Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCPH within the STS design. When used, if conflicts exist between this manual and Ohio Administrative Code 3701-29, the state code shall prevail. STS contactors shall follow the approved STS design.

HSTS

HOUSEHOLD SEWAGE TREATMENT SYSTEM

INSTALLER'S MANUAL

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TABLE OF CONTENTS

Prologue

The following document is a compilation of previous documents that provided specifications, guidelines, and installation standards for various types of Household Sewage Treatment Systems (HSTS). This document contains a combination of information that relates to conventional technology and advanced technology. Therefore, traditional gravity leaching trenches and "advanced" mound installation guidelines appear in the same document, as well as others. The intent was to provide a document with a broad scope that is able to meet the challenges this developing industry faces. It is hoped that this document will remove some of the "growing pains" associated with taking part in the evolving industry of onsite wastewater treatment.

This manual is the product of a collaboration between the Hamilton County General Health District, the Clermont County General Health District, and the Brown County General Health District. Mr. Ralph Benson, R.S. and Mr. Glen Vonderembse, S.I.T. both of the Clermont County General Health District, as well as Mr. Steven Dick, R.S. of the Brown County General Health District, worked in conjunction with the Hamilton County General Health District, Division of Water Quality to form a manual team to arrive at this common document. It is believed that consistency across county lines will result in a broader understanding of the requirements for HSTS installations in this area.

The Clermont County General Health District was instrumental in providing the starting point for this manual. Their "Advanced Technology Specifications and Guidance Manual, 2002 and 2003" was the beginning point for this document**.** It is planned that this manual will be updated on an annual basis by the manual team. There have been discussions with several other county health districts within southwest Ohio to include them in the review process. As those counties embrace advanced technology onsite systems, they plan to adopt this document in there jurisdictions. A steering committee has been formed by the National Onsite Wastewater Recycling Association's (NOWRA) Technical Practices Committee to review and amend this document. Their plan is to use our "regional" document as a starting point to develop a National Manual of Installation Practice.

Acknowledgments

This document would not have been possible without the efforts and work of many people. Input ranged from technical guidance, to proof reading draft versions of this document. Without their cooperation and tolerance, this document would not have come to fruition. The following is a partial list of those whose contributions are to be noted to this document; the Hamilton County Board of Health and the Division of Water Quality Staff at the Hamilton County General Health District, the Clermont County Board of Health and Staff at the Clermont County General Health District, the Brown County Board of Health and Staff at the Brown County General Health District.

Chris Griffith, *R.S.*

1 Section 1.0 Introduction

1.1 General Information

Household Sewage Treatment Systems (HSTS) are a vital part of a total wastewater infrastructure that supports the quality of life in communities. This infrastructure protects human health and the environment and maintains property values. The preservation of public health and the environment requires that every home in the County be provided with a means for treating wastewater produced by its occupants. Many residences are connected to public sanitary sewers. The balance of the residences are served by privately owned individual HSTS.

Building this infrastructure requires the work of professionally-minded people committed to quality work. The investment being made by the property owners in these systems requires that installers and vendors of equipment be committed to successful installations and trouble-free, long-term operation with routine service.

A HSTS is only as good as its design and installation. This is true where excellent soil and site conditions allow for the use of totally passive treatment systems. It is also true where advanced treatment systems must compensate for marginal soil and site conditions. Assuring that installations result in competitively priced, trouble-free systems that are maintainable at reasonable costs is one of the greatest challenges that the onsite wastewater treatment industry faces. The industry cannot afford to leave the satisfaction of customers to chance.

It is important to realize that this document will continued to be supplemented and revised on an annual basis, or until it is replaced by a standard manual of installation practice for the onsite industry. Any alternative means or methods offered to achieve the objectives of this manual are subject to review by the Hamilton County General Health District (hereafter referred to as the Health District).

1.2 Purpose of Manual

This manual has evolved out of the need to fill the gap that has existed between “state of the art” design practices and equipment, and the state of readiness of the practitioners in the field. This manual is designed to continue to bridge this gap to promote solidly grounded standards of good installation practices, to meet the need of uniform standards, and provide the mechanisms to assure and document quality work. This manual contains the engineering practices

acceptable to meet Regulation 529. As new technologies are approved they will be added to this manual.

This manual has been developed by the Health District to:

- Promote sound construction practices for conventional and advanced HSTS in general.
- Provide construction guidance for conventional and advanced HSTS designed specifically for local soils.
- Build consensus and cooperation among those persons involved in:
  - Design, sale, installation, and inspection of onsite systems.
  - Development and sale of property with onsite systems.
  - Operation and maintenance of onsite systems.

This manual is **not intended** to substitute for, or replace:

- Training and experience that qualifies a person in the procedures of HSTS installation.
- Training that certifies a person to install specific systems, or products.
- Professional qualifications and sound professional judgement of HSTS practitioners.

The manual is formatted to promote the use of checklists and documentation by persons responsible for:

- Design, sale, installation, and inspection of HSTS.
- Development and sale of property with HSTS.
- Operation and maintenance of HSTS.

1.3 Layout of Manual

The layout of the manual is to give a simple reference and checklist type format, giving direct and short guidance on the requirements and suggestions regarding HSTS's within the Health District's jurisdiction. This manual has consolidated information that was previously contained in a variety of other sources of information. It also provides combined guidance and requirements for HSTS's that are classified as conventional technology and advanced technology.

This document is broken down into sections. A listing of these sections is found in the Table of Contents. The sections are as follows:

1.0 Introduction
2.0 HSTS Installation Planning
3.0 Tanks

4.0 Aggregates and Cover
5.0 Piping
6.0 Finished Appearance
7.0 Drainage Enhancements
8.0 Electrical Systems
9.0 Disinfection and Monitoring Devices
10.0 Mounds/Modified Mounds/Other At-Grade Structures
11.0 Leaching Trenches
12.0 Subsurface Sand Filters
13.0 Intermittent Sand Filters
14.0 Aerobic Household Sewage Treatment System
15.0 Puraflo® Peat Biofilters
16.0 Recirculating Media Filters
17.0 American Manufacturing® Drip Distribution
18.0 Pressurized Leach Beds
19.0 System Checkout Procedures
------ Appendices

Section 2.0 (HSTS Installation Planning) thru Section 19.0 (System Checkout Procedures) contain the requirements and specifications for HSTS systems. Within each section, most items are presented in a manner that provides a simple, easy to follow format. The format allows a person to use applicable sections of this document for planning and installation considerations. The appendices contain forms, drawings, and other important documentation that are used to guide and document the HSTS installation.

It must be understood that not all sections of this document are applicable for every given HSTS. For example, piping has been assigned its own section, but the section does not include pipe specific to leach lines or subsurface sand filters.

1.4 HSTS Types Included

As stated previously, this manual was written as an inclusive document to provide a single source of information for the planning and installation of HSTS systems. Conventional and advanced technology now appear within the same document. These two technologies, although classified and handled differently, do share similar requirements. For example, all have the same requirements for the building sewer. A simple rule of thumb for the distinction between conventional and advanced technology is the following: *If a HSTS system is time dosed, that is, it has a timer controlling dosing or other mechanism based on time, then it is categorized as advanced technology (This does not apply to demand dose applications).*

An effort was made to incorporate more information and guidance on HSTS systems that are considered proprietary. Most are considered to be advanced technology, too. As time passes, these types of systems are becoming more prevalent throughout the onsite wastewater industry. The following is a listing of different technologies covered in this document. They are listed based upon their typical consideration as conventional or advanced technology.

Conventional	Advanced Technology
Gravity Leach Trenches	Modified Mounds
Gravity Subsurface Sand Filter	Wisconsin Mounds
	Peat Filters
	Recirculating Media Filters
	Intermittent Sand Filters
	Drip Distribution
	Pressurized Leach Beds
	Timed Dosed Aerobic System

Table 1.1 - Conventional and Advanced Technology Classification (Hamilton County)

It must be understood that the above listing is for systems as currently applied. It may be that there are instances when the above may be classified differently due to specific requirements for a given site.

1.5 HSTS Component Application(s)

A variety of components are offered by the onsite industry for use in HSTS's. For any of these components, the component must be approved by the component manufacturer for installation and operation in the situation which they will be used. Ohio Department Of Health (ODH) approval must also be received. Additionally, these components must be preapproved by the Health District for use in the County, and be installed following Health District approved manufacturer specifications.

2 Section 2.0 HSTS Installation Planning

2.1 General

Planning the construction of a HSTS is an critical part of the overall HSTS installation process. Proper planning works to the benefit of all the involved parties. It reduces the potential for errors that require changes that cost time and money. Proper planning also provides a means by which special considerations for a particular installation may be thought out before field work.

2.2 Critical Elements of Job Planning and Execution

The following items are critical for a successful installation:

- ❑ Positive mental attitude.
- ❑ Commitment to quality work.
- ❑ Safe job site and safe construction practices.
- ❑ OSHA guidelines for trenching and shoring followed.
- ❑ Communication among involved parties.
- ❑ Understanding the plan.
- ❑ Knowledge of job specifications.
- ❑ Layout survey and notes.
- ❑ Maintaining horizontal and vertical job control.
- ❑ Stability of components.
- ❑ Watertight tanks and components.
- ❑ Usage of specified components & aggregates.
- ❑ Good solvent welds on every glued connection.
- ❑ Protecting components from surface and groundwater inflows.
- ❑ Freeze protection of pipes.
- ❑ Mechanical protection of pipes.
- ❑ Components installed per product specifications.
- ❑ Components are accessible and serviceable.
- ❑ Electrical system wired to specifications.
- ❑ Electrical system protected from moisture.
- ❑ Controls set properly.
- ❑ As-built documentation.
- ❑ System check-out & start-up documentation.
- ❑ Homeowner maintenance contracts.
- ❑ Walk-thru inspection within 90 to 120 days after the system is put into service.
- ❑ Good vegetative cover.
- ❑ Attractive finished appearance.
- ❑ Regular service and maintenance.

2.3 Job planning

Job planning is the process by which the installer assesses the requirements for completion of a job for a designed HSTS. It includes all the activities considered before beginning site activities. These activities shall include, but are not limited to, construction equipment scheduling, personnel scheduling (e.g.- electrician), material procurement (e.g.- pump(s), aggregates, pipe, tanks, etc.), system construction layout, site activities necessary to achieve completion, and documentation.

2.3.1 Site and Plan Review

A site plan and review shall consist of studying the proposed HSTS layout with respect to the actual site conditions.

- ❑ Homeowner and/or person(s) responsible for overall site protection shall be conferred with.
- ❑ Accuracy of site plan with respect to structures and features shall be confirmed.
- ❑ Sources of water from the house, such as down spouts, foundation drain outlets, etc., shall be reviewed and verification of discharge away from the HSTS shall be confirmed.
- ❑ HSTS components, including control panel (if applicable) location(s), shall be reviewed.
- ❑ Confirmation that all wastewater is connected to the building sewer shall be completed.

2.3.2 Wet Weather Planning

During the initial planning of a HSTS installation, thought must be given to the potential of wet weather and the impacts wet weather may have on the performance of the finished product and installation schedule. Certain aspects of HSTS installation, especially basal area preparation and leach line installation, are extremely sensitive to wet weather installation. The sensitivity is based on the soil moisture content and the resulting response of the soil due to activities such as plowing, excavating, or equipment traffic.

Construction activities, such as plowing and excavation, in wet weather can result in conditions that restrict the infiltration of wastewater into the soil. To say this another way, the HSTS has little or no chance of working if installed when the soil is plastic. In fact, the soil conditions may be unacceptable and require a new location on the site, so that natural and uncompromised soil conditions can be relied upon for infiltration. In addition, leach trenches and sand filters are susceptible to siltation from unmanaged run-off during extended rain events.

It is therefore, very important that an installer considers the potential effects that a wet weather episode may have on a particular installation. The overall planning for the project should contain provisions and/or contingencies for such weather. Some activities that can aid an installer with wet weather are covering a soil absorption area with plastic/tarps or ensuring an adequate quantity of sand for placement on the basal area after approval is given for plowing activities, prior to the rain event.

The following shall be done:

- ❑ Guidance given in Section 2.4 shall be used.
- ❑ Weather forecast shall be checked for time period of planned weather sensitive activities.
- ❑ For mounded HSTS, aggregate shall be available at the site for immediate placement upon Health District approval.

The following are recommended:

- ❑ Provisions should be taken to reduce impacts of rain event on weather sensitive activities; for example covering soil absorption areas.
- ❑ Wet soils should be allowed to dry before stockpiling. If wet soil is stockpiled, it will not dry in a stockpile.
- ❑ Stockpiles should be graded to shed water.
- ❑ Any soil stockpiles should be covered to maintain them at a workable moisture content.
- ❑ Systems should be covered immediately after approval is given.

2.3.3 Planning the Work

The following are some items to consider before any work begins.

- ❑ Ohio Underground Utility Protection Service (OUPS) shall have marked utilities prior to any excavation.
- ❑ Utilities not marked by OUPS shall be contacted, to mark for their utilities.
- ❑ Owner (homeowner or builder) shall be contacted to identify locations of any underground utilities that were not marked by OUPS or other entity.
- ❑ Site constraints, such as utility locations, construction corridors and isolation distances, shall be identified.
- ❑ Work site shall be maintained in a “rain ready” condition.
- ❑ Controlling elevations of the work site shall be identified.
- ❑ Any unanticipated or “surprises” found during planning shall be brought to the attention of the system designer, as soon as possible.
- ❑ Material procurement and staging should be determined.

2.3.4 HSTS Protections

HSTS protections are measures taken to ensure that any other group or person does not harm the proposed site, system, and/or any of the system components.

- ❑ Owner (homeowner and/or builder) shall be contacted with regard to system location so that they are aware and cautioned to not disturb this area by any of their activities.
- ❑ Planned soil absorption area *and* reserve area shall be barricaded to prevent unauthorized access, and avoid possible damage.
- ❑ HSTS shall be protected from damage from waste from new home construction, homes under repair, or homes being remodelled.
- ❑ HSTS excavations shall be protected from damage due to surface water flooding.
- ❑ Installed HSTS components shall be protected (or restrained) from floating. Special care shall be taken with pipes, tanks, treatment units and other components that are susceptible to floatation.

2.3.5 Planning to Prevent Future Damage by Others

Steps must be taken to give assurance that a system is not damaged by others. This will prevent unnecessary call-backs, after installation.

- ❑ Homeowner, general contractor, or person with overall project responsibility shall be given an as-built of the HSTS by the installer.
- ❑ As-built package should include language stating responsibility for damage after system completion is not the installer's, after as-built has been submitted to the proper project authorities (Consult an attorney, in this matter).
- ❑ Receipt of the as-built package by the homeowner, general contractor, or responsible person of the project should be documented.

2.4 Soil Moisture Condition Planning

A primary cause of ponding in mounds is construction of the system when the soil is too wet or too dry. For soil absorption systems, compaction of soils when soil is too wet contributes to failure of these system types. Before beginning chisel plowing operations or leach line excavation, it must be determined if the soil is plastic near the infiltration surface. The following shall apply to the mound type system basal area preparation.

