# AT-GRADE COMPONENT USING PRESSURE DISTRIBUTION

# MANUAL FOR PRIVATE ONSITE

# WASTEWATER TREATMENT SYSTEMS

**(and Addendum A)**

**State of Wisconsin**

**Department of Commerce**

**Division of Safety and Buildings**

SBD-10570-P (R.6/99)

## Observation Pipe Location – POWTS Component Manual Addendum A
## 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.*

**NOTE:** This text replaces all references to **Observation Pipe Location(s)** specified within this manual and now shown as strike-through text.

Strike-through text may be found in any of the following areas in this manual: Table 3; Figures for detailed system cross-section, detailed plan view and/or observation pipe locations; Worksheet; and Component Design and Plan View sections.

TABLE OF CONTENTS




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# I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for an at-grade 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 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. 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 review and approval by the governing unit having authority over the plan for the installation. Also a Sanitary permit must also 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 |
| Volume of a single dose | ≥ 5 times the void volume of distribution lateral(s) |
| Design wastewater flow (DWF) from one- and two-family dwellings | ≥ 150 gal/day/bedroom |
| Design wastewater flow (DWF) from public facilities | ≥ 150% of estimated wastewater flow in accordance with Table 4 of this manual or s. Comm 83.43 (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**<br>**SIZE AND ORIENTATION** | |
|---|---|
| Total effective distribution cell area | ≥ Design wastewater flow ÷ soil application rate for the most restrictive soil horizon in contact with the distribution cell. Soil application rates are listed in s. Comm 83 Table 83.44-1 or -2, Wis. Adm. Code. |
| Effective distribution cell credit width (A) | 10 ft or width of distribution cell, which ever 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 + outside 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 sloped sites. Component is not allowed on concave slopes. |

| Table 3<br>**OTHER SPECIFICATIONS** | |
|---|---|
| Slope of original grade | ≤ 25% in area of at-grade |
| 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. Comm 83 Table 83.44-3, Wis. Adm. Code |
| Effluent application | By use of pressure distribution network conforming to **sizing methods** of either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" or Dept. of Commerce publication SBD-10573-P, entitled "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 | Meets requirements of s. Comm 84.30 (6) (i), Wis. Adm. Code |
| Fabric cover of distribution cell when aggregate is used | Geotextile fabric meeting s. Comm 84.30 (6) (g), Wis. Adm. Code |
| Effluent application | Evenly along the length of the distribution cell |
| 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 | ~~Along opposite sides of distribution cell. Each at a distance equal to 1/6 of the distribution cell length from opposite ends~~ |
| Location of observation pipes for components on a slope | ~~Along down slope edge of distribution cell. Each at a distance equal to 1/6 of the distribution cell length from opposite ends.~~ |

| Table 3<br>**OTHER SPECIFICATIONS**<br>(continued) | |
|---|---|
| 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:<br>1. The tilled area, and<br>2. For sloping sites - 15 feet down slope of component area if there is a restrictive horizon that affects treatment or dispersal, or<br>3. For level sites – 10 feet on both sides of component area if there is a restrictive horizon that affects 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 |

## II. DEFINITIONS

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. “At-grade” means an on-site wastewater treatment and distribution component. The component contains a distribution cell on top of a tilled in situ soil absorption area and is covered by soil. The soil cover consists of material that will support growth of vegetation and offer protection for the distribution cell and absorption area.

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

C. “Distribution cell” means a layer of stone aggregate that receives effluent from a distribution network and distributes that effluent onto a tilled in situ soil absorption area.

D. “Excessively permeable soil” means soil with textural classifications of coarser than gravely medium sand according to the US Department of Agriculture, Natural Resource Conservation Service classification system.

E. “Permeable Soil” means soil with textural classifications of silt loam to gravely medium sand according to the US Department of Agriculture, Natural Resource Conservation Service classification system.

F. “Saturated flow” means liquid flow through a soil media under a positive pressure potential. Under saturated flow conditions, nearly all soil pores are filled with liquid thus excluding oxygen and other soil gases.

G. “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.

H. “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.

I. “Uniform Distribution” means a method of distribution that results in nearly equal distribution of the influent throughout the distribution network.

J. “Vertical Flow” means the effluent flow path downward through soil that involves travel along soil surfaces or through soil pores.

K. “Vertical Separation” means the total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell and seasonal saturation defined by redoximorphic features, groundwater or bedrock.

## III. DESCRIPTION AND PRINCIPLE OF OPERATION

POWTS at-grade component operation 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 in situ soil. These processes are affected by the physical characteristics of the influent 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 in situ soil. In addition, many pollutants are converted to other chemical forms by oxidation processes

The at-grade consists of a distribution cell, distribution network, and a soil cover. Influent is distributed into the distribution cell where it flows into the in situ soil and undergoes biological, chemical, and physical treatment and dispersal into the environment. See Figure 1 for a typical at-grade component.

