component</u>: This includes sizing the total width and length of the distribution cell, component height, location of the effluent distribution lateral, and observation pipes.

a) Determine the total width of distribution cell for level sites, the total width of distribution cell (TW) is equal to or greater than the effective distribution cell credit width (A).

$$TW \geq A$$

b) For sloping sites, the total width of distribution cell is equal to or greater than the effective distribution cell credit width (A) plus 2 feet.

$$TW \geq A + 2 \text{ feet}$$

c) Determine the overall width (W) of the component:

The minimum width of component must be equal to or greater than the total width of distribution cell plus 10 ft for soil cover.

$$W \geq TW + 10 \text{ ft}$$

NOTE: Greater widths for landscaping purposes are satisfactory.

d) Determine the overall length (L) of the component:

Minimum overall length of component must be equal to or greater than the distribution cell length (B) plus 10 ft for soil cover.

$$L \geq B + 10 \text{ ft}$$

NOTE: Greater lengths for landscaping purposes are satisfactory.

e) Horizontal location of distribution lateral in the distribution cell:

(1) Level site with one effluent distribution lateral; the lateral is located in the center of distribution cell.

(2) Level site with more than one effluent distribution lateral; the laterals are equally spaced apart with the center two laterals the same distance from center of the cell and the distance from the outside laterals to the edge of the cell being one half the lateral spacing.

(3) Sloping site with one lateral; the effluent distribution lateral is located 2 feet down slope from up slope edge of the distribution cell.

(4) Sloping site with more than one effluent distribution lateral; one lateral is located 2 feet down slope from the up slope edge of the distribution cell and the other(s) is (are) down slope of the upper lateral and up slope of the mid point of the distribution cell effective width.

f) Vertical location of distribution lateral in the distribution cell:

The distribution lateral must be at least 6 inches above the elevation of original grade before plowing.

g) Determine the height of the component:

(1) Height of component over the distribution lateral must be equal to or greater than 6 inches of aggregate beneath distribution pipe plus the nominal diameter of distribution lateral plus 2 inches above the distribution lateral plus 12 inches of soil cover.

(2) Height of component over the rest of the distribution cell must be equal to or greater than 6 inches of aggregate plus 12 inches of soil cover.

h) Location of the observation pipes: **(See Appendix A**

i) Distribution Network and Dosing System:

A pressure distribution network conforming to the Department of Safety & Professional Services (formerly Department of Commerce) publications SBD-

10573-P or SBD-10706-P, entitled “Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems” and based on pipe sizing methods contained in Small Scale Waste Management Project publication 9.6 entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems” must be used.

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of an at-grade component are just as critical as the design of the component. A good design with poor construction results in component failure. It is emphasized that the soil only be plowed when it is not frozen and the moisture content is low to avoid compaction and puddling. Consequently, installations are to be made only when the soil is dry as required. The construction plan to be followed includes:

A. Equipment

Proper equipment is essential. Track type tractors or other equipment that will not compact the at-grade area or the down slope area are required.

B. Sanitary Permit

Prior to the construction of the component, a state Sanitary Permit shall be obtained and posted in a clearly visible location on the site. Arrangements for inspection(s) must also be made with the governmental unit issuing the Sanitary Permit. [NOTE: When a POWTS is located or will be located on property owned by the state, the Sanitary Permit shall be obtained from the department. Arrangements for inspections(s) shall be made with the department.]

C. Construction Procedures

1. Check the moisture content of the soil to a depth of 8 inches or to the anticipated plow depth, whichever is greater. Smearing and compacting 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 1/4-inch wire, the site is too 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 distribution cell area on the site so that the upslope edge of the effective distribution cell is level or on a contour line (points of equal elevation).

3. For components in open areas, measure the average ground elevation along the up slope edge of the distribution cell. For components on uneven sites (rough terrain), plow the surface, before the average ground elevation along the up slope edge of the distribution cell is measured. The average elevation is referenced to a benchmark for future use. This is necessary to determine the bottom elevation of the distribution cell. Note that the entire component area (L x W) is plowed.

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 or after plowing. 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 as close as possible to the ground surface 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 plowing the surface soil perpendicular to the direction of the slope, and to a depth of 7-8 inches so as to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. Plowing with a Moldboard plow is done along contours. Chisel plowing is the preferred method especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that an uncompacted rough, unsmeared surface be left. The aggregate will intermingle between the clods of soil, which maintains the infiltration rate into the natural soil.