This procedure will direct chisel plowing efforts. Three (3) cases are given for plasticity (an indication of soil wetness) with respect to depth. Each case provides allowable chisel plowing methodologies (See

Figure 2.1 Chisel Plowing Activity with Respect to Depth to Plastic Soils). Field activities that do not follow the actions listed in the figure, may be subject to disapproval and other associated consequences.

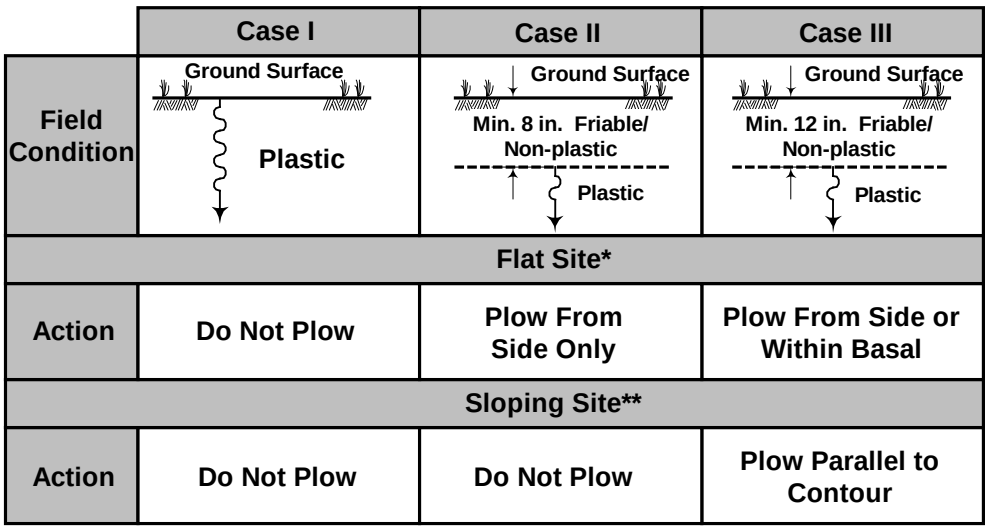


Figure 2.1 - Chisel Plowing/Excavation Activities with Respect to Depth to Plastic Soils. *A flat site has a slope less than 4%. **A sloping site has a slope equal to or exceeding 4%.

The following shall apply to soil absorption systems. They are:

- Soil moisture shall be below the plastic limit. The simple field technique is attempting to roll a small amount of soil into a thread or wire. If it rolls into a thread or wire, soil is plastic - soil shall not be worked.
- Infiltrative surface shall be protected from wind blown silt and rain;
  - For mounded systems, aggregate placement on basal areas can alleviate this item.
- HSTS constructed during "wet" conditions will result in disapproval of the work by the Health District.
- For mounded systems, if soil is too dry, four (4") inches to six (6") inches thick sand shall be placed on the basal area before chiselling, **OR** water shall be added and sufficient time for the water to soak in shall pass before working the basal area. For example, if water was added in the p.m., then check the soil moisture in the a.m. before plowing.

2.5 Clearing

Clearing shall consist of vegetation removal from the proposed soil absorption site. All of the following shall apply:

2.5.1 Areas Without Trees or Brush

- ❑ See Section 2.5.3 for equipment requirements.
- ❑ If a mounded structure, basal area vegetation shall be cut as close as possible to the ground without compaction, rutting, or smearing.
- ❑ For other soil absorption units, mowing of the area may be needed; this activity shall not cause compaction, rutting, or smearing.
- ❑ No heavy equipment shall be used.
- ❑ For any mounded structures, clipped (loose) vegetation shall be removed by raking or blowing off basal area; removal methods shall not cause compaction or smearing.

2.5.2 Areas with Trees or Brush

- ❑ Trees or bushes with a trunk diameter three (3") inches or larger shall be cut as close to the ground as possible, leaving the stump.
- ❑ Trees or bushes with a trunk diameter of less than three (3") inches shall have had stumps removed by pulling it out or cut as close to the ground as possible, leaving the stump.
- ❑ Organic debris shall be removed.
- ❑ Areas with excessive litter (e.g. - woods), shall have vegetative matter removed in an acceptable manner. (Raked/blown off)

2.5.3 Mechanical Clearing

- ❑ Use of mechanical means for clearing shall be subject to the same limitations that apply in sections 2.4, 2.5.1, and 2.5.2.
- ❑ Machines with very low ground pressure of less than 4 psi shall be used; for example, skid steers with rubber tracks, and/or small rubber tracked excavators.
- ❑ No rubber tire equipment shall be used, except walk behinds.
- ❑ Care shall be taken to ensure soil compaction and smearing are avoided.

2.6 Layout Survey, Excavation Planning and As-built (Survey Notes)

This three step approach is given to provide a systematic process for HSTS installation. The process starts with the layout survey. Information from the layout survey is used to develop the excavation plan. During the excavation planning, materials are ordered, excavation sequence (installation sequence) is determined, and job control procedures are developed to ensure that target grades are met. The as-built is your record of the completed installation.

2.6.1 Layout Survey (Step 1 – Required)

A layout survey shall consist of laying out, in the field, the location of all the components of the HSTS. This layout will assist the installer in planning the execution of the installation of the HSTS. See the guidance in the appendix for further information.

- ❑ Minimum of two (2) benchmarks shall be located, marked, and recorded; these shall either be permanent features (e.g., top of concrete walk) or they may be temporary; if temporary, benchmark is durable enough to maintain its integrity over the duration of the system installation.
- ❑ Various dimensions, such as, length and width shall be physically measured in the field, confirming feasibility of proposed system location in accordance with the installation plan.
- ❑ All activities with the layout shall be consistent, easy to cross-check, and repeatable, by others, such as inspectors and/or designers.
- ❑ **Layout survey shall be required to be completed PRIOR TO a preconstruction conference.**
- ❑ Component installation areas shall be marked in the field with elevations recorded within the installer's layout survey paperwork. A copy of this information shall be given to the Health District at the preconstruction conference.

2.6.2 Excavation Plan (Step 2 – Recommended)

The excavation plan is the step during planning in which the system installation is planned based upon information from the layout survey. The field data should be used to estimate the needs to complete the installation, such as material requirements. See the guidance in the appendix for further information.

- ❑ Grades projected during the layout survey should be those used as target grades.

2.6.3 As-built (Step 3 – Required)

The as-built is the documentation that records the findings from the layout survey and survey of installed components. As-built drawing ***shall be required***. See the guidance in the appendix for further information.

- ❑ Survey notes shall be continuation of the layout survey.
- ❑ Survey notes shall be recorded in the format given in the appendix; if format used deviates from this, notation shall be provided showing methodology used.
- ❑ **Survey notes are required in 2005**.
- ❑ Survey notes shall contain recorded elevations, pipe diameters, tank sizes, system types, and distances.

- Survey notes shall recorded any and all buried electric for the HSTS.
- As-builts shall be drawn neat, be properly scaled and shall contain all pertinent information from the installation.

2.7 Homeowner Education

Homeowner education is educating the end users on the proper care and maintenance for the type of system installed. Also, the end users are given available documentation for the installed system, such as installed product information and warranties, copy of as-built, and installer contact information. The end users are the ones that provided the dollars to install the HSTS, so they have the greatest vested interest in the proper functioning of the system. That is not to say that other involved parties have any less interest, but since the end user "pays the bill," their interest takes priority over others. It is therefore important that the following be accomplished to promote better understanding by the end users. The goal of this function is to eliminate the "flush and forget" mentality that prevails. It should emphasize the importance of end user's responsibility to maintain a HSTS to maximize the system's performance potential.

- Operation and function of the HSTS's control panel and alarm (if applicable) shall be reviewed by house occupants.
- General operation of the system should be understood by the owner, general contractor, or other responsible party.
- Operation manuals and any warranty information, if applicable, shall be given to the owner, general contractor, and/or responsible party.
- Basic system maintenance and monitoring requirements shall be explained to the homeowner, general contractor, or other responsible party.
- Septic tank maintenance and care shall be explained to the homeowner, general contractor, or responsible party.
- Homeowner, general contractor, or responsible party shall be given emergency contact information for that system.
- Installer shall ensured that the complete HSTS is functioning as intended prior to normal usage of the HSTS.
- For 2006, a chain-of-custody form will be added to requirements to ensure all HSTS documentation is received by the homeowner, general contractor or responsible party.

2.8 Considerations for HSTS Repair

The following items are those that shall require verification prior to beginning field activities. **Additionally, a signoff form, found in the Appendix, shall be completed by the installer/homeowner before final HSTS approval is given**. This form ensures that all household

wastewater is directed to the HSTS and no other clean water enters system.

- ❑ Adequate electric circuits to power the HSTS shall be available.
- ❑ "Added costs" due to electrical service panel replacement should be included, as applicable.
- ❑ Required isolation distances from various features can be maintained.
- ❑ Available HSTS area is identified during planning, so that sensitive areas may be protected.
- ❑ Presence of leaking pipes, allowing groundwater infiltration into the house drain shall be verified and eliminated.
- ❑ Verification and corrective action shall be taken, if necessary (applicable permits obtained, for example plumbing permit), ensuring that all piping tied into the HSTS is from household wastewater sources. All sources of wastewater shall be routed to the HSTS.
- ❑ Verification and corrective action shall be taken, if necessary to ensure that no downspout, foundation drain, and/or other non-wastewater sources are routed to the HSTS.
- ❑ Discharges of downspouts, foundation drains and/or other non-wastewater sources shall be directed away from the absorption area.
- ❑ Building sewer shall be replaced, back to the exit of the house, or as close as practically possible.
- ❑ Any leaking fixtures shall be properly identified and fixed by the installer/homeowner before final approval.

3 Section 3.0 Tanks

3.1 Definitions

A tank is any *watertight* vessel, chamber, or vault that is designed to contain a liquid. Several classes of tanks are defined based upon the purpose of the tank. The classes are septic tanks, dosing tank/basins, dosing septic tanks, filtrate sumps and other tanks. Other tanks include, but are not limited to, chlorine contact chambers, upflow filters, sample wells, etc.

Septic tanks are used to provide passive solids and fat/oil/grease removal through sedimentation and flotation. A dosing septic tank is a two compartment tank that serves as both a septic tank and a dosing basin. A dosing tank/basin and filtrate sump are the same type of tank. The difference in terms originates from the type of effluent each receives. A filtrate sump receives liquids from a pretreatment unit; while a dosing tank, typically, receives effluent from a septic tank.

3.2 Scope and Applicability

This section will cover the requirements for the sizing, and installation of septic tanks, dosing tanks, filtrate sumps, and dosing septic tanks. It will also provide requirements regarding the risers and other tank components, such as inlet/outlet seals, effluent filters, riser lids, etc. It is important that the Health District approved manufacturer's installation guidance is followed. This manual reflects that guidance, but the manufacturer (or tank vendor) must be consulted to obtain guidance directly from them.

3.3 General

The following are general requirements for all tanks that are part of an HSTS. These shall apply to all tanks regardless of location or function within the HSTS.

- ❑ Septic tank shall be approved by the Ohio Department of Health for use in the State of Ohio.
- ❑ Tanks shall be watertight.
- ❑ Riser to tank connections shall be watertight.
- ❑ Inlet and outlet seals shall be watertight and meet material specification of ASTM C-923.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.
- ❑ Tank shall be installed per Health District approved manufacturer's recommendations, for all tanks.

- In-field watertight tank test per Health District requirements shall be performed.
- *Tank shall be ballasted against flotation once set*.
- Tanks shall be approved by the tank manufacturer for installation and operation in the situation which they will be used.
- For Aerobic Treatment Systems, the guidance provided within Section 3.6 shall apply. The guidance applied shall be based upon the tank's material of construction.
- For proprietary treatment systems requiring special consideration due to the possibility that the system may be incorrectly loaded, the Minimum Operating Capacity can be sized to the manufacturer's specifications when preauthorized by the Health District. All other capacities shall be met.

3.4 Primary Tank Sizing

The following subsections are the requirements for the size or capacity for the septic tank and tank combinations for all HSTS. These subsections are broken down by the type of HSTS. The types are Advanced Technology, Dosed Conventional Systems, and Gravity Conventional Systems. Advanced Technology HSTS are ones that use a timer or other means to control the frequency of dosing, not including demand dosed HSTS's. Dosed Conventional Systems are HSTS systems that are dosed by demand (i.e. - dosing controlled solely by liquid levels in the dose tank). Gravity Conventional Systems are systems that deliver water to treatment components by gravity due to inflows into the septic tank (e.g. - conventional subsurface sand filter).

The total volume of the septic tank shall be derived from individual volume requirements for various capacities. The following definitions are given to assist in using the following tables and formulas.

- Daily Design Flow (DDF): Peak flow capacity of the system, based on 120 gallons per bedroom per day or as dictated by Regulation 529. Minimum of 360 GPD for tank sizing.
- Emergency Reserve Capacity (ERC): Tank capacity located above the level at which high water alarm is activated.
- Functional Capacity: Usable capacity to meet design objectives. Includes ERC, MOC, SC, and DC.
- Minimum Operating Capacity (MOC): Tank capacity located between tank bottom and lowest operating liquid level for primary treatment in the tank (tank portion that provides settling and flotation of solids).

- ❑ Surge Capacity (SC): Tank capacity located between emergency reserve capacity and minimum operating capacity; that is, between the lowest operating liquid level maintained in the tank for primary treatment and the level of the high water alarm activation.
- ❑ Dose Capacity (DC): Tank capacity located between the dosing pump's "ON" position and "OFF" position.
- ❑ Non-Functional Capacity: The volume required to satisfy conditions imposed by various factors. For example, the volume of water required to submerge a pump in a dosing basin or dosing septic tank is non-functional capacity. Also, demand dosed systems are required to maintain two (2") inches between the high water alarm and the "ON" elevation of a float; This is non-functional capacity.

3.4.1 Advanced Technology System

The following items are the requirements for these types of HSTS.

- ❑ Tank or tank combinations shall have functional capacities for the *sum* of all the following:
  - A) 80% of Daily Design Flow = *Emergency Reserve Capacity.*
  - B) 80% of Daily Design Flow (Based on actual liquid control/switch settings in the tank) = *Surge Capacity*.
  - C) Minimum of 250% of Daily Design Flow = *Minimum Operating Capacity*.
  - D) Volume to submerge a pump (for dosing basins and dosing septic tanks), if applicable, as required by the design.
  - E) Tank or tank combinations must always meet ODH minimums. If the sum of A), B), C) and D), above, is greater than the ODH minimum, then that capacity shall be used. (See the last column in Table 3.1 for guidance).
  - F) For proprietary systems, tank capacities shall *also* meet the manufacturer's minimum specifications, if different than what is stated above.