Cover material, consisting of soil provides frost protection and moisture retention sufficient to maintain a good vegetative cover.

The in situ soil serves as the treatment medium and disperses the effluent into the environment.

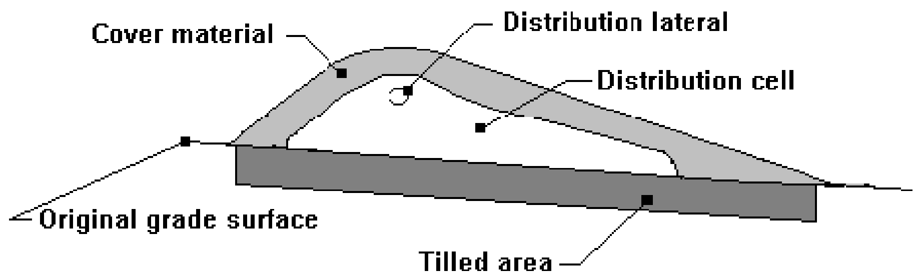


Figure 1 - A cross-section of an at-grade component for POWTS.

This manual specifies site characteristics, design criteria and construction techniques for an at-grade component to provide treatment and dispersal of pretreated domestic wastewater.

The advantages of an at-grade are two-fold. 1. The effluent enters the more permeable in situ topsoil over a larger area, where it can move laterally until absorbed by the less permeable subsoil; 2. Construction is eliminated in the wetter subsoil where smearing and compacting are often unavoidable.

## 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, that it 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 performances 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 -

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.

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

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 the reduced infiltration area beneath the at-grade. Rock fragments, tree roots, stumps and boulders occupying an area, reduce 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 soil.

4. Setback distances - The setbacks specified in ch. Comm 83, Wis. Adm. Code for soil subsurface treatment and distribution components apply to at-grade components. The distances are measured from the perimeter of the dispersal cell tilled infiltrative area.

## V. COVER MATERIAL

The cover material (above the distribution cell and absorption area) is a finer textured soil to allow (1) plant growth due to a higher water holding capacity and (2) increased runoff due to its more dense nature. Sands are not recommended, as they drain rapidly and allow more infiltration of precipitation into the absorption area. Also, clays are not recommended as they can restrict oxygen transfer. Often, excavated soil from the site can be used. Seeding or other means must be done to prevent erosion of the at-grade.

## 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 influent along the length of the distribution cell. A pressurized distribution network designed in accordance with **sizing methods** of either Small Scale Waste Management Project publication 9.6, entitled “Design of Pressure Distribution Networks for Septic Tank – Soil Absorption System” or Dept. of Commerce publication SBD-10573-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" is acceptable.

B. Component Design – Detailed plans and specifications must be developed, reviewed and approved by the governing unit having authority over the plan for the installation. A Sanitary permit must also be obtained from the governmental unit having jurisdiction.

Design of the at-grade component is based on the estimated daily wastewater load and soil characteristics. It must be sized such that it can accept the daily wastewater load without causing surface seepage or groundwater pollution. Consequently, the effective absorption area, which is the in situ soil area beneath the distribution cell, must be sufficiently large enough to absorb the effluent in the underlying soil.

Design of the at-grade includes three steps, which are: (A) calculating the daily wastewater load, (B) design of the distribution cell and (C) design of the entire at-grade component. Each step is discussed. A design example is included at the end of this manual.

Step A. Design Wastewater Flow Calculations

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 formula 1.

Formula 1

DWF = 150 gallons/day/bedroom

Public Facilities. 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. 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 wastewater flow per source per day (from Table 4) x 1.5

| Table 4<br>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)<br>Patron<br>Service bay | <br>Patron<br>Service bay | <br>3<br>50 |
| Hospital* | Bed space | 135 |
| Hotel, motel or tourist rooming house | Room | 65 |
| Medical office building<br>Doctors, nurses, medical staff<br>Office personnel<br>Patients | <br>Person<br>Person<br>Person | <br>50<br>13<br>6.5 |
| Migrant labor camp (central bathhouse) | Employee | 20 |

* = May be high strength waste

| Table 4<br>Public Facility Wastewater Flows<br>(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

Step B. Design of the Distribution cell - This section determines the required effective cell area of the distribution cell as well as the dimensions for the complete at-grade component.

1. 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 Table 83.44-1 or -2, Wis. Adm. Code, to determine the soil application rate.

2. 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).

3. Choose an effective distribution cell credit width. The effective credit width can not exceed 10 ft.

4. 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.