6. The required observation pipes must have slots on the bottom 6 inches of the observation pipe. Installations of all observation pipes include a suitable means of anchoring. See Figure 5.

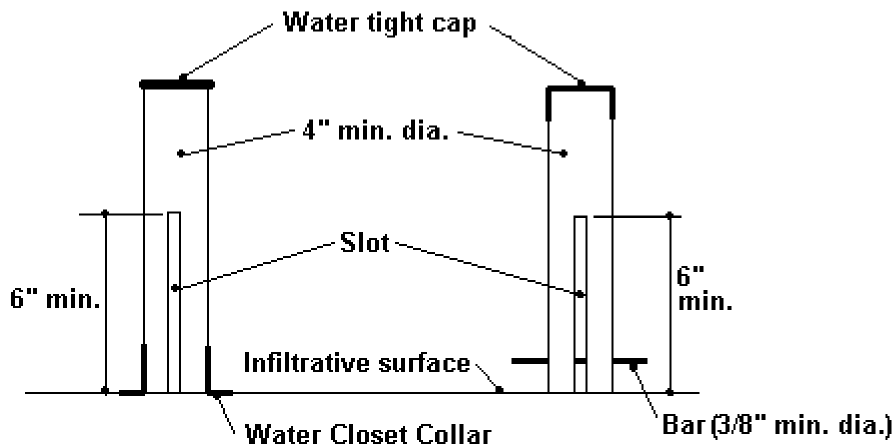


Figure 5 Observation pipes

7. Immediate application of at least 6 inches of aggregate is required after plowing. Shape the aggregate to obtain a uniform minimum depth of at least 6 inches above the original grade. All vehicular traffic is prohibited on the plowed area. On sloping sites, vehicle traffic is also prohibited for 15 ft. down slope and 10 ft. on both sides of level sites. If it rains after the plowing 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.

8. Place the effluent distribution lateral(s) on the aggregate. Connect the lateral(s) using the needed connections and piping to the force main pipe from the dosing chamber. Slope the piping from the lateral(s) to the force main pipe or lay the effluent distribution lateral(s) level, with the perforations down. All pipes shall drain after dosing.

9. Place at least 2 inches of aggregate over the lateral(s).

10. Place geotextile fabric conforming to requirements of ch. SPS 384, Wis. Adm. Code, over the aggregate.

11. Place soil cover material on top of the geotextile fabric and extend the soil cover to the boundaries of the overall component.

12. Complete final grading to divert surface water drainage away from the at-grade. Sod or seed and mulch the entire at grade component.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. Owner is Responsible

The POWTS owner is responsible for the operation and maintenance of the component. The county, department or POWTS service provider may make periodic inspections of the components, checking for surface discharge, and ponded effluent levels in the observation pipes, etc.

The owner or owner's agent is required to submit necessary maintenance reports to the governmental unit or designated agent.

B. Approvals and Inspections

Design approvals and site inspection before, during, and after the construction is accomplished by the governmental unit or other appropriate jurisdiction(s) in accordance with ss. SPS 383.22 and 383.26, Wis. Adm. Code.

C. Routine and preventative maintenance aspects

1. Treatment and dose tanks along with related mechanical components are to be inspected routinely and maintained when necessary in accordance with the management plan.

2. Inspections of the at-grade component 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 component.

3. Traffic, except for lawn maintenance, on the at-grade component is not permitted to avoid frost penetration in winter and to minimize compaction during other times.

4. A good water conservation plan within the house or establishment will help assure that the at-grade component will not be overloaded.

D. User's Manual

A user's manual is to accompany the at-grade component and be provided to the owner following installation. At a minimum, the manual is to contain the following information:

1. Diagram(s) 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 governmental unit authority, component manufacturer or POWTS service provider to be contacted in the event of component failure or malfunction.

3. A management plan that contains information on the periodic inspection, maintenance or servicing of the component, including electrical/mechanical components.

4. What activities can or cannot occur on the reserve area, if one is provided.

5. Notice that the dose chamber, if one is utilized, may fill due to flow continuing during pump malfunction or power outages. One large dose when the power comes on or when the pump is repaired may cause the distribution component to over load. In this situation, the pump chamber should be pumped by a certified septage servicing operator before pump cycling begins or other measures shall be used to dose the at grade component with only the proper amount of influent. This may include manual operation of the pump controls until such time the pump chamber has reached its normal level.