The following table summarizes the tank sizing criteria for this section:

Number of Bedrooms	Daily Design Flow, "DDF" (gal/day)	(C) Minimum Operating Capacity, "MOC" (gal)	(A) Emergency Reserve Capacity, "ERC" (gal)	(B) Surge Capacity, "SC" (gal)	Sum (A) (B) & (C) (gal)	ODH Minimum Tank Size (gal)	Minimum Required Tank Size (gal)
1,2,3	360	900	288	288	1,476	1,500	1,500
4	480	1,200	384	384	1,968	2,000	2,000
5	600	1,500	480	480	2,460	2,000	2,500
6	720	1,800	576	576	2,952	2,500	3,000
7	840	2,100	672	672	3,444	2,500	3,500

Table 3.1 - Breakdown of Tank Combination Sizing Requirements. Minimum 1500 gallon Tank.

3.4.2 Demand Dosed Conventional System

The following items are the requirements for these types of HSTS systems.

- ❑ Tank or tank combinations have functional capacities for the ***sum*** of all the following:
  - A) 100% of Daily Design Flow = *Emergency Reserve Capacity.*
  - B) 100% System Specific Dose Volume = *Dose Volume Capacity.*
  - C) Minimum of 250% of Daily Design Flow = *Minimum Operating Capacity.*
  - D) Volume to submerge a pump and other Non-Functional Capacities (for dosing basins and dosing septic tanks), if applicable.
  - E) Tank or tank combinations must always meet ODH minimums. If the sum of A), B), C) and D), above, is greater than the ODH minimum, then that capacity shall be used. (See the last column in Table 3.1 for guidance).
  - F) For proprietary systems, tank capacities shall *also* meet the manufacturer's minimum specifications, if different than what is stated above.

The following general formula shall be used to guide the sizing of tank(s) for a *demand dosed conventional system*:

$$TankageVolume = [2.5 \times DDF] + [DoseVolume] + [1.0 \times DDF] + [Non - FunctionalCapcity]$$

Equation 3.1 - General Capacity Formula for a Demand Dosed Conventional Systems.

The tankage volume calculated by the above equation shall be used for general guidance or consideration of proposing changes to the required tankage. The result of the above equation shall be checked against the ODH minimum tankage volumes. The larger of ODH minimum tank volumes and tank volume calculated using the formula above shall be selected for a given number of bedrooms or daily peak flow rate as stated in Regulation 529, whichever is greater.

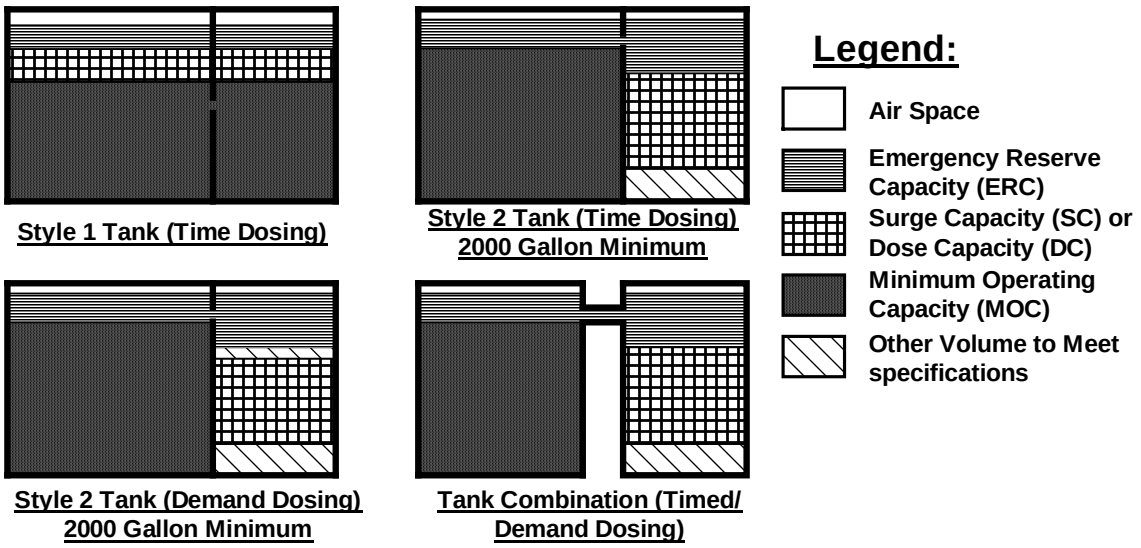


Figure 3.1 - Tank Sizing Criteria Schematic. For Style 2 tanks, the minimum tank capacity shall be one size larger than the size found in Table 3.1 with a minimum of 2000 gallons.

3.4.3 Gravity Conventional System

Table 3.2 gives the minimum tank volumes that shall be required for gravity conventional HSTS. (Note that for a one (1) or two (2) bedroom HSTS that the minimum total volume is fifteen hundred (1,500) gallons).

Number of Bedrooms	Daily Design Flow	Minimum Required Tank Capacity (gal)
2	240	1,500
3	360	1,500
4	480	2,000
5	600	2,000
6	720	2,500
7	840	2,500

Table 3.2 - Gravity Conventional Systems Tank Sizing. (Hamilton County).

3.4.4 Primary Tank Volume Reductions

The volumes within the primary tank may be reduced based on the following:

3.4.4.1 Non-Proprietary Treatment Systems

Provided that:

- ❑ The system is for a four bedroom or larger home, **AND**
- ❑ The system control panel is equipped with telemetry which shall alert a contracted Registered Operator or backup Registered Operator and the Health District by phone, or internet 24/7 when there is an alarm condition in the treatment system. There shall be, as a condition of the maintenance agreement, a maximum of 24 hours between the time of an alarm and the arrival of a service provider at the site.

Then:

- ❑ 60% of Daily Design Flow = *Emergency Reserve Capacity.*
- ❑ 60% of Daily Design Flow (Based on actual liquid switch/control settings in the tank) = *Surge Capacity*.
- ❑ All other tank volumes are the same.

3.4.4.2 Proprietary Treatment Systems

Provided that:

- ❑ The system has the current NSF Standard 40 rating or Health District approved equivalent.
- ❑ The system control panel is equipped with telemetry which shall alert a contracted Registered Operator or backup Registered Operator and the Health District by phone, or internet 24/7 when there is an alarm condition in the treatment system. There shall be, as a condition of the maintenance agreement, a maximum of 24 hours between the time of an alarm and the arrival of a service provider at the site.

Then:

- ❑ 50% of Daily Design Flow = *Emergency Reserve Capacity.*
- ❑ 50% of Daily Design Flow (Based on actual liquid control/switch settings in the tank) = *Surge Capacity*.
- ❑ All other tank volumes shall be the same.

3.5 Location and Depth of Placement

The location and the depth of the tank must be planned. The following shall be considered:

- ❑ Tank location shall comply with Health District's required isolation distances.
- ❑ Tank depth shall not exceed the manufacturer's specified burial depth or those that follow below. This may exclude certain tanks, depending on type of system and site conditions.
  - ❑ For Gravity Systems, maximum burial depth shall be two (2') feet.
  - ❑ For Pumped Systems, maximum burial depth shall be three (3') feet.
- ❑ Tank depth shall not exceed the Health District's maximum for riser heights for conventional and advanced technology, except for system repair/replacement situations where no other options exist.
- ❑ Depth and location shall be generated from the installation plan and shall be verified.
- ❑ Tank location shall allow for future servicing of the tank.
- ❑ ***Design constraints of tank shall override all other considerations.***

3.6 Tank Installation

Today's market offers varying tank choices based upon material of construction. Pre-cast concrete tanks, plastic tanks and fiberglass tanks are available for use in HSTS. Any of these choices provides a viable means to achieve the goals. Each type of tank, however, does require specific installation practices that are specified by a manufacturer, or manufacturer's association to ensure a good tank installation. Guidance in this manual will be provided based on the tank's material of construction. ***Installers shall always consult with the tank vendor/manufacturer to obtain the Health District approved guidance on the installation of that specific tank.***

3.6.1 Precast Concrete (PCC) Tanks

"Proper installation of the tank is absolutely necessary for maintaining the watertightness produced in the plant. Many of the problems experienced with leakage can be attributed to incorrect procedures

during installation." (Stated in National Precast in the Association Septic Tank Manufacturing Best Practices Manual)

The following is a checklist summary for the installation of PCC tanks:

3.6.1.1 Tank Excavation

- ❑ Shall follow the Health District approved manufacturer specifications.
- ❑ Firm and uniform base of virgin soil shall be achieved.
- ❑ Any soft or organic soils shall be removed.

3.6.1.2 Tank Bedding

- ❑ Shall provide level bearing surface, free of rocks, boulders and deleterious material. Deleterious material is any material that may have a harmful effect. Some examples are organic debris and materials not meeting specifications.
- ❑ Minimum of four (4") inches clean gravel shall be provided, **or** greater if required by tank manufacturer (**Do Not Use** ODOT #304 or other "crusher run" stone).
- ❑ When rock is encountered in the excavation, a minimum of six (6") inches clean gravel shall be provided, or greater if required by the tank manufacturer.

3.6.1.3 Tank Joint Seals

The following shall apply to two (2) piece PCC Tanks

- ❑ Joint preparation and sealing shall be performed in accordance with the most recent National Precast Concrete Association Tank Manufacturing Best Practices Manual and in accordance with the Health District approved manufacturer's specifications.
- ❑ Joint sealant shall be allowed to fully compress before tank is backfilled (Check with tank manufacturer for settling time vs. ambient temperature requirements).

3.6.1.4 Tank Backfilling

- ❑ Backfill material shall be a manufacturer approved gravel listed in Section 4.0**; *or***,
- ❑ Backfill shall be a gravel which is preapproved by the Health District and the Tank Manufacturer.
- ❑ Backfill shall be free of large rocks (Less than three (3") inches, along the longest dimension).
- ❑ Level of water inside the tank shall not exceed the level of fill outside the tank, during backfilling operations.
- ❑ Tank backfill shall provide uniform support for piping entering and exiting the tank.

- ❑ Manufacturer's backfilling procedure shall be followed when more stringent/elaborate.

3.6.1.5 Tank Riser(s)/Riser Connections

- ❑ See Section 3.11.
- ❑ Riser ring adapters shall be cast into the tank top to secure the riser, **or** risers shall be monolithically cast with the "lid" of the tank. "Grooved" or "flat" riser connections shall not be permitted.
- ❑ Riser seal shall be in accordance with riser manufacturer's specifications.
- ❑ Riser seal shall be **watertight.**
- ❑ Riser seal shall not be affected by backfilling activities.
- ❑ Riser seal shall not be affected by frost heave actions (no deflection or movement).
- ❑ Riser seal shall not be sealed with silicone sealant, latex caulks, hydraulic cement, or mortar.
- ❑ Riser seal shall be sealed with a product meeting the manufacturer's specifications.
- ❑ When PVC risers are used, the contact surfaces of the risers and adapters shall be roughened prior to application of adhesive.

3.6.1.6 Tank Inlet/Outlet Pipe Connectors

- ❑ Connectors shall be watertight.
- ❑ Connectors provided shall be cast as part of the tank.
- ❑ Boot style connectors, compression seals shall be used meeting or exceeding ASTM C-923 (No tear seal gaskets shall be allowed).
- ❑ Mortar, pipe-to-pipe couplings, mastics or sand collars grouted in cored holes shall not be used to attempt to seal a pipe to a tank.
- ❑ Hydraulic cement shall not be used to attempt a watertight seal.
- ❑ Seals shall not be sealed with silicone sealant, latex caulks, hydraulic cement, or mortar.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.

3.6.1.7 Final Grade

- ❑ Final grade shall have a minimum uniform slope away from the tank/risers of 16H:1V (six (6") inches of fall in eight (8') feet).
- ❑ Tank backfill shall be adequately compacted to reduce the potential for depression formation around tank.

- ❑ Final grade shall not cause minimum or maximum burial depths to be exceeded (check with tank manufacturer for minimums and maximums).
- ❑ Maximum burial depth for PCC tank shall be three (3') feet or less depending on structural strength. (For ease of access for servicing and inspection).

3.6.1.8 Protection

- ❑ "If the water level in the hole is allowed to rise to a high level, concrete tanks can float. To prevent flotation during backfilling, fill the tank with water, place soil on top of the tank or keep water pumped out of the hole until backfilling is completed." (Stated in National Precast Concrete Association Septic Manufacturing Best Practices Manual).
- ❑ Protection shall be provided to prevent vehicle damage to risers, lids and tanks that are not designed for this type of loading condition, during and after system installation.

3.6.1.9 Reference

Best Practices Manual
National Precast Association
10333 North Meridian Street
Suite 272
Indianapolis, IN 46290
(Voice) 800.366.7731 or 317.571.9500
(Fax) 317.571.0041
www.precast.org

3.6.2 Fiberglass Tanks

The following guidance shall apply to tanks that are fabricated from fiberglass materials. This guidance is not intended to replace Health District approved vendor and/or manufacturer specifications for the installation of these types of tanks.

3.6.2.1 Tank Excavation

- ❑ Shall be excavated as required by tank manufacturer.
- ❑ Firm and uniform base of virgin soil shall be provided..
- ❑ Any soft or organic soils shall be removed.

3.6.2.2 Tank Bedding

- ❑ Shall provide level bearing surface, free of rocks, boulders and deleterious material.
- ❑ Bedding shall be provided per Health District approved manufacturer's requirements.

3.6.2.3 Tank Seam

- ❑ Tank seam shall be tested at time of assembly to ensure watertight tank joint.

3.6.2.4 Tank Backfilling

- ❑ Backfill material shall be a gravel material per Health District approved manufacturer's specifications.
- ❑ Backfill shall be free of deleterious material.
- ❑ Level of water inside the tank shall not exceed the level of fill outside of the tank.
- ❑ Tank backfill shall provide uniform support for piping entering and exiting the tank.

3.6.2.5 Tank Riser(s)/Riser Connections

- ❑ See Section 3.11 Risers/Lids for general requirements.
- ❑ Riser seal shall be in accordance with Health District approved manufacturer's specifications.
- ❑ **Riser seal shall be watertight.**
- ❑ Riser seal shall not be affected by backfilling activities.
- ❑ Riser seal shall not be affected by frost heave actions.
- ❑ Riser seal shall not be sealed with silicone sealant, latex caulks, hydraulic cement or mortar.
- ❑ The contact surfaces of risers and adapters shall be roughened prior to application of adhesive.
- ❑ Risers shall be capable of resisting forces from frost heave without deflection or movement.

3.6.2.6 Tank Inlet/Outlet Pipe Connectors

- ❑ Connectors shall be watertight.
- ❑ Connectors shall be provided as part of tank.
- ❑ Connectors shall meet, or exceed material requirements of ASTM C-923 (No tear seal gaskets are allowed).
- ❑ Connectors shall be bonded to tank, per Health District approved manufacturer's/vendor's specification.
- ❑ Mortar, pipe-to-pipe couplings, mastics, silicone or latex caulks shall not be used to seal a pipe to a tank.
- ❑ Hydraulic cement shall not be used to attempt a watertight seal.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.

3.6.2.7 Final Grade

- ❑ Final grade shall have a minimum uniform slope away from the tank/risers of 16H:1V (or six (6") inches of fall in eight (8') feet).

- ❑ Tank backfill shall be adequately compacted to reduce the potential for depression formation around tank.
- ❑ Shall not cause the maximum, or minimum burial depth to be exceeded.