5. 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 $\leq 0.3$ gal/ft$^2$/day that are within 12 inches below the distribution cell, the linear loading rate (LLR) can not exceed 4.5 gal/ft.

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

Step C. Design of the entire at-grade component. This includes sizing the total width and length of the distribution cell, component height, location of the effluent distribution lateral, and observation pipes.

1. 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).

      $TW \geq A$

    - 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.

      $TW \geq A + 2$ feet

2. 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.

      $W \geq TW + 10$ ft

      NOTE: Greater widths for landscaping purposes are satisfactory.

3. 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.

      $L \geq B + 10$ ft

      NOTE: Greater lengths for landscaping purposes are satisfactory.

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 lateral; the effluent distribution lateral is located 2 feet in from up slope edge of 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 other(s) is (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.

   - The distribution lateral must be at least 6 inches above the elevation of original contour before tilling.

6. Determine the height of the component.

   - 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.
   - 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.

7. Location of the observation pipes.

   - ~~Components on a level site must include two observation pipes. The observation pipes are along opposite sides of the distribution cell and located at a distance equal to 1/6 of the distribution cell length from opposite ends.~~
   - ~~Components on a sloping site must include two observation pipes. The observation pipes are along the down slope edge of distribution cell located at a distance equal to 1/6 of the distribution cell length from opposite ends.~~

8. Distribution Network and Dosing System

   - A pressurized distribution network designed in accordance with **sizing methods** of either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" or Dept. of Commerce publication SBD-10573-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" is acceptable.

## 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 tilled 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 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 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 component area and distribution cell area on the site so that the distribution cell runs perpendicular to the direction of the slope.

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), till 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.

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 tilling. 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 Moldboard plow, it should have as many bottoms as possible to reduce the number of passes over the area to be tilled, to minimize the compaction of the subsoil. Tilling with a Moldboard plow is done along contours. Chisel type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that a rough, unsmeared surface be left. The aggregate will intermingle between the clods of soil, which improves the infiltration rate into the natural soil.

   Immediate application of at least 6 inches of aggregate 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. Install the required observation pipes with the bottom 6 inches of the observation pipe perforated. Installations of all observation pipes include a suitable means of anchoring. See Figure 2.

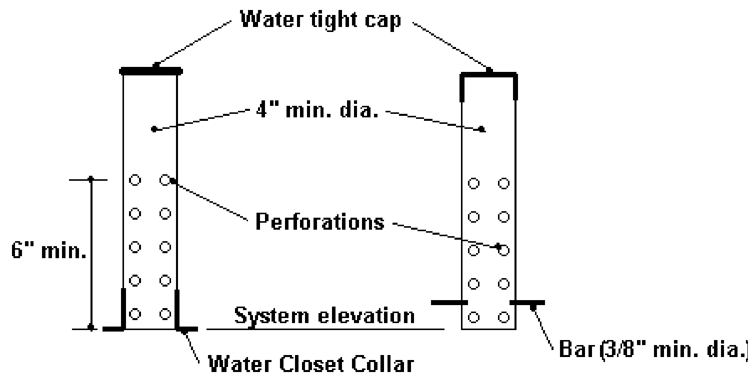


Figure 2 Observation pipes

7. Place the remaining distribution cell aggregate in the component. Shape the aggregate to obtain a uniform minimum depth of at least 6 inches above the original grade.
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. Lay the effluent distribution lateral(s) level. All pipes must drain after dosing.
9. Place at least 2 inches of aggregate over the lateral(s).
10. Place geotextile fabric conforming to requirements of ch. Comm 84, Wis. Adm. Code, over the aggregate.
11. Place cover material on the 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 at-grade. Sod or seed and mulch the entire at grade component.

## 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 is accomplished by the county or other appropriate jurisdictions in accordance to ch. Comm 83, 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 at-grade 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 at-grade.
   3. Winter traffic on the at-grade is not permitted to avoid frost penetration and to minimize compaction.
   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. 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 the periodic maintenance 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 conventional soil absorption component to have problems. In this situation, the pump chamber should be pumped by a licensed pumper before pump cycling begins or other measures shall be used to dose the conventional soil absorption 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 monitoring must be performed 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.

   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, is 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 in accordance with ch. Comm 83, 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:

- 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 ____

Depth to limiting factor - _____inches

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

## B. DESIGN WASTEWATER FLOW (DWF)

One- or Two-family Dwelling.

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

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

= ____________ gal/day

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 in contact with the distribution cell that matches the soil conditions. 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 credit width (A). The effective credit 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. 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 for such soils, the component must be lengthened to reduce the LLR to 4.5 gal/day/ft 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 ≥ elevation of original contour directly under distribution lateral + 6 inches

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

   Elevation of distribution lateral = _____ ft.