E. Performance

Performance monitoring must be completed on at-grade components installed in accordance with this manual.

1. The frequency of monitoring must be:

   a) At least once every three years after installation, and

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

2. The minimum criteria addressed in performance monitoring of at-grade components are:

   a) Type of use.

   b) Age of component.

   c) Nuisance factors, such as odors or user complaints.

   d) Mechanical malfunction within the component 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 overloading the design rate, poor maintenance of vegetative cover, inappropriate cover over the at-grade, or inappropriate activity over the at-grade component.

   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) Pump or siphon chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.

   j) Ponding in distribution cell, prior to the pump cycle. Ponding may be evidence of development of a clogging mat or reduced infiltration rates.

   k) Siphon or pump malfunction including dosing volume problems, pressurization problems, breakdown, burnout, or cycling problems.

   l) Overflow or seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.

3. Reports are to be submitted to the governmental unit or designated agent in accordance with ch. SPS 383, Wis. Adm. Code.

IX. REFERENCES

J.C. Converse, E. Jerry Tyler, and James O. Peterson 1990. “Wisconsin At-Grade Soil Absorption System Siting, Design, and Construction Manual” Small Scale Waste Management Project #15.21.

X. AT-GRADE WORKSHEET

AT-GRADE WORKSHEET

A. SITE CONDITIONS:

Evaluate the site and soils report for the following:

a) Surface water movement.

b) Measure elevations and distances on the site so that slope, contours and available areas can be determined.

c) Description of several soil profiles where the component will be located.

d) Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.

Slope - ____%

Occupancy: One- or Two-family Dwelling, # of bedrooms - ____

Public Facility ____

Depth to limiting factor - _____inches

In situ soil application rate used - _____ gal/ft^2/day

B. DESIGN WASTEWATER FLOW (DWF):

1. One- or Two-family Dwelling:

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

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

= ____________ gal/day

2. Public Facilities:

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

= __________ gal/day x 1.5

= __________ gal/day

C. EFFECTIVE WIDTH AND LENGTH OF THE DISTRIBUTION CELL:

1. Determine the design loading rate (DLR) for the site:

From Table 83.44-1 or -2, Wis. Adm. Code, select the soil application rate for the most restrictive soil horizon that may affect treatment and dispersal. The soil application rate selected from Table 83.44-1 or -2, Wis. Adm. Code, is the design-loading rate (DLR) for the site.

DLR = _____ gal/ft^2/day

2. Determine the distribution cell area.

Calculate the distribution cell area by dividing the daily design wastewater flow (DWF) by the design-loading rate (DLR).

Distribution cell area = DWF ÷ DLR

Distribution cell area = _____ gpd ÷ ____ gal/ft^2/day

Distribution cell area = _____ ft^2

3. Select an effective distribution cell width (A). The effective width can not exceed 10 feet.

A = ____ ft

4. Determine the distribution cell length.

Calculate the distribution cell length (B) by dividing the required distribution area by the effective distribution cell width (A).

B = Distribution cell area ÷ A

B = _____ ft^2 ÷ ____ ft

B = _____ ft

5. 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

6. Determine the linear loading rate (LLR) if, the soil application rate of any horizon within 12 inches below the distribution cell has a soil application rate of ≤ 0.3 gal/ft^2/day.

   If the LLR exceeds 4.5 gal/ft/day for such soils, the component must be lengthened to reduce the LLR to 4.5 gal/ft/day or less.

   LLR = DWF ÷ B

   LLR = _____ gal/day ÷ ____ ft

   LLR = ____gal/day/ft

D. DESIGN OF ENTIRE AT-GRADE COMPONENT:

1. Determine the total width of distribution cell.

   For level site, the total width of the distribution cell (TW) is equal to or greater than the effective distribution cell credit width (A).

   TW ≥ A

   TW = ______ ft

   For sloping site, the total width of the distribution cell (TW) is equal to or greater than the effective distribution cell credit width (A) + 2 feet.

   TW ≥ A + 2 feet

   TW ≥ _____ ft + 2 feet

   TW = _____ ft

2. Determine the overall width (W) of the component.

   W ≥ TW + 10 ft

   W ≥ _____ ft + 10 ft.