3.6.2.8 Protection

- ❑ Fiberglass tanks shall be protected against floatation. Measures must be taken to provide ballast against this action.
- ❑ Unless certified by the manufacturer, vehicle traffic shall not be permitted on top of installed tank.
- ❑ Protection shall be provided to prevent vehicle damage to risers, lids and tanks that are not designed for this type of loading condition.

3.6.3 Plastic Tanks

The following guidance applies to tanks that are fabricated from plastics. This guidance is not intended to replace vendor and/or manufacturer specifications for the installation of these types of tanks. It shall be required that the Health District approved manufacturer specifications for these tanks are followed.

3.6.3.1 Tank Excavation

- ❑ Shall be as required by the Health District approved tank manufacturer specifications.
- ❑ Firm and uniform base of virgin soil shall be provided.
- ❑ Any soft or organic soils shall be removed.

3.6.3.2 Tank Bedding

- ❑ Shall provide level bearing surface, free of rocks, boulders and deleterious material.
- ❑ Bedding shall be provided per Health District approved manufacturer's requirements.

3.6.3.3 Tank Setting

The following must be carefully considered during the planning of the layout of the HSTS.

- ❑ Layout and depth of placement shall be planned before setting tank(s) so that tank capacities of Minimum Operating Capacity, Surge/Dose Volume(s), and Emergency Reserve Capacities, as applicable, will be met ***and*** manufacturer's recommended maximum burial depth will not be exceeded and minimum burial depths will be met.

3.6.3.4 Tank Backfilling

- ❑ Health District approved manufacturer specified gravel backfill shall be used.
- ❑ Backfill shall be free of rocks that are greater than three (3") inches along the longest dimension.
- ❑ Backfill shall be free of deleterious material.
- ❑ Level of water inside the tank shall not exceed the level of fill outside of the tank, unless otherwise specified by the tank manufacturer.
- ❑ Tank backfill shall provide uniform support for piping entering and exiting the tank.

3.6.3.5 Tank Riser(s)/Riser Connections

- ❑ See Section 3.11, Risers/Lids for general requirements.
- ❑ Riser seal shall be in accordance with Health District approved manufacturer's specifications.
- ❑ **Riser seal shall be watertight.**
- ❑ Riser seal shall not be affected by backfilling activities.
- ❑ Riser seal shall not be affected by frost heave actions.
- ❑ Riser sealant shall not be silicone, latex caulks, hydraulic cement or mortar. Riser sealant shall be approved by tank manufacturer.
- ❑ Risers shall be capable of resisting forces from frost heave without deflection or movement.

3.6.3.6 Tank Inlet/Outlet Pipe Connectors

- ❑ Connectors shall be watertight.
- ❑ Connectors provided shall be part of tank.
- ❑ Connectors shall meet, or exceed material requirements of ASTM C-923 (No tear seal gaskets are allowed).
- ❑ Mortar, pipe-to-pipe couplings, mastics, silicone or latex caulks shall not be used to seal a pipe to a tank.
- ❑ Hydraulic cement shall not be used to attempt a watertight seal.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.

3.6.3.7 Final Grade

- ❑ Final grade shall have a minimum uniform slope away from the tank/risers of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Tank backfill shall be adequately compacted to reduce the potential for depression formation around tank.
- ❑ Final grade shall not cause maximum or minimum burial depth to be exceeded.

3.6.3.8 Protection

- ❑ Plastic tanks shall be protected against floatation. Measures shall be taken to provide ballast against this action.
- ❑ Unless certified by the manufacturer, vehicle traffic shall not be permitted on top of installed tank.
- ❑ Protection shall be provided to prevent vehicle damage to risers, lids and tanks that are not designed for this type of loading condition.

3.7 Watertight Tank Field Test

All tanks shall be tested in the field for watertightness. ***This test shall be witnessed by the Health District, unless Conditions for Exemption of Watertight Field Test Procedure are met.*** It is highly recommended that the installer perform this test before the certifying test to prove to themselves that a given tank is watertight.

Two procedures are given for the watertight field test. One is for PCC tanks; the other is for fiberglass/plastic tanks. The difference in the tests is to accommodate the different requirements between PCC tanks and fiberglass/plastic tanks. **NOTE: Piping used in the watertight field test penetrating the tank must become part of the permanent system. Pipe segments shall not be removed after successful completion of this test.**

3.7.1 PCC Tanks (Includes Filtrate Sumps) – Watertight Field Test Procedure

This procedure is presented in a step-by-step fashion:

1. Install tank, risers, inlet and outlet pipes per Health District approved manufacturer's specifications and Health District's requirements.
2. Fill tank with water so that the tank body joint is submerged, for mid tank joint (Goto #4 for top tank joint).
3. Check for leakage at this location:
    a. If no leakage noted, goto #4.
    b. If leakage noted:
        i. Contact tank vendor to have leak repaired.
            1. **<u>DO NOT USE</u>**: Silicone, latex caulks, mortar or hydraulic cement to repair leak(s).
        ii. Repeat #2 & #3 until no leakage is noted.
4. Backfill tank per Health District approved specifications.
5. Place fill material on top of the tank to provide ballast.
6. Fill tank so that water is at least two (2") inches above the riser/tank joint. Allow time for concrete to absorb water (twenty-four (24) hours).

7. Add water as necessary to give no more than two (2") inches of water above the tank/riser joint, but at least above the tank/riser joint.
8. Water adjacent to the exterior of the tank is removed so that ponding is below the tank joint or the outlet penetration, whichever is lower. ***NOTE**: Water ponded within tank excavation above the lower of these two points is grounds for failure.*
9. **STOP** Health District must witness watertight tank test. The following steps are performed by the Health District:
   a. Water level within riser is marked and time is noted.
   b. After one (1) hour, water level is checked against mark.
   c. If water level has not changed: Tank passes. Water level changes: Tank is not watertight. (The installer must take corrective action to find & repair leakage). *NOTE: Tank repairs must be made in accordance with the manufacturer's specifications which are acceptable to the Health District.* After corrective action was taken, above steps a. thru c. are repeated, usually at the next inspection or re-inspection.
   d. Test failures and repairs will be documented in the inspection record.

3.7.2 Plastic/Fiberglass (including filtrate sumps) – Watertight Tank Field Test Procedure

This procedure is presented in a step-by-step fashion:

1. Install tank, risers, inlet and outlet pipes per manufacturer's and Health District's requirements.
2. Backfill tank per Health District approved specifications.
3. Place fill material on top of the tank to provide ballast against flotation.
4. Fill tank so that water is at least two (2") inches above the riser/tank joint.
5. Ponded water, adjacent to the exterior of the tank is removed to point below the outlet penetration. **NOTE**: Water ponded within tank excavation above this point is grounds for failure.
6. **STOP** Health District must witness watertight tank test. The following steps are performed by the Health District:
   a. Water level within riser is marked and time is noted.
   b. After one (1) hour, water level is checked against mark.
   c. If water level has not changed: Tank passes. Water level changes: Tank is not watertight. (The installer must take corrective action to find and repair the

leakage). *NOTE: Tank repairs must be made in accordance with the manufacturer's specifications which are acceptable to the Health District.* After corrective action was taken, above steps a. thru c. are repeated, usually at the next inspection or re-inspection.

d. Test failures and repairs will be documented in the inspection record.

3.8 Pump Installation

This Section applies to HSTS that rely on a pump to dose a HSTS component, such as a proprietary treatment unit, or mound.

- ❑ Pump shall be capable of supplying the required flow rate and TDH to provide distribution as required by the design.
- ❑ Pump discharge piping shall have a glued horizontal quick disconnect within ten (10") inches of the top of the riser.
- ❑ Nylon lift rope shall be supplied and secured, as required.
- ❑ Electric shall be installed per Section 8.0.
- ❑ Centrifugal pump shall be on a minimum of six (6") inch block off the bottom, or turbine pump shall be within a properly designed flow inducer.
- ❑ Schedule 40 PVC gate valve shall be supplied, if required by the design. Gate valve shall be installed in line with pump discharge assembly and within ten (10") inches of riser lid.
- ❑ Check valve shall be installed, if required by the design.
- ❑ Pump discharge piping shall be installed so that removal of a screened pump filter does NOT require removal of the pump or discharge piping to remove the filter for inspection and maintenance.
- ❑ Pump shall be located in tank that is downstream of an effluent filter or within a screened pump vault.
- ❑ Flow rate of pump shall be verified by timed draw down test or other approved method.

3.8.1 Flow Rate Testing of Installed Components

For Advanced Technology Systems, it shall be required that the flow rate of the installed and adjusted system be measured. It is particularly important for the longevity of the system and for future operation and maintenance. In order to measure the flow rate of any HSTS, the following items must be completed before the flow rate test.

- ❑ All fittings and pipes segments shall be solvent welded and glued.
- ❑ Distribution network shall be properly flushed (Section 5.14).
- ❑ Weep hole(s) shall be properly drilled.
- ❑ Operating head shall be properly set (Section 5.9.1).
- ❑ Distribution network clean outs shall be closed.

Sections 3.8.1.1 & 3.8.1.2 are the two (2) Health District approved methods for determining the flow rate of a system which does not have a flow meter. They are the Timed Draw Down Test and the Control Volume Test. The Timed Draw Down Test measures an unknown volume of water pumped through a system for a known period of time. The Control Volume Test measures the time to pump a known volume of water.

3.8.1.1 Timed Draw Down Test

This test measures the amount of liquid pumped for a given period of time (typically two to four (2-4) minutes). The amount of liquid pumped is calculated using tank geometry and water level measurements within the tank. The following shall be the procedure for the timed draw down test:

1. No flows coming into tank (Inlet sealed if necessary).
2. Liquid level in the tank is within the ***expected normal operating range*** for the system design.
3. Measure to the nearest eighth ($^1/_8$") inch the distance from a straight edge across the riser opening to the water surface. Record this measurement.
4. Run the pump for two (2-4) minutes (or other specified time period).
5. Repeat step 3., measuring from the straight edge to the water surface again.
6. Compute gallons pumped based on tank geometry.
7. Divide gallons pumped by 2 (or other appropriate time increment).
8. Answer from Step 7. is the gallons pumped per minute.

3.8.1.2 Control Volume Test

This test measures the time to pump a known amount of liquid. The amount of liquid pumped is calculated using the liquid volume between the *Set Points* and the field-measured time to pump this predetermined liquid volume. The following is the procedure for the Control Volume Test:

1. No flows coming into the tank (inlet sealed, if necessary).
2. Liquid level in the tank is set to the level of the stipulated starting liquid level. Set the liquid level by measuring the distance from a straight edge across the riser opening to the water surface.
3. Start the pump and stop watch.
4. Measure the time it takes for the liquid level in the tank to drop from the “Start” liquid level to the “Stop” liquid level.
5. Record this time. Convert all time units into decimal minutes (6 seconds = 0.10 minutes).

6. Divide the Manufacturer/Vendor supplied liquid volume between set points by the time (in decimal minutes) to arrive at the system flow rate.
7. Answer from Step 6., is the flow rate of the system in gallons per minute.

3.8.1.3 Flow Meter Test

This test utilizes a mechanical or an acoustical device that responds to the movement of fluid within a piped system. Some mechanical and acoustical (Doppler flow meter) devices use the geometry of pipe at the measurement point and fluid velocity to deduce the flow rate of the system. Other mechanical devices use the pipe geometry and volume of fluid passing thru the device to indicate water through that point in the system. For this type of devices, the volume of water pumped over time must be known to calculate the flow rate of the system; thus, requiring a time measurement component and a calculation.

3.9 Effluent Filter

An effluent filter is a device that is used to separate solids from liquids. They shall be used to filter the effluent from a septic tank. Aerobic HSTS, which are designed to digest solids, do not have to meet these specifications. The following are the requirements for all effluent filters. All effluent filters must meet the conditions of Section 3.9.1.

3.9.1 General

- ❑ Effluent filters shall be installed on any primary dosed treatment system, including timed dosed and demand dosed systems.
- ❑ Effluent filter shall be installed to allow easy removal for inspection and maintenance, without removal of any pump, pump piping, or supports.
- ❑ Alarm shall be provided to alert of filter servicing needs.
- ❑ Effluent filter shall be capable of retaining any solids that are larger than one sixteenth ($^{1}/_{16}$") inch as liquid passes through the filter.
- ❑ Effluent filter shall have a minimum usable surface area that does not require inspection/service at an interval less than normal maintenance intervals.
- ❑ Effluent filter shall have a minimum open area equal to or greater than one hundred (100) square inches.
- ❑ Effluent filter shall be rated for commercial use.
- ❑ Filter handles shall be installed to within ten (10") inches of riser lid.

3.9.2 Dosing Septic Tank Effluent Filter Types

The following shall be the two categories of effluent filter specifications for either a shared liquid level dosing septic tank (style 1) or a non-shared liquid level dosing septic tank (style 2).

3.9.2.1 Screen Vault Filter (Style 1 Tank)

Filters used within a Style 1 dosing septic tank shall meet the following:

- ❑ The filter shall meet the requirements of Section 3.9.1.
- ❑ Screen vault filter shall be capable of retaining any solids that are larger than one eighth ($^1/_8$") inch as liquid passes through filter.
- ❑ Pump that is installed shall not exceed the filters maximum flow rate.
- ❑ Filter inlet holes shall be within the clear zone of the tank.
- ❑ Screen vault filter shall have a minimum open area equal to or greater than five hundred (500) square inches.

3.9.2.2 Special Effluent Filters (Style 2 Tank)

Filters used within a Style 2 dosing septic tank shall meet the following:

- ❑ The filter shall meet the requirements of Section 3.9.1.
- ❑ Filter shall be rated for commercial use.
- ❑ Filter shall be capable of filtering solids that are one thirty-second (1/32') inch and larger.
- ❑ Filter shall have a minimum open area equal to or greater than seven hundred and seventy (770) square inches.
- ❑ Filter shall have a filtering surface area equal to or greater than two thousand eight hundred and fifty (2850) square inches.

3.10 Floats/Transducers Settings

This section provides general guidance on the set-up of float/transducer switches/controls used for time dosed systems and demand dosed systems. The system's switch/control settings (or liquid levels in a dosing tank) require consideration of system specific requirements.

3.10.1 General

The following items shall apply to any and all switches/controls within a HSTS regardless of location or application.

- ❑ Narrow angle, signal rated float controls (or a transducer) shall be used in conjunction with motor contactors/solid state pump control relays in the control panel to operate any pumps where accuracy is needed to meet liquid level requirements in dosing tanks and/or where precision is needed in dosing.

- ❑ Floats/transducers shall be able to move freely, without any interference from flowing water, adjacent floats, piping, wires, pump, or other feature that may cause conflict.
- ❑ Float cord ends shall be protected from moisture.
- ❑ Floats/transducers shall be placed on their own support tree with only one lock in position (not relying on pump discharge for support), for ease of servicing.
- ❑ Float/transducer support mechanisms shall lock into an exact position.
- ❑ Float trees and support mechanisms shall be non-corrosive.
- ❑ Adequate cord length or transducer umbilical tubing shall be provided to allow float/transducer removal from tank during times service or inspection.
- ❑ Floats/transducer shall be set up to achieve the minimum requirements in 3.4.1, 3.4.2, 3.4.4, or 3.12 depending on the application. Surge and reserve volumes shall be maximized.
- ❑ Excess float cords/transducer umbilical tubing shall be gathered up neatly and zip tied out of the way.