6. Determine the height of the component.

   Height over the distribution lateral ≥ 14 inches +nominal diameter of lateral

   Height over the distribution lateral ≥ 14 inches +_____ inches

   Height over the distribution lateral = _______ inches

   Height over the rest of the distribution cell ≥ 12 inches

   Height over the rest of the distribution cell = _____ inches

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

   ~~Distance from end of distribution cell to end observation pipes = B ÷ 6~~

   ~~Distance from end of distribution cell to end observation pipes = _____ft. ÷ 6~~

   ~~Distance from end of distribution cell to end observation pipes = _____ft.~~

XI. EXAMPLE WORKSHEET

## AT-GRADE 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 - __<1__%

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)

One- or Two-family Dwelling.

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

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

= __450__ gal/day

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 in contact with the distribution cell that matches the soil conditions. 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 = __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 credit width (A). The effective credit 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. 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/ft²/day.

   If the LLR exceeds 4.5 gal/ft for such soils, the component must be lengthened to reduce the LLR to 4.5 gal/day/ft 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 ≥ TW + 10 ft

   W ≥ __10__ ft + 10 ft.

   W = __20__ 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 ≥ elevation of original contour directly under distribution lateral + 6 inches

   Elevation of distribution lateral ≥ _105_ ft. + 0.5 ft.

   Elevation of distribution lateral = _105.5_ ft.

6. Determine the height of the component.

   Height over the distribution lateral ≥ 14 inches +nominal diameter of lateral

   Height over the distribution lateral ≥ 14 inches +_1.5_ inches

   Height over the distribution lateral = _15.5_ inches

   Height over the rest of the distribution cell ≥ 12 inches

   Height over the rest of the distribution cell = _12_ inches

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

   ~~Distance from end of distribution cell to end observation pipes = B ÷ 6~~

   ~~Distance from end of distribution cell to end observation pipes = _75_ ft. ÷ 6~~

   ~~Distance from end of distribution cell to end observation pipes = _12.5_ ft.~~

## XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

### A. Plan Submittal

In order to install a component correctly, it is important to develop plans that will be used to install the component correctly the first time. The following checklist may be used when preparing plans for review. The checklist is intended to be a general guide. 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.

Forms and Fees

- Application form for submittal, provided by reviewing agency along with proper fees set by reviewing agent.
- Onsite verification report signed by the county or appropriated state official.

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.

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 component area.
- Benchmark and north arrow.
- Setbacks indicated as per appropriate code.
- Two-foot contours to 25ft. on all sides of system area or include elevations at all four corners of proposed system.
- Location information; legal description of parcel must be noted.
- Location of any nearby existing component.

Plan View

- Dimensions for distribution cell(s).
- Location of observation pipes.
- 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 Component

- Include tilling requirement, depth and size of aggregate, percent slope, side slope, and topsoil.
- Lateral elevation, position of observation pipes, dimensions and depths of aggregate, and type of cover material such as geotextile fabric, and depth, if applicable.

Component 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 pump or siphon model, pump performance curve, friction loss for force main and calculation for total dynamic head.
- Cross section of tank / chamber to include storage volumes; connections for piping, vents, and electricity; pump “off” setting; dosing cycle and volume; and location of vent and manhole.
- Cross section of two compartments tanks or tanks installed in a series must include information listed above.

Other

- For design flows greater than 1000 gpd, include the manufacturer, model, and location of a metering device, which accurately meters the amount of effluent entering the component.

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 component installation and/or plans is to verify that the component at least conforms to specifications listed in Tables 1-3 of this manual.

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 Available | |

| **TANK INFORMATION** | | | **SETBACKS** | | | | |
|---|---|---|---|---|---|---|---|
| TYPE | MANUFACTURER | CAPACITY | P/L | WELL | BLDG. | VENT TO AIR INTAKE | ROAD |
| SEPTIC | | | | | | | |
| DOSING | | | | | | | |
| AERATION | | | | | | | |
| HOLDING | | | | | | | |

**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 Diameter | Cell Depth | Horizontal Separation | Liquid Depth | No. of Cells |
|---|---|---|---|---|---|---|

| LEACHING CHAMBER OR UNIT | Manufacturer | Model No. |
|---|---|---|

| 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 center of cell: | Depth over edge of cell: | Depth of Topsoil | Seeded / Sodded | Mulched |
|---|---|---|---|---|

**DEVIATIONS FROM APPROVED PLAN**

| DATE OF INST. DIRECTIVE: | DATE OF ENFORCEMENT ORDER: |
|---|---|
| DATE OF REFERRAL TO LEGAL COUNSEL: | |

**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 | | | | | |
| 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