   W = ft

3. Determine the overall length (L) of the component.

   L ≥ B + 10 ft

   L ≥ _____ ft + 10 ft.

   L = ft

4. Horizontal location of distribution lateral in the distribution cell.

   ___ Level site with one effluent distribution lateral; the lateral is located in the center of distribution cell.

   ___ Level site with more than one effluent distribution lateral; the laterals are equally spaced apart with the center two laterals the same distance from center of the cell and the distance from the outside laterals to the edge of the cell being one half the distance between laterals.

___ Sloping site with one effluent distribution lateral; the effluent distribution lateral is located 2 feet in from up slope edge of total distribution cell.

___ Sloping site with more than one effluent distribution lateral; one lateral is located 2 feet down slope from the up slope edge of the distribution cell and the others are down slope of the upper lateral and up slope of the mid point of the distribution cell credit width.

5. Vertical location of distribution lateral in the distribution cell.

Elevation of distribution lateral invert ≥ elevation of original contour directly under distribution lateral + 6 inches

Elevation of distribution lateral invert ≥ _____ ft. + 0.5 ft.

Elevation of distribution lateral invert = _____ ft.

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

See Appendix A.

XI. EXAMPLE WORKSHEET:

AT-GRADE WORKSHEET

A. SITE CONDITIONS:

Evaluate the site and soils report for the following:

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

Slope - <u> <1 </u>%

Occupancy: One- or Two-family Dwelling, # of bedrooms - __3__

Public Facility ____

Depth to limiting factor - __38__inches

In situ soil application used - __0.6__ gal/ft^2/day

B. DESIGN WASTEWATER FLOW (DWF):

1. One- or Two-family Dwelling.

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

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

= __450__ gal/day

2. Public Facilities:

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

= __________ gal/day x 1.5

= __________ gal/day

C. EFFECTIVE WIDTH AND LENGTH OF THE DISTRIBUTION CELL:

1. Determine the design-loading rate (DLR) for the site.

   From Table SPS 383.44-1 or 2, Wis. Adm. Code, select the soil application rate for the most restrictive soil horizon that may affect treatment and dispersal. The soil application rate selected from Table SPS 383.44-1 or -2, Wis. Adm. Code, is the design-loading rate (DLR) for the site.

   DLR = __0.6__ gal/ft^2/day

2. Determine the distribution cell area.

   Calculate the distribution cell area by dividing the daily design wastewater flow (DWF) by the design-loading rate (DLR).

   Distribution cell area = DWF ÷ DLR

   Distribution cell area = __450__ gpd ÷ __0.6__ gal/ft^2/day

   Distribution cell area = __750__ ft^2

3. Select an effective distribution cell width (A). The effective width can not exceed 10 feet.

   A = __10__ ft

4. Determine the distribution cell length.

   Calculate the distribution cell length (B) by dividing the required distribution area by the effective distribution cell width (A).

   B = Distribution cell area ÷ A

   B = __750__ ft^2 ÷ __10__ ft

   B = __75__ ft

5. 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

6. Determine the linear loading rate (LLR) if, the soil application rate of any horizon within 12 inches below the distribution cell has a soil application rate of ≤ 0.3 gal/ft^2/day.

   If the LLR exceeds 4.5 gal/ft/day for such soils, the component must be lengthened to reduce the LLR to 4.5 gal/ft/day or less.

   LLR = DWF ÷ B

   LLR = _____ gal/day ÷ ____ ft

   LLR = ____gal/day/ft

D. DESIGN OF ENTIRE AT-GRADE COMPONENT:

1. Determine the total width of distribution cell.

   For level site, the total width of the distribution cell (TW) is equal to or greater than the effective distribution cell credit width (A).

   TW ≥ A

   TW = __10__ ft

   For sloping site, the total width of the distribution cell (TW) is equal to or greater than the effective distribution cell credit width (A) + 2 feet.

   TW ≥ A + 2 feet

   TW ≥ _____ ft + 2 feet

   TW = _____ ft

2. Determine the overall width (W) of the component.

   W ≥ __10__ ft + 10 ft.

   W = __20__ ft

   W ≥ TW + 10 ft

3. Determine the overall length (L) of the component.

   L ≥ B + 10 ft

   L ≥ __75__ ft + 10 ft.