3.10.2 Floats/Transducers Switches and Controls – Time Dosing Applications

- ❑ Tether length of floats shall be set-up per the manufacturer's recommended length.
- ❑ Narrow angle, signal rated float controls (or a transducer) shall be used in conjunction with motor contactors/solid state pump control relays in the control panel to operate any pumps where accuracy is needed to meet liquid level requirements in dosing tanks and/or where precision is needed in dosing (Ex. Mounds, ISF's Time dosed HSTS shall operate on a three or four control (float or transducer) system. The controls shall be:
  - ❑ Low Level/Redundant Off Control - Must cut power to the pump which it controls when the liquid level drops below the sensor and activate the low level alarm.
  - ❑ Timer Enable Control – Must activate the programmable timer for controlling the pump and allow the pump to dose at the Average Design Flow.
  - ❑ Timer Override/Peak Enable Control – Must activate the programmable timer override function for controlling the pump and allow the pump to dose at the Peak Design Flow.
  - ❑ High Level Control – Must activate the High Level Alarm. This control may be combined with the Timer Override/Peak Enable Control.
- ❑ See Section 8.11.1 for other float/transducer to control panel interactions.

3.10.3 Floats/Transducers Switches and Controls – Demand Dosing Applications

- ❑ High water alarm setting shall be set two (2") inches above the "ON" float or "ON" position. (This provides the homeowner timely warning of a problem).
- ❑ Tether lengths shall be set at the manufacturer's minimums for float setup that have separate "ON" and "OFF" floats, whether motor-rated or signal-rated.
- ❑ Tether lengths for dual function floats (e.g., One (1) float providing "ON" and "OFF" capabilities) shall be installed per the manufacturer's specifications to achieve the required distance between the float activation points.
- ❑ For separate "ON" and "OFF" floats, both floats shall have equal tether lengths.

3.11 Risers/Lids

The following shall apply to all risers used on a tank/basin (See Sections 3.6.1.5, 3.6.2.5, and 3.6.3.5).

- ❑ Minimum riser diameter shall be:
  - ❑ Circular: eighteen (18") inch diameter (24" for risers containing pump or other components needing service)
  - ❑ Rectangular: eighteen (18") inch shortest side length (24" for risers containing pump or other components needing service)
- ❑ Risers shall be capable of resisting forces from frost heave without deflection or movement.
- ❑ Maximum number of riser joints shall be one (1) per porthole (Exceptions may be made for replacement systems)
- ❑ The number of riser extensions shall be minimized. (ex. if a 12" extension is needed use one 12" NOT two 6" extensions.)
- ❑ Riser shall be constructed of rigid, watertight sidewall construction, extending minimum four (4") inches above original grade. Interior wall shall be smooth.
- ❑ Final grade shall be to the lid of the riser and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads used).

3.12 Dosing Basins/Filtrate Sumps

The following section will apply to basins or sumps used to collect/store effluent for the purpose of pumping to the next component within a treatment train. Typically, these are used for the purpose of dosing the soil absorption component of the treatment train following a pre-treatment component such as a textile packed bed filter, peat packed bed filter or intermittent sand filter. The following apply to all dosing basins/filtrate sumps.

- ❑ Shall be sized:
  - ❑ To keep pump submerged.
  - ❑ With enough volume to properly dose the next system component.
  - ❑ So that effluent quality does not significantly degrade within the basin.
  - ❑ To allow for the inlet invert and any weep hole to be freely draining with six (6”) inches of freeboard.
- ❑ Minimum dimensions shall be:
  - ❑ Circular: eighteen (18") inch diameter.
  - ❑ Rectangular: eighteen (18") inch shortest side length.
- ❑ Shall be constructed of rigid, watertight construction, extending minimum four (4") inches above original grade.
- ❑ Interior wall shall be smooth.
- ❑ Connectors shall be watertight.
- ❑ Connectors shall meet, or exceed material requirements of ASTM C-923 (No tear seal gaskets are allowed).
- ❑ Mortar, pipe-to-pipe couplings, mastics, silicone or latex caulks shall not be used to seal a pipe or riser to a tank.
- ❑ Hydraulic cement shall not be used to attempt a watertight seal.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.
- ❑ Final grade shall be to lid of the riser and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads used).

4 Section 4.0 Aggregates and Cover

4.1 Definition

Aggregates are a broad class of granular materials (or non-cohesive soils). Examples of aggregates are sand and gravel. They are used for a variety of purposes such as media for the treatment of HSTS liquids, pipe support, and backfill material.

Cover materials are specific soils used to backfill overtop and around an HSTS. Examples include sand loam topsoil, topsoil, and other site soils. These materials are used to establish proper slope, prevent erosion, and generally protect the HSTS.

4.2 Scope and Applicability

This section provides specifications for aggregates that are placed within the treatment train. An example is sand in a subsurface sand filter. It will also provide guidance for other uses of aggregates in a HSTS, for example, aggregate for pipe support. This section does provide guidance on gravel backfill acceptable for many tanks. However, the vendor or manufacturer is to be consulted regarding the exact gravel material and methodologies. The aggregates for which specifications will be given are sand, #57 stone, and #8 stone.

4.3 Stockpiling Requirements

The following are general requirements that shall apply to all aggregates.

- ❑ Aggregates stockpiles shall be located so that any equipment traffic will not damage the soil absorption area.
- ❑ Aggregates shall be maintained in separate, distinct stockpiles, to avoid mixing.
- ❑ Material shall be stockpiled in an area not subject to water ponding.

4.4 Miscellaneous Aggregates

Miscellaneous aggregates are those that have general uses such as pipe support. These do not include any aggregates that are used within a treatment system of any HSTS system or aggregates used to backfill a tank.

- ❑ Mason's sand is not acceptable and shall not be used as an bedding or filling aggregate.
- ❑ **Aggregate material shall be compacted**.
- ❑ Aggregate material shall not be co-mingled with any organic material, soil or other deleterious material.

- ❑ Maximum particle size of aggregate shall be two (2") inches in diameter.
- ❑ For thicknesses greater than twenty-four (24") inches of miscellaneous aggregate, material shall be placed in lifts and compacted.
- ❑ Aggregate shall contain a minimal quantity of fines (i.e. - clay size particles).

4.5 ODOT #57 Stone (Rounded)

#57 stone is a graded aggregate of varying sizes that is used in HSTS. The following is a list of HSTS uses for this aggregate.

- **Subsurface Sand Filter**
- **Gravel Leach Line Trenches**
- **Intermittent Sand Filters**
- **Pressurized Leach Beds**

The following shall be the specifications for usage in HSTS applications within the Health District's jurisdiction.

- ❑ ***#57 stone shall be rounded, not angular*** (i.e.- graded crushed limestone shall ***NOT*** be permissible).
- ❑ #57 stone shall meet gradation requirements of ODOT 703.01 (AASHTO M 43).
- ❑ #57 stone shall not exceed 1.0% by weight passing the No. 200 (75 μm) sieve when tested in accordance with AASHTO T11or ODOT Supplement 1004. *Note*: 1.5% by weight passing the No. 200 sieve shall be permissible if the material is essentially free of clay and shale materials.
- ❑ #57 shall meet the quality requirements of ODOT 703.02(B)(2). Deleterious substances shall not exceed percent by weights for super-structures.
- ❑ Material shall be approved for use as #57 stone, by ODOT or by the Health District.

4.6 ODOT #8 Stone (Rounded)

#8 stone is a graded aggregate of varying size that is used in HSTS. The following is a list of HSTS uses for this aggregate.

- **Mound/Modified At-grades/Modified Mounds**
- **Intermittent Sand Filters**
- **Pressurized Leach Beds**

The following shall be the specifications for usage in HSTS applications within the County.

- ❑ #8 stone shall be rounded not angular.
- ❑ #8 stone shall meet gradation requirements of ODOT Item 703.01 (AASHTO M 43).

- ❑ #8 stone shall not exceed 1.0% by weight passing the No. 200 (75 μm) sieve when tested in accordance with AASHTO T11or ODOT Supplement 1004. *Note*: 1.5% by weight passing the No. 200 sieve shall be permissible if the material is essentially free of clay and shale materials.
- ❑ #8 shall meet the quality requirements of ODOT Item 703.02(B)(2). Deleterious substances shall not exceed percent by weights for super-structures.
- ❑ Material shall be approved for use as #8 stone, by ODOT or by the Health District.

4.7 ODOT #57 or #8 Stone (Angular)

#57 or #8 stone is a graded aggregate of varying size that is used in HSTS. The following is a list of HSTS uses for this aggregate.

- **Pretreated Effluent - Modified At-grades/Modified Mounds**
- **Pretreated Effluent - Intermittent Sand Filters**
- **Pretreated Effluent - Pressurized Leach Beds**

The following shall be the specifications for usage in HSTS applications within the County.

- ❑ ***#57 stone may be angular*** (i.e.- graded crushed limestone is permissible).
- ❑ See Section 4.5 ODOT #57 Stone (Rounded) for the gradation and quality requirements of this aggregate type.
- ❑ ***#8 stone may be angular*** (i.e.- graded crushed limestone is permissible).
- ❑ See Section 4.6 ODOT #8 Stone (Rounded) for the gradation and quality requirements of this aggregate type.

Gravel Type	Subsurface Sand Filter	Gravel Leach Trenches	Wisconsin Mound	ISF's	Modified At-Grade/Modified Mounds	Pressurized Leach Beds
ODOT #57 Rounded	Yes	Yes	Yes	Yes	Yes	Yes
ODOT #57 Angular	No	No	No	Yes (Pretreated Effluent)	Yes (Pretreated Effluent)	Yes (Pretreated Effluent)
ODOT #8 Rounded	No	No	Yes	Yes	Yes	Yes
ODOT #8 Angular	No	No	No	Yes (Pretreated Effluent)	Yes (Pretreated Effluent)	Yes (Pretreated Effluent)

Table 4.1 – Gravel Usage Table by System and Effluent Type. Note that these gravels may be used for pipe backfill and other backfill materials, as required.

4.8 Sand for Treatment

Sand for treatment is sand used within an HSTS for the treatment and dispersal of effluent. The sand is the most important component of these types of systems. The following table (Table 4.2) is a summary of Sections 4.8.1 and 4.8.2. The various HSTS are listed with the sand that shall be used in construction with that system.

Sand Type	Intermittent Sand Filter (ISF)	Wisconsin Mound	Modified At-Grades/Modified Mounds	Subsurface Sand Filter	Pressurized Leach Bed
ODOT Natural Sand	Yes (Pretreated Effluent)	No	Yes (Pretreated Effluent)	No	Yes (Pretreated Effluent)
ASTM C-33 Concrete	Yes (Pretreated Effluent)	No	Yes (Pretreated Effluent)	No	Yes (Pretreated Effluent)
Filter Sand	Yes (Septic Tank Effluent)	Yes	Yes (Septic Tank Effluent)	Yes	Yes (Septic Tank Effluent)

Table 4.2 - Sand Usage Table by System and Effluent Type. Note that these sands may be used for pipe backfill and other backfill materials, as required.

4.8.1 HSTS Receiving Septic Tank Effluent (Intermittent Sand Filter/Wisconsin Mound/Subsurface Sand Filter)

For these structures (any structure that receives septic tank effluent), sand meeting the following specifications shall be used:

- Sand shall meet the following gradation:

Sieve Size	% Passing
3/8	100
#4	95-100
#8	80-100
#16	45-85
#30	15-60
#50	3-10
#100	0-2
#200	0-1

Table 4.3 - Intermittent Sand Filter/Wisconsin Mound/Subsurface Sand Filter required sand gradation.

- For this sand, D_{10} (effective size) shall be 0.3 to 0.5 mm.
- For this sand, C_u (coefficient of uniformity) shall be 1 to 4.
- Gradation analysis shall meet ASTM wet sieve analysis protocols for fines.

4.8.2 HSTS Receiving Filtrate (Pre-treated Effluent – Modified Mound/ISF/Leach Beds)

For these structures (structures receiving pretreated effluent), sand meeting the following specifications shall be used:

- ❑ Sand shall meet the specifications of ASTM C-33, (C-33 concrete sand); **or,**
- ❑ Sand shall be ODOT Natural Sand which is not manufactured and meets:
  - ❑ The gradation requirements of ODOT Item 703.02(A)(2).
  - ❑ The requirements of ODOT Item 703.02(A)(3).

4.9 Gradient Drain/Interceptor Drain Aggregate

Gradient/interceptor drain aggregate shall adhere to the following:

- ❑ #57 or #8 stone defined in Section 4.5 or 4.6 (above) is acceptable. This aggregate may also be **clean** crushed limestone meeting Section 4.7, provided that grade stakes delineating the trench bottom are placed with the gradient drain trench. Stakes located at the corners and every twenty (20') feet of drain or per approved plans. See Section 7.0 Drainage Enhancement for further information.

4.10 Cover Soil Specifications

The cover specification includes the requirements for covering a treatment system with the appropriate materials. Three types of cover materials are available. They are sandy loam topsoil, site generated topsoil, and other site soils. Some general requirements for all cover soils shall be:

- ❑ Geotextile fabric per Section 4.11 or other approved barrier material shall be placed prior to final cover installation.
- ❑ Cover soil shall be free of any rocks (larger than three (3") inches) and large roots.
- ❑ All soil clods, larger than two (2") inches in diameter, shall be broken apart.
- ❑ Cover grading shall allow for easy, trouble-free lawn care maintenance in the future.
- ❑ Cover soils shall allow grass to germinate and grow unimpeded.

4.10.1 Sandy Loam Topsoil

When moistened, this soil will feel gritty and will not form a ribbon when rubbed between the thumb and forefinger.

- ❑ Not usually found at the site and therefore must be trucked in.

- ❑ No added "filler" materials shall be present in the soil such as mulch, sawdust, or other organic debris.
- ❑ Shall be used on advanced treatment systems that receive septic tank effluent.
- ❑ Shall be placed overtop of treatment system gravel areas and to within one (1') foot of all sides of these gravel areas, unless otherwise specified.
- ❑ Remaining areas on or around treatment system may be covered with a quality topsoil found at the site.

4.10.2 Site Generated Topsoil and Other Topsoils

When moistened, this soil feels floury and will ribbon out to one (1") inch or less if rubbed between the thumb and forefinger. Soil does not have a shine when rubbed on a smooth metal object.

- ❑ Commonly found at the site within the top six (6") inches of the ground surface or can be trucked in from another location.
- ❑ No added "filler" materials shall be present in the soil such as mulch, sawdust, or other organic debris.
- ❑ May be used on advanced treatment systems that receive pretreated effluent.
- ❑ Shall be placed overtop of treatment system gravel areas and to within one (1') foot of all sides of these gravel areas, unless otherwise specified.
- ❑ Remaining areas on or around treatment system may be covered with other site soils provided they are not clay or silty clay(see 4.10.3).