   L = __85__ ft

4. Horizontal location of distribution lateral in the distribution cell.

   __**X**__ Level site with one effluent distribution lateral; the lateral is located in the center of distribution cell.

   ___ Level site with more than one effluent distribution lateral; the laterals are equally spaced apart with the center two laterals the same distance from center of the cell and the distance from the outside laterals to the edge of the cell being one half the distance between laterals.

___ Sloping site with one effluent distribution lateral; the effluent distribution lateral is located 2 feet in from up slope edge of total distribution cell.

___ Sloping site with two effluent distribution laterals; one lateral is located 2 feet down slope from the up slope edge of the distribution cell and the others are down slope of the upper lateral and up slope of the mid point of the distribution cell credit width.

5. Vertical location of distribution lateral in the distribution cell.

   Elevation of distribution lateral invert ≥ elevation of original contour directly under distribution lateral + 6 inches

   Elevation of distribution lateral invert ≥ 105 ft. + 0.5 ft.

   Elevation of distribution lateral invert = 105.5 ft.

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

   See Appendix A.

XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal:

In order to install a POWTS correctly, it is important to develop plans that will be used to guide the installation. The following checklist may be used when preparing plans for review. 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 agency for specific plan submittal requirements, which may be different than the list included in this manual.

B. General Submittal Information:

1. Legible photocopies of reports forms, plans, and other documents are acceptable. However, an original signature is required on certain documents (e.g., index page).

2. Submittal of additional information requested during plan review, or questions concerning a specific plan shall be referenced to the Identification number assigned to that plan by the reviewing agency.

3. Plans or documents must be permanent, legible copies or originals.

C. Forms and Fees:

A current version of a completed Application For Review form, (SBD-10577) along with proper fees must be included with plans submitted to the department. An Application can be downloaded at http://dsps.wi.gov/SB/docs/SB-FormPowtsAppl10577.pdf . If plans are to be submitted to a designated county plan review agent, the agent should be contacted for information regarding application forms and fees.

D. Soils Information:

1. A completed Soils Evaluation Report form, (SBD-8330) signed and dated by a certified soil tester, with credential number.

2. Separate sheet showing the location of all borings. The location of all borings and observation pits must be able to be identified on the plot plan.

E. Documentation:

1. Architects, engineers or designers shall sign, seal and date each page of the submittal or sign, seal and date index page, which is attached to the bound set.

2. Master Plumbers and Master Plumbers Restricted Service shall sign, date and include their license number on each page of the submittal or sign and date an index page, which is attached to each bound set.

3. At least three sets of plans and specifications (clear, permanent and legible) shall be submitted to the department. Submittals must be on paper measuring at least 8-1/2 by 11 inches. Each plan set shall be bound by staples, brads or other fasteners. Pages

which are held together by rubber bands and/or paper clips are not considered to be a bound volume.

F. Plot Plan Information:

1. Dimensioned plans or plans drawn to scale (scale indicated on plans) with property lines, parcel size and property boundaries clearly marked.

2. Slope directions and percent in component area.

3. Benchmark and north arrow.

4. Pertinent setbacks distances as per appropriate code.

5. Two-foot contours or other appropriate contour interval within the system area.

6. Location information; legal description down to 40 acres and /or subdivision, block and lot number of platted lands.

7. Pertinent existing and proposed buldings, wells water lines, swimming pools, flood plain location and elevation and OHWM designations of navigable waters.

G. Plan View:

1. Dimensions for distribution cell(s).

2. Location of observation pipes.

3. Pipe lateral layout, which includes the number of laterals, pipe material, diameter and length; and number, location and size of orifices.

4. Manifold/force main locations, with materials, length and diameter of each.

H. Cross Section of Component:

1. Include plowing requirement, distribution cell details, and cover material.

2. Lateral elevation, position of observation pipes, dimensions of distribution cell, and geotextile fabric barrier.

I. Component Sizing:

1. For one- and two-family dwellings, the number of bedrooms shall be included.

2. For public buildings, the sizing calculations shall be included.

J. Tank and Pump / Siphon Information:

1. Construction details for site-constructed tanks. (Note: site constructed tanks that do not have a valid plumbing product approval are not included within the scope of this manual and must be submitted as individual site designs.)