4.10.3 Other Site Soils

Soils which do not contain high amounts of clay. These soils are still soft when moistened and are not resistant to pressure between the thumb and forefinger. Additionally they are not sticky when wet.

- ❑ Commonly found at the site within the top twenty four (24") inches of the ground surface or can be trucked in from another location.
- ❑ No added "filler" materials shall be present in the soil such as mulch, sawdust, or other organic debris.
- ❑ May be placed on advanced treatment systems that receive pretreated effluent.
- ❑ Can be placed outside of treatment gravel areas unless otherwise specified.
- ❑ May be used to berm up areas and backfill trenches.

4.11 Geotextile Fabric

Geotextile fabric used in an HSTS to prevent backfill material from entering a treatment or soil absorption system shall meet the requirements listed in Table 4.4.

Geotextile Property	Test Method	Average Role Value
Thickness (mil)	ASTM D1777	Minimum – 4 mil Maximum – 20 mil
Air Permeability (cfm/ft)	ASTM D737	Minimum - 500 cfm
Grab Tensile (lbs)	ASTM D4632 or D1682	Minimum – 18 lbs
Grab Elongation (%)	ASTM D4632 or D1682	Minimum – 50%
Puncture (lbs)	ASTM D4833	Minimum – 10 lbs
Trapezoidal Tear (lbs)	ASTM D4533 or D1117	Minimum – 10 lbs
AOS (Sieve Size)	ASTM D4751	Minimum - #20 Sieve Size Opening Maximum - #70 Sieve Size Opening

Table 4.3 - Geotextile Fabric Specifications. Partly adopted from the Wisconsin Department of Commerce Administrative Code. Comm. 84.40.

4.12 Gravel Aggregates Jar Test

Once the proper O.D.O.T. approved gravel arrives at the job site it still may not appear to be clean. An in field Jar Test shall be utilized to qualitatively assess the materials cleanliness for use within the treatment system. The following steps should be performed:

- ❑ Fill a quart glass jar half full with the gravel.
- ❑ Fill the jar with clean tap water.
- ❑ Shake the jar vigorously and allow to settle for 30 minutes.
- ❑ If a sixteenth (1/16") inch or greater amount of fines has accumulated on top of the gravel or at the bottom of the jar, then the gravel shall be rejected and not used in the system. It may be used for pipe support, tank bedding, or backfill, **but not in the treatment system**.

5 Section 5.0 Piping

5.1 General

This specification includes conveyance piping systems associated with a Household Sewage Treatment System (HSTS). It includes specifications for gravity systems and pressure distribution systems.

- ❑ Any piping which is marked on plans or stated in this manual as SCH 40 PVC shall meet ASTM D-1785/D-2665.

5.2 Gravity Piping

A piping system that is non-pressurized which conveys liquids and solids by gravity. Gravity piping types included in the following are building sewer and other gravity piping downstream of the septic tank. It does not include gravity piping within leach trenches, subsurface sand filters, gradient drains or gravity piping that are part of a proprietary treatment system.

5.3 Building Sewer

The building sewer is pipe that conveys raw wastewater from within the house to the septic tank or primary treatment unit.

5.3.1 Pipe Type (Building Sewer)

- ❑ Solid schedule 40 PVC pipe; shall meet/exceed ASTM D-1785/D-2665.
- ❑ Four (4") inch diameter shall be used.
- ❑ Pipe markings shall face upwards.
- ❑ No cell core, or other lightweight pipe shall be used.

5.3.2 Pipe Installation (Building Sewer)

- ❑ Minimum slope shall be one-quarter ($^1/_4$") inch per foot (2%).
- ❑ Slope shall be uniform.
- ❑ Pipes installed on land slopes greater than 20% must not travel directly down the hill. Pipe, and pipe trench, must be slightly “zig zagged” down the slope or be anchored at every connection.
- ❑ Connections shall be solvent welded; for bell and spigot pipe, bells shall point upstream.
- ❑ Color primer shall be used in the solvent welding process.
- ❑ No sudden or extreme slope change or vertical pipe segments which could cause separation of solids and liquids in the pipe (resulting in pipe blockage) shall be installed in the building sewer.

- ❑ Uniform support over the entire length of pipe shall be provided by bedding in gravel, compacted sand or on virgin soil. Aggregates shall meet the specifications in Section 4.0.
- ❑ No dirt clods, rocks or similar objects shall be used to support pipe.
- ❑ Backfill shall be free of rocks larger than three (3") inches, along the longest dimension.
- ❑ Backfill shall be free of deleterious material.
- ❑ Backfill shall be placed so that no depressions are formed after settlement.
- ❑ Pipe shall be cased in area where pipe is crossed by driveway (See 5.5).
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.
- ❑ Pipes shall be installed completely under the final grade.
- ❑ Foundation drain shall be hard pipe (solid walled) where the building sewer alignment conflicts with a foundation drain or other drain. Pipes shall be hard piped and backfilled with friable soils for five (5') feet in all directions.
- ❑ Existing building sewer shall be replaced, back to the exit of the house, or as close as practically possible.
- ❑ Eccentric reducers shall be used on any existing building sewer to decrease the size of larger existing pipes to four (4") inch. Clean out shall be installed within three (3') feet of reduction in pipe size.

5.3.3 Clean Outs for Building Sewer

Clean outs will be designated as C/O.

- ❑ Schedule 40 PVC pipe shall be used which meets/exceeds ASTM D-1785/D-2665.
- ❑ Four (4") inch diameter pipe shall be used.
- ❑ Four (4") inch diameter threaded cap shall be provided.
- ❑ C/O shall be tied into sewer pipe with sanitary tee pointing toward the tank.
- ❑ C/O shall extend a minimum ten (10") inches above final grade.
- ❑ C/O shall be installed either within three (3') feet from wall exterior or within one (1') foot of wall interior. An outside C/O is recommended for ease of service.
- ❑ C/O shall be installed upstream from any horizontal alignment change greater than forty-five (45) degrees.
- ❑ C/O shall be installed for every fifty (50') feet of building sewer (excluding mandatory C/O adjacent to house). Example: If more than fifty (50') feet but less than one hundred (100') feet, C/O installed at midpoint.

- ❑ C/O shall be installed before an eccentric reducer, when needed to reduce pipe size.

5.4 Other Gravity Piping

Other gravity piping includes gravity pipes associated with a HSTS. It does not include gravity piping within leach trenches, subsurface sand filters, gradient drains, building sewer pipe(s) or gravity piping that are part of a proprietary treatment system. An example of an installation location is between a septic tank and dose basin, headline piping or discharge piping

5.4.1 Pipe Type

- ❑ Solid schedule 40 PVC pipe shall be used which meets/exceeds ASTM D-1785/D-2665.
- ❑ Four (4") inch diameter shall be used.
- ❑ Pipe markings shall face upwards.
- ❑ No cell core, or other lightweight pipe shall be used.

5.4.2 Pipe Installation

- ❑ Minimum slope shall be one eighth ($^1/_8$") inch per foot (1%)
- ❑ Pipes shall have no vertical pipe segments.
- ❑ Pipes installed on land slopes greater than 20% must not travel directly down the hill. Pipe, and pipe trench, must be slightly “zig zagged” down the slope or be anchored at every connection.
- ❑ Pipes shall be installed completely under the final grade.
- ❑ Connections shall be solvent welded; For bell and spigot pipe, bells shall point upstream.
- ❑ Color primer shall be used in the solvent welding process.
- ❑ Uniform support over entire length of pipe shall be provided by bedding in gravel, or compacted sand (except where earth dams are required, and around drop boxes per specifications), or virgin ground.
- ❑ No dirt clods, rocks or similar objects shall be used to support pipe.
- ❑ Soil backfill shall be free of rocks larger than three (3") inches, along the longest dimension.
- ❑ Pipe shall be cased in area where pipe is crossed by driveway (See 5.5).
- ❑ Backfill shall be placed so that no depressions are formed after settlement.
- ❑ Any rubber boot type fitting shall be secured with clamps fabricated from high grade non-corrosive stainless steel.

5.4.3 Clean Outs for Other Gravity Piping

Clean outs will be designated as C/O.

- ❑ Schedule 40 PVC pipe shall be used which meets/exceeds ASTM D-1785/D-2665.
- ❑ Four (4") inch diameter pipe shall be used.
- ❑ Four (4") inch diameter threaded cap shall be provided.
- ❑ C/O shall be tied into sewer pipe with sanitary tee pointing:
  - ❑ Upstream where no access point is available upstream, **OR**
  - ❑ Downstream for all other installation conditions.
- ❑ C/O shall extend a minimum ten (10") inches above final grade.
- ❑ C/O shall be Installed every one hundred (100') feet. Example: If more than one hundred (100') feet but less than two hundred (200') feet, C/O installed at midpoint.

5.4.4 Discharge Line

The discharge line is a part of other gravity piping which serves to convey effluent, collected after the treatment system, to the final discharge location, via gravity. The specifications found here shall apply to any discharge pipe.

- ❑ Section 5.4.1, 5.4.2, and 5.4.3 shall apply.
- ❑ For proprietary HSTS that discharge using piping smaller than four (4) inches in diameter, then this pipe shall be properly transition to four (4) inch pipe meeting 5.4.1 and 5.4.2 within one pipe length of final treatment unit.
- ❑ Discharge line shall terminate at the flow line of specified defined drainage way.
- ❑ Minimum of six (6) inches of freeboard shall be required between the invert of the discharge pipe and the water surface of the receiving waterway.
- ❑ Commercial “swing gate” animal guard; or two (2) one quarter ($^{1}/_{4}$") inch bolts placed horizontally shall be provided (like an equal sign (=)). Drain baskets shall not be permitted.

5.5 Casing Pipe

Casing pipe is used to protect buried piping from “heavy” surface loads, such as under vehicles paths.

- ❑ All pipes shall be cased that lie under driveways, or other vehicle paths.
- ❑ Schedule 40 PVC pipe shall be used which meets/exceeds ASTM D-1785/D-2665.
- ❑ Casing pipe shall be bedded in #57 or #8 Stone (See Section 4.0).
- ❑ Casing pipe shall extend beyond driveway or vehicle path by at least five (5') feet on either side.

- ❑ Pipes shall be cased over or under a water line for ten (10') feet to either side of the water line.
- ❑ If the top of the pipe is five (5') feet or greater below the surface, then the pipe may be bedded in gravel and backfilled with compacted site soils without being cased.

5.6 Pressure Piping

Pressure piping is any pipe that conveys water under pressure supplied by a pump, or siphon action. Pressure piping is installed in locations in which the water must be pushed to reach its destination. Typically, pressure piping is used in mound soil absorption systems, dosed systems, and proprietary treatments systems. This specification shall not include pressure discharge piping associated with a gradient drain, see Section 7.0, Drainage Enhancements, for specifications.

5.6.1 Pipe Type

- ❑ Schedule 40/80 PVC pipe shall be used which meets/exceeds ASTM D-1785/D-2665.
- ❑ Pipe markings shall face upwards.
- ❑ ***Fittings shall be pressure rated*** for Schedule 40/80, meeting/exceeding ASTM D-2466.
- ❑ Diameter shall be as specified, or determined by hydraulic analysis of overall pressure pipe network (reviewed and approved by the designer and the Health District, prior to installation).
- ❑ Minimum velocity in pipe shall be two (2) $^{feet}/_{second}$ (Allowances will be made for HSTS with a siphon).

5.6.2 Pipe Installation

- ❑ All connections shall be solvent welded; small applicator shall be used to minimize potential for excess cement causing joint roughness, increasing friction losses.
- ❑ Color primer shall be used in solvent welding process.
- ❑ Pipes installed on land slopes greater than 20% must not travel directly down the hill. Pipe, and pipe trench, must be slightly “zig zagged” down the slope or be anchored at every connection.
- ❑ Pipes shall be installed completely under the final grade.
- ❑ Pipes shall be laid upon firm, virgin soils or bedded in compacted sand or gravel. (See Section 4.0 for specifications) No pipe deflection shall be allowed under applied pressure.
- ❑ No dirt clods, rocks or similar objects shall be used to support pipe.
- ❑ No direct, vertical, pipe-to-pipe/pipe-to-conduit contact shall be installed (Either move pipes, case both pipes, or encase

both pipes in gravel in the region of contact. Maximum particle size of the gravel shall be $^1/_3$ of the pipe diameter).

- ❑ Pipe shall be cased in areas where pipe is crossed by driveway (See 5.5).
- ❑ Pressure distribution piping shall not share a common trench with any portion of the gradient drain or interceptor drain. They shall have a minimum of three (3') feet separation.
- ❑ Direct flame contact shall not be used to achieve a permanent bend in PVC pipe. ("Conduit bending boxes" designed for bending PVC are acceptable, provided the cross-sectional dimension of the pipe has not changed).
- ❑ Pressure main or sub-main run from subsurface to the top of a mound or other above-ground structure shall use a combination of elbows for elevation change or pipes shall be bent per requirements and supported per this section.
- ❑ Rubber type boot fittings shall not be used in to join pipe segments.
- ❑ If pipes are bent:
  - ❑ Bent section shall have circular cross-section.
  - ❑ No creasing of pipe shall be allowed.
  - ❑ Pipe wall thickness, within bend, shall not be significantly decreased.

5.7 Pipe Protection

Includes both mechanical and freeze protection.

5.7.1 Freeze Protection

Pressure pipes shall be protected from freezing by one of the following methods:

- ❑ At least twenty four (24") inches of soil cover shall be provided or per approved plan or;
- ❑ Drain back of areas with less than twenty four (24") inches cover shall be achieved **or;**
- ❑ Combination of both twenty four (24") inches soil cover and drain back shall be used.
- ❑ For drain back freeze protection, weep hole shall be installed to allow complete drainage of pressure pipe segment without adequate soil cover.
- ❑ Lines that are laid to drain back shall have a minimum slope of one eighth (1/8") inch per ft. towards the pump and shall be rigorously bedded firmly on that grade. **Absolutely no pipe movement under pressure will be approved.**
- ❑ For drain back, weep hole size shall not cause distal pressure to fall below design pressures.
- ❑ Weep hole shall be installed at correct elevation to ensure liquid does not rest in pipe segments with less than twenty

four (24") inches of soil cover or per approved plans, if more stringent.

5.7.2 Mechanical Protection

Pipes shall be protected from mechanical damage and shall follow these general guidelines.

- ❑ Pipes under driveways shall be cased (Section 5.5).
- ❑ No direct pipe-to-pipe/pipe-to-conduit contact shall be installed (Either move pipes, case both pipes, or encase both pipes in gravel in the region of contact. Maximum particle size of the gravel shall be $^1/_3$ of the pipe diameter).
- ❑ No vertical pipe segments shall be allowed. Angle pipes to change elevation.(Except within a tank/basin or in or under a valve box.)
- ❑ Pipes with less that twelve (12") inches cover shall be cased, except for pipes within a treatment system (Section 5.5).

5.8 Pressure Pipe Network

The pressure pipe network for any pressurized treatment system includes all piping from the dose chamber to the final discharge network. It includes dosing pump, force main pressure piping, sub-main pressure piping, pressurized laterals and all associated fittings.

For the pressure distribution system, it is the installer's responsibility to assure that the distribution system operates as designed. Care must be taken during the assembly to remove dirt and debris and to prevent entry of dirt and debris from entering the pipes. It is prudent to assume that dirt and debris will be present in pipes after field assembly is completed.

The following are practices which should be used for pipe preparation:

- ❑ Clear lateral pipes of any burrs and/or tailings.
- ❑ Solvent-weld couplings in place on one side of a connection.
- ❑ Pre-assemble manifolds and distribution laterals.
- ❑ Mark and bundle distribution laterals in the shop for fast re-assembly in the field.
- ❑ Tape over open ends of the distribution lateral pipes.

5.8.1 Pressure Piping – Force Main

The force main is a segment of a pressure piping system that conveys effluent from a point of energy input (i.e. - pump or siphon) to another point within the HSTS system.

- ❑ All requirements of Section 5.0 shall be met.
- ❑ Force main diameter shall be as specified ***or*** diameter shall be justified by hydraulic calculations based on actual site conditions.

- ❑ Minimum scouring velocity of two (2') $^{feet}/_{second}$ shall be maintained, at the design flow rate.
- ❑ Pump discharge piping shall have a glued horizontal pressure rated quick disconnect installed within ten (10") inches of the top of the riser when required by the design.
- ❑ Schedule 40 PVC gate valve shall be supplied, if required by the design.
- ❑ Check valve shall be installed, if required by the design.
- ❑ Pump discharge piping shall be installed so that removal of a screened pump filter does NOT require removal of the pump or discharge piping to remove the filter for inspection and maintenance.
- ❑ Excavation for the force main shall not occur within any chisel plowed area. *If this occurs, a redesign may be required with applicable re-design fees and/or re-inspection fees.*
- ❑ Force main transitions to laterals shall be made with pressure rated crosses of the same diameter as the force main. *Tees shall not be permitted in this location.* A threaded cap on one (1) branch of cross shall provide a cleanout location.
- ❑ For force mains entering a distribution box, or drop box the force main shall transition to four (4") inch diameter Schedule 40 PVC pipe ten (10') feet before entering the distribution/drop box and the four (4”) inch pipe shall be sloped towards the distribution/drop box. Transition to four (4") inch pipe shall use prefabricated PVC couplers designed for this purpose.
- ❑ Minimum of three (3') feet separation shall be maintained to any drain or leaching trench.
- ❑ If a force/sub-main must cross a drain as part of an approved design, then the drain shall be hard piped across the force/sub-main to five (5') feet on either side and backfilled with tamped dirt.

5.8.2 Pressure Piping – Sub-Main

The sub-main is that portion of a pressure distribution network that is used to convey liquid from the force main to the laterals or manifold of the distribution network.

- ❑ All requirements of Section 5.0 are shall be met.
- ❑ Sub-main diameters shall be as specified ***or*** diameter shall be justified by hydraulic calculations based on actual site conditions and design flow rate.
- ❑ Minimum scouring velocity of two (2') $^{feet}/_{second}$ shall be maintained, at the design flow rate.

- ❑ Schedule 40 PVC gate valve shall be supplied, if required by the design.
- ❑ Excavation for the sub-main shall not occur within any chisel plowed area. *If this occurs, a redesign may be required with applicable re-design fees and/or re-inspection fees.*
- ❑ Sub-main transitions to laterals shall be made with pressure rated crosses of the same diameter as the sub-main. *Tees shall not be permitted in this location.* A threaded cap on one (1) branch of cross shall provide a cleanout location.
- ❑ Crosses shall be installed level.
- ❑ Appropriate use of fittings, such as forty-five (45) degree elbows, or approved pipe bending techniques shall be used to "ramp" the sub-main onto the mound or structure from the subsurface.
- ❑ Lateral layout, and sub-mains shall be of equal lengths and symmetrical unless otherwise stated in an approved plan.
- ❑ Sub-mains shall be installed at the same elevations with other sub mains within the same pressure network unless otherwise stated in an approved plan.
- ❑ Unless otherwise specified in an approved plan, sub mains shall be laid so that equal amounts of drain back occur compared with other sub mains in the same system.
- ❑ Minimum of three (3') feet separation shall be maintained to any drain or leaching trench.
- ❑ If a force/sub-main must cross a drain as part of an approved design, then the drain shall be hard piped across the force/sub-main to five (5') feet on either side and backfilled with tamped dirt.

5.8.3 Pressure Piping – Manifold

The manifold is that portion of a pressure distribution network that is used to convey liquid from the force main or sub-main to the laterals of the distribution network.

- ❑ All requirements of Section 5.0 shall be met.
- ❑ Manifold diameters shall be as specified ***or*** diameter shall be justified by hydraulic calculations based on actual site conditions and design flow rate.
- ❑ Minimum scouring velocity of two (2') $^{feet}/_{second}$ shall be maintained, at the design flow rate.
- ❑ Schedule 40 PVC gate valve shall be supplied, if required by the design.
- ❑ Manifold transitions to laterals shall be made with pressure rated crosses of the same diameter as the manifold. *Tees shall not be permitted in this location.* A threaded cap on one (1) branch of cross shall provide a cleanout location.
- ❑ Crosses shall be installed level.

- For symmetrical lateral layouts, manifolds shall be of equal length.
- Unless otherwise specified in an approved plan, manifold shall bee laid so that equal amounts of drain back occur compared with other manifolds in the same system.

5.8.4 Pressure Piping – Distribution Laterals

The distribution lateral is the portion of the pressure distribution network used to uniformly spread pumped liquids, via orifices, over the surface of the treatment media of a treatment system. In soil absorption systems, their length along the contour is the result of meeting the soil's linear loading rate requirements.

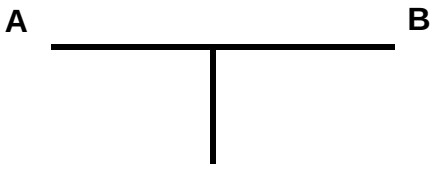
- Distribution laterals shall be fabricated from schedule 40/80 PVC pipe meeting/exceeding ASTM D-1785/D-2665.
- Diameter of laterals shall be three-quarter ($^3/_4$") inches, unless otherwise specified or design requirements can be met otherwise.
- Difference in head between the proximal and distal orifice (first and last orifice) shall be less than 10%.
- Laterals lengths, orifice spacings, and layouts shall be installed as specified in the approved plan.
- **All** couplers and fittings used shall be **pressure rated**, meeting/exceeding ASTM D-2466.
- Schedule 40 PVC gate valve shall be supplied, if required by the design.
- All connections shall be solvent welded. Solvent shall be applied with small applicators to minimize potential of excess cement causing roughness in the joint, increasing friction losses.
- Color primer shall be used in the solvent welding process.
- Laterals shall be uniformly supported over the entire length; *includes lateral segments between orifice shields*. Sagging between orifices shall not be permitted.
- Laterals shall be installed flat or sloped back towards the pressure flow direction based on the following:
  - For less than or equal to two (2') foot center-center orifice spacing, orifices shall be installed at the six (6) o'clock position and the laterals are installed flat (0%).
  - For greater than two (2)' foot center-center orifice spacing, orifices shall be installed at the twelve (12) o'clock position and laterals are installed to slope back to force/sub-main at one (1") inch per ten (10') feet (0.83%) within compacted aggregate.
- Orifice shields shall be required for all orifices.

- For multiple laterals set side by side, laterals shall be installed so that lateral orifices are staggered at specified positions between laterals.

5.8.5 Maximum Squirt Height (Operating Head) Variation

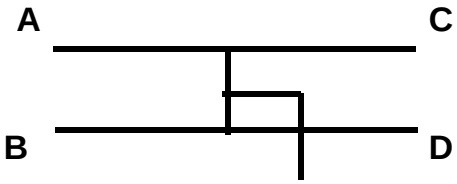
The following guidance shall be applied to the allowable maximum squirt height variation between different location within the pressure piping laterals. This guidance assists in determining if the distribution over the all infiltrative surface is uniform (i.e. - uniform dosing over the area).

- Acceptable tolerance for squirt height variation for various lateral configurations are as given in Figure 5.1 (a), (b) and (c) - Maximum Squirt Height Variation.
- Squirt height variations for more elaborate lateral layouts not found in Figure 5.1 shall be six (6") inches.

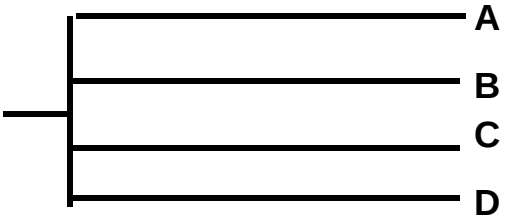


Tee Pattern

Maximum Difference between Point A & B and C & D is 2 inches.
(a)

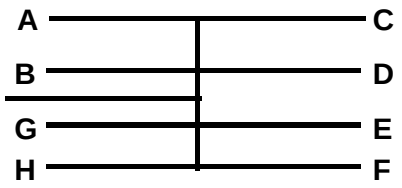


1 H Pattern

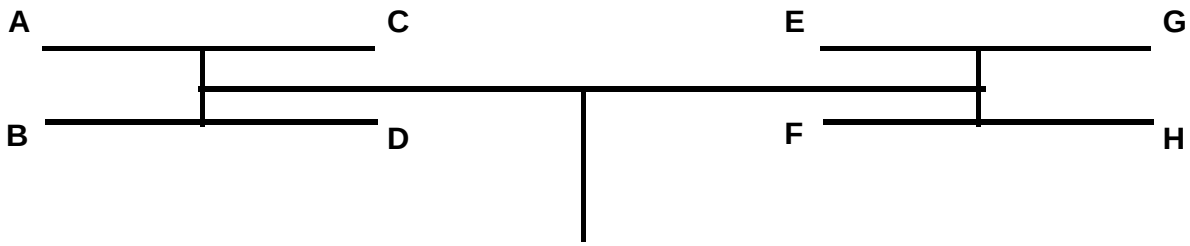


Typical End Feed ISF Pattern

Maximum Difference between Points A & C or D is 3 inches
Maximum Difference between Points B & C or D is 3 inches
(b)



Typical Center Feed ISF Pattern



2 H Pattern

Maximum Difference between Points A & E or F or G or H = 6 inches
Maximum Difference between Points B & E or F or G or H = 6 inches
Maximum Difference between Points C & E or F or G or H = 6 inches
Maximum Difference between Points D & E or F or G or H = 6 inches
(c)

Figure 5.1 (a), (b) and (c) – Maximum Squirt Height Variation for Pressure Distribution Laterals

5.8.6 Pressure Piping – Lateral Cleanouts (C/O)

Lateral clean outs (C/O) shall allow for the flushing of the laterals, after construction and as part of maintenance.

5.8.6.1 Lateral Cleanout(s) – General requirements

- ❑ C/O shall be installed at the end of each lateral.
- ❑ C/O shall be placed within an access well/valve box.
- ❑ C/O shall be slightly elevated (one half ($^1/_2$") inch) above lateral to drain back for freeze protection.
- ❑ C/O shall be completely bedded in gravel for support.
- ❑ Access well/valve box lid shall allow for a minimum of two (2") inch clearance to the C/O assembly.

5.8.6.2 One (1) Inch Diameter or Smaller Lateral Cleanout Requirements

- ❑ C/O shall be the same size as the lateral.
- ❑ C/O shall be installed so that it can be easily opened/closed with one hand.
- ❑ C/O shall extend a maximum of (six and one half (6 ½") inches above lateral top.
- ❑ Shall use a "sweeping 90" to make ninety (90) degree turn. (Note: sweep ninety (90) can be SCH 40 PVC electrical conduit).
- ❑ Shall include a equally sized quarter-turn (slip fit by threaded, threaded end up) PVC ball valve equal in size to the lateral.

5.8.6.3 One (1) Inch Diameter or Larger Lateral Cleanout Requirements

- ❑ C/O installed shall be the same size as laterals.
- ❑ C/O shall use wyes with female adapters and cleanout plugs (Note: C/O fittings may be DWV fittings) with wye facing upwards and forty five (45) degree fitting installed to make a (90) degree total turn up).
- ❑ C/O shall be accessible for testing and service; a closed fist "fits" between the C/O and the well or box wall.
- ❑ Both upper and lower C/O shall be accessible for routine maintenance.

5.9 Operating Head (Squirt Height) Adjustment

The following gives options that are acceptable methods to control the operating head of a HSTS. All options shall be made accessible within a valve box or access well.

- ❑ High pressure Schedule 40 or 80 PVC gate valve shall be used; **or,**
- ❑ Orifice type flow restrictor shall be used and located within an accessible union**; or,**
- ❑ Other flow control devices or methods of adjustment shall be subject to review by the Health District before approval.

5.9.1 Operating Head

The following gives the minimum squirt heights for varying sized orifices. The squirt height must be adjusted to these heights after flushing the laterals. Measurements shall be taken from the top of the lateral not the top of the clean out.

- ❑ One eighth (1/8") inch orifices; minimum squirt height shall be sixty (60") inches.

- ❑ Three sixteenths (3/16") inch orifices; minimum squirt height shall be forty-eight (48") inches.
- ❑ One quarter (1/4") inch orifices; minimum squirt height shall be thirty (30") inches.

5.10 Orifice and Orifice Shields

The following sections present the requirements of orifices and orifice shields. Each will be presented in its own sub-section.

5.10.1 Orifice(s)

An orifice is an opening in a pipe that is sized to allow discharge of liquid at a specific flow rate.

- ❑ Orifices shall be drilled on a drill press. Field drilling of orifices shall not permitted.
- ❑ All orifices shall be cleaned of burrs. A reamer the same size as the drill bit shall be used. It is recommended that a "dreamer " be used. A "dreamer" is a special drill bit that functions as both a pilot bit and reamer, providing good results, if properly used.
- ❑ Orifice spacing shall be based upon the pressure distribution network detail drawings, corresponding to the system capacity. (See pressure distribution network drawings)
- ❑ Burred or improperly sized orifices will result in failure for that inspection.
- ❑ Orifices shall be drilled at a low RPM to discourage burning or melting through pipe.

5.10.2 Orifice Shield(s)

An orifice shield is a device that functions to protect the orifice from becoming blocked.

- ❑ Orifice shields shall be installed on all pressure distribution laterals.
- ❑ Commercially manufactured shields shall be installed, unless pre-approved non-commercial shields are installed (see below).
- ❑ Non-commercial orifice shields installed shall meet the following specifications:
  - ❑ Clearance between orifice and shield shall be a minimum of one half (½") inch.
  - ❑ Length or diameter shall be a minimum of three (3") inches.
  - ❑ Open area for drainage out of the shield shall be a minimum of one (1") in^2.
  - ❑ Shields shall be reviewed by the Health District prior to use. A sample and a photograph or scale drawing

shall be provided by the fabricator. (The photo or drawing will be kept on file).