2. Size, model number and manufacturer information for prefabricated tank(s).

3. Installation information must include vent and access opening locations, depth to inlet; and height/elevation of freeboard, if applicable.

4. Anchoring information shall be provided whenever a tank is located within the 100-year floodplain and/or the depth to seasonal soil saturation indicates anchoring is necessary to prevent flotation of the tank.

5. Notation of pump or siphon model, pump performance curve, friction loss for force main and calculation for total dynamic head.

6. Notation of high water alarm manufacturer and model number.

7. Cross section of 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.

8. Cross section of two compartments tanks or tanks installed in series shall include information listed above.

K. Inspections:

Inspection shall be made in accordance with ch. 145.20, Wis. Stats., and s. SPS 383.26, Wis. Adm. Code. The inspection form on the following two pages may be used. The inspection of the component installation and/or plans is to verify that the component conforms to specifications listed in Tables 1-3 of this manual and the approved plans.

POWTS INSPECTION REPORT

(ATTACH TO PERMIT)

GENERAL INFORMATION

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

TANK INFORMATION			SETBACKS				
TYPE	MANUFACTURER Model #	CAPACITY	P/L	WELL	BLDG.	VENT TO AIR INTAKE	ROAD
SEPTIC							
DOSING							
AERATION							

PUMP / SIPHON INFORMATION

Manufacturer:	Model No.	Demand in GPM	Vert. Lift

FORCE MAIN INFORMATION			FRICTION LOSS		
Length	Diameter	Dist. To Well	Component Head	TDH - As Built	TDH - Design

SOIL ABSORPTION COMPONENT

TYPE OF COMPONENT				COVER MATERIAL		
Cell Width	Cell Length		Cell Depth	Horizontal Separation		No. of Cells

SETBACK INFO.	Property Line	Bldg.	Well	Lake/Stream

DISTRIBUTION COMPONENT / Elevation data on back of form

Header / Manifold		Distribution Pipe(s)			Hole size	Hole Spacing	Obsv. Tubes Inst. & No.
Length	Dia.	Length	Dia.	Spacing			

SOIL COVER

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

DEVIATIONS FROM APPROVED PLAN

COMMENTS (Persons present, discrepancies, etc.)

COMPONENTS NOT INSPECTED

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

ELEVATION DATA

Point	Backsight	Height of Instrument	Foresight	Elevation	Comments
Bench mark					
Bldg. sewer					
Tank inlet					
Tank outlet					
Tank inlet					
Tank outlet					
Dose tank inlet					
Bottom of dose tank					
Dist. lateral 1					
Component elev. 1					
Dist. lateral 2					
Component elev. 2					
Dist. lateral 3					
Component elev. 3					
Grade elev. 1					
Grade elev. 2					
Grade elev. 3					

SKETCH OF COMPONENT & ADDITIONAL COMMENTS

Table 4 Public Facility Wastewater Flows		
Source	**Unit**	**Estimated Wastewater 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)	Patron (10 sq. ft./patron)	4
Bar or cocktail lounge* (w/meals - all paper service)	Patron (10 sq. ft./patron)	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 (minimum 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
Medical office building Doctors, nurses, medical staff Office personnel Patients	 Person Person Person	 50 13 6.5
Migrant labor camp (central bathhouse)	Employee	20

* May be high strength waste

Table 4 Public Facility Wastewater Flows (continued)		
Source	**Unit**	**Estimated Wastewater Flow (gpd)**
Mobile Home (Manufactured home) (served by its own POWTS)	Bedroom	100
Mobile 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)	Patron seating space	40
Restaurant*, 24-hr. (toilet and kitchen waste with dishwasher and/or food waste grinder)	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 residential clothes washers)	Clothes washer	200
Swimming pool bathhouse	Patron	6.5

* May be high strength waste

APPENDIX A – Location of Observation Pipes

Observation Pipe Location – POWTS Component Manual
Effective Date – 09/01/2010

Observation pipes will be installed in each distribution cell so as to be representative of a cell's hydraulic performance.

be located such that there are a minimum of two installed in each dispersal cell at opposite ends from one another

be located near the dispersal cell ends

be at least 6 inches from the end wall and sidewall

be installed at an elevation to view the horizontal or level infiltrative surface within the dispersal cell.

Observation pipes may be located less than 6 inches from end walls or side walls if specified in state–approved manufacturers' installation instructions.