- ❑ Installer shall have written approval to use non-commercial shield.
- ❑ Shields shall be available for inspection on site before installation.

5.11 Air Release Valves

An air release valve is a device used to allow the release of trapped gases from within a pipe. Trapped gases within pressure piping do not allow the pressure distribution system to operate as designed.

- ❑ Air release valve shall be used anywhere water does not drain from force/sub-mains and air is trapped between pumping unit and piping which holds water. Commonly seen where pumping uphill to a “locally high point”. Liquid in the pipes following this high point is purposely trapped to minimize drain back and/or insure equal pressurization times.
- ❑ Air release valve shall be installed per design requirements.
- ❑ Air release valve shall be designed for use with wastewater.
- ❑ Air release valve shall be installed at relative high points (based on elevation) in the pipe.
- ❑ Air release valve shall be contained in an access well/valve box that is open to the atmosphere.
- ❑ Access well/valve box lid shall allow for a minimum of two (2") inch clearance to the air release valve.

5.12 Flow Direction Control Valves

These devices are used to control the direction of the flow. They may either allow flow in a specified direction or allow flow distribution in specified ratios for flow control. Some examples of these devices are flow splitters, K-rain valves, flow separators and solenoids.

- ❑ Device shall be installed per Health District approved manufacturer /distributor specifications.
- ❑ Device shall provide type of service required by design.
- ❑ Device used shall be specified as part of the HSTS design.
- ❑ Device shall be accessible for adjustment and/or maintenance.
- ❑ Device shall function properly at start-up.

5.12.1 K-Rain Valves

Hydraulically activated valve which automatically switches zones every time the pump starts. These valves work solely on the pressure of the pump to change zones. These valves shall:

- ❑ Have a pressure rated ball valve of equal size to the device inlet positioned immediately upstream.

- ❑ Contain a one and a half ($1^1/_2$") inch or longer piece of clear Acrylic (SCH 40 equivalent) pipe on every valve outlet equal in size to the device outlet diameter.
- ❑ Be contained in a structurally sound enclosure which allows for easy valve servicing. The enclosure must have a secure insulated lid (capable of holding 300 pounds with minimal deflection). Lid shall either be heavy concrete (minimum weight sixty (60) pounds) or bolted with three (3) stainless steel, $^3/_{16}$ inch hex heads or S3 recessed square heads.

5.13 Pressure Pipe Network Dose Pump

The pressure pipe network dose pump is the device used to push water through the distribution network.

- ❑ Pump shall be rated for effluent use by the manufacturer.
- ❑ Pump shall be a UL or CSA Listed product.
- ❑ Pump size shall be based upon required flow rate and total dynamic head. Total dynamic head shall be calculated from elevational differences, pipe size/type, fittings used, lateral/orifice configuration, scouring velocity, and minimum distal operating head (squirt height) with respect to design flow rate.
- ❑ Pump discharge piping shall include a glued quick disconnect that is horizontal and within ten (10") inches of the top of riser, for easy service.
- ❑ Nylon lift rope shall be attached to the pump and secured within ten (10") inches of the top of the lid.
- ❑ Dose pump shall either:
  - ❑ Rests within a screened pump vault; **or**,
  - ❑ Rests on a six (6") inch block; **or**,
  - ❑ Rest a specified by a proprietary design; **or**,
  - ❑ Rest within a flow inducer (turbine type pumps ONLY) designed to satisfy flow rate of pump and prevent cavitation.
- ❑ Type of pump shall be documented on the dose sheet.
- ❑ Pump float/transducer settings shall be documented on dose sheet.
- ❑ Pump discharge piping shall allow for easy removal of effluent filter without removal of the pump or discharge piping.
- ❑ Floats/transducers shall not be connected to the discharge assembly.
- ❑ Pump cords shall be left long enough to easily remove the pump for service.

5.14 Flushing Procedure

The following is the procedure that shall be used to clean the pressure network. Flushing shall be done before the operating head adjustments are made and the flow rate measured. The following is a step-by-step guide to perform the flushing procedure:

1. Ensure adequate water volume in tank.
2. Set gate valve and/or any ball valves in the pressure network to full flow.
3. Open sub-main clean outs for full flow.
4. Ensure lateral clean out valves are closed.
5. Run pump to fill main and sub-main a minimum of twice at full flow **or** until all dirt and debris is no longer evident in the discharge, after twice (2x) the total pipe volume has been pumped.
6. Time of Flushing = $^{\text{Total Pipe Volume}}/_{\text{Set Flow Rate}}$ where;

   $$\textit{Total Pipe Volume} = \textit{Total Pipe Length} \times [^{gallons}/_{foot\ of\ pipe}]$$

7. Shut off pump, close sub-main clean outs.(treat threads with pipe dope/Teflon tape).
8. Ensure sub-main clean outs are closed.
9. Flush lateral pipes one-at-a-time. Allow each clean out to be flushed for a minimum of fifteen (15) seconds **or** until water flows free of dirt and debris.
10. Ensure all clean outs are closed tightly.

Note: Evidence of orifice tailings, pipe shavings, or other debris during startup pressure test inspection will result in failure of that inspection.

5.15 Required Net Dose Volume

The required net dose volume is the volume of liquid that is to be applied to a distribution system or proprietary device each dose to maximize treatment.

- ❑ Proprietary pretreatment devices - installer shall refer to Health District approved product guidelines for recommended net dose volumes. Settings must maximize treatment; **or**,
- ❑ Dose volume shall be five (5) times the total lateral volume, unless otherwise specified; **and**,
- ❑ Net dose shall provide one quarter (0.25) $^{\text{gallon}}/_{\text{orifice/dose}}$ to (0.42) $^{\text{gallon}}/_{\text{orifice/dose}}$ and shall be based on the approved design.
- ❑ Drainback volume shall be properly incorporated into the net dose volume to derive the total dose required.

6 Section 6.0 Finished Appearance

6.1 General

The finished appearance of the HSTS is an important part of the system installation. It is the portion of the system that may not directly affect the operation of the system or system components, but yet it is the portion of the system that is visible long after system completion. ***The finished appearance may be the one thing that makes an impression on a past or future customer.*** It will frequently be the single item by which the quality of work by an installer is judged. This may be a "make or break" situation when others are considering bids or proposals. Care and attention to these items may result in good referrals. Items included in this section are: 1) grading; 2) care of surface water; 3) seeding and mulching; 4) erosion control; and 5) diversion swales.

6.2 Grading

Grading is the act of cutting and/or filling to achieve desired final elevations. The requirements for grading will apply to any disturbances cause by activities associated with the installation of the HSTS.

- ❑ All grade transitions shall be smooth and reasonably gradual, such that lawn care activities will not result in scalping of vegetation.
- ❑ Any exposed system components such as valve boxes, distribution boxes, drop boxes, etc. shall be backfilled and cover material shall be firmly tamped in place so that soil around these components will not compact further under foot pressure. Lids shall be flush with final settled grade.
- ❑ Any and all soil rutting shall be eliminated.
- ❑ Cover over treatment system shall be as specified in Section 4.10 and other applicable sections.
- ❑ All clods of soil larger than two (2") inches shall be broken down so that no irregularities are present on surface; large rocks and roots shall be removed.
- ❑ All aggregate stockpile locations shall be treated so that vegetation can be established.
- ❑ Areas of potential settlement shall be mounded to offset settlement, such as pipe trenches.
- ❑ Minimum final grade shall be 3H:1V, or less, unless otherwise specified.

The following procedure for calculating the proper 3H:1V slope of any elevated structures is provided. This procedure is adopted from Converse, J. C. and Tyler, E. J., 2000. Wisconsin Mound Soil Adsorption System: Siting, Design and Construction Manual. Publication #15.24 (Available on the Internet at www.wisc.edu/sswmp/pub_15_24.pdf).

Slope %	Down Slope Correction Factor	Up Slope Correction Factor
0	1.00	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.92
4	1.14	0.89
5	1.18	0.88
6	1.22	0.85
7	1.27	0.83
8	1.32	0.80
9	1.38	0.79
10	1.44	0.77
11	1.51	0.75
12	1.57	0.73
13	1.64	0.72
14	1.72	0.71
15	1.82	0.69
16	1.92	0.68
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.62
21	2.70	0.61
22	2.94	0.60
23	3.23	0.59
24	3.57	0.58
25	4.00	0.57

Table 6.1 - Down-Slope and Up-Slope Correction Factors. (Adopted from Converse and Tyler, 2000).

For "up-slope" the following equation shall be used to determine this horizontal "run" distance:

$D_{"up\text{-}slope"}$ = 3 x [Height of structure above original ground surface] x (Up-Slope Correction Factor from Table 9.1)

Where the Height and resulting $D_{"up\text{-}slope"}$ is in feet **NOT feet and inches**.

For "down-slope" the following equation shall be used to determine this horizontal "run" distance:

$D_{"down\text{-}slope"}$ = 3 x [Height of structure above original ground surface] x (Down-Slope Correction Factor from Table 9.1)

Where the Height and resulting $D_{"down\text{-}slope"}$ is in feet **NOT feet and inches**.

6.3 Care of Surface Water

With soil being used as the final component within the treatment train, it is not desirable to have extraneous surface water infiltration into this component. This will result in additional hydraulic loading which may effect its capabilities of performing properly.

- ❑ Areas contributing to surface water run-on to a HSTS shall be diverted away from this component (see Section 6.6, for diversion swale or Section 7.6 for interceptor drain).
- ❑ Diverted water will not create erosion problems within diversion or at its outlet.
- ❑ Recommended to protect basal area or proposed leaching trench field from excess surface water run-on, prior to and during construction of the system.
- ❑ Surface water will not be trapped behind component.

6.4 Seeding and Mulching

Seeding and mulching shall be use to establish vegetation on disturbed areas where the grade has significantly changed. Additionally, mulching is used to protect pressure pipes from freezing.

- ❑ Seed bed shall be raked prior to seeding, removing rocks, sticks, and roots; large clods shall been broken up so that final seed bed is not lumpy.
- ❑ Seed bed shall have sufficient organic content to facilitate vegetative growth.
- ❑ For heavy or acidic soils; pelletized limestone or agricultural lime shall be added to promote structure development in the

soil. This material shall be applied at a rate of one third ($^1/_3$) pound per square yard.

- ❑ Fertilizer, per seed manufacturer's recommendations or soil test results, shall be added to soil prior to seeding and mulching.
- ❑ <u>For warm weather seeding</u>: (Typically April-October)
  - ❑ Seed mix used shall meet:
    1. ODOT's specified seed mix for areas urban in character, see ODOT Item 659.09:
       - ❑ 30% Kentucky Bluegrass.
       - ❑ 30% Creeping Red Fescue.
       - ❑ 20% Annual Ryegrass.
       - ❑ 20% Perennial Ryegrass.

    OR,

    2. A Turf Type Fescue Mix shall be used.
  - ❑ Seed shall be applied at a rate of 0.015 pounds per square yard.
  - ❑ Straw mulch shall be applied until the soil surface can not be seen.
- ❑ <u>For cold weather seeding</u>: (Typically November to March)
  - ❑ Seed mix used shall meet:
    1. ODOT's specified seed mix for areas urban in character, see ODOT Item 659.09:
       - ❑ 30% Kentucky Bluegrass.
       - ❑ 30% Creeping Red Fescue.
       - ❑ 20% Annual Ryegrass.
       - ❑ 20% Perennial Ryegrass.

    OR,

    2. Turf Type Fescue Mix shall be used.
  - ❑ Cold weather seed rate = warm weather seed rate doubled.
  - ❑ Cold weather mulch rate = warm weather mulch rate.

6.5 Erosion Control

Erosion control is any provision taken that will prevent the migration of soil particles due to the action of moving water.

- ❑ Disturbed areas where grade has significantly changed shall be seeded and mulched as soon as possible, based on approval to cover or area no longer required.
- ❑ Methods to control water movement through work area shall be applied to prevent soil migration (See 6.6, Diversion Swale for example).
- ❑ Recommend following applicable erosion control practices given in *Rainwater and Land Development* available through the Ohio Department of Natural Resources.

6.6 Diversion Swale

A constructed channel with a supporting ridge on the lower side that lies across the slope to intercept and redirect surface water.

- ❑ Diversion swale shall be installed as located on plan.
- ❑ Diversion shall be ten (10') feet or greater from the HSTS.
- ❑ Diversion swale outlet shall be ten (10') feet or more from the property line or as specified by other local codes or ordinances.
- ❑ Outlet will not create erosion of receiving channel.
- ❑ For drainage area less than six (6) acres:
  - ❑ Swale bottom width shall be one (1') foot maximum.
  - ❑ Depth shall be fourteen (14") inches maximum.
  - ❑ Overall top width shall be eight and one half (8.5') feet minimum.
  - ❑ Ridge/berm width shall be one (1') foot or greater.
  - ❑ Maximum side slope shall be 3H:1V or flatter.
  - ❑ Channel shape shall be: parabolic, V-shaped, or trapezoidal.
  - ❑ Swale slope shall be greater than 0.4% but less than 1%.
  - ❑ Swale shall extend a minimum of ten (10') feet beyond HSTS before outletting.

7 Section 7.0 Drainage Enhancements

7.1 Description

Drainage enhancements are measures taken to assist in removing subsurface water and proper management of surface water. For example a gradient drain is a subsurface drain installed beneath the ground surface to collect and convey groundwater. The primary purpose of the gradient drain is to collect groundwater and to remove it from the adsorption area. A drain is composed of a collector segment, discharging segment and, possibly, a pump basin. The collector segment is the portion of the drain that actively collects water from the surrounding areas, via gravity. The discharging segment is the portion utilized to convey water away from the soil absorption area. A drain may have a gravity discharge or may require a pumped discharge.

The type of discharge for the drain is dictated by site conditions. Adequate elevation change is required to achieve a gravity discharging drain. In areas with insufficient elevation change, a pressurized discharge will be required. If a pressurized discharge is required, then the drain must incorporate a sump basin in which collected water is stored for pumping in discrete pumping cycles.

An interceptor drain or a diversion swale are other drainage enhancements. See Section 7.6 Interceptor Drain, Section 6.6 Diversion Swale, Section 6.3 Care of Surface Water, and 6.5 Erosion Control for other drainage enhancements.

7.2 Gradient Drain Collector Segment

The requirements for the collector portion of the gradient drain are:

- ❑ Drain shall be installed as located on approved plan.
- ❑ Pipe Diameter shall be four (4") inches.
- ❑ Minimum trench width shall be based upon type of backfill:
  - ❑ #57 stone fill, minimum trench width shall be twelve (12") inches.
  - ❑ #8 stone fill, minimum trench width shall be eight (8") inches.
- ❑ Minimum slope shall be one sixteenth ($^1/_{16}$") inch per foot ($^1/_2$%) of pipe and trench bottom.
- ❑ Corrugated or smooth interior slotted pipe shall be used meeting/exceeding ASTM F-405.
- ❑ Minimum depth of pipe invert/trench bottom shall be twenty-four (24") inches below ground surface on mounded or other above grade structures, or six (6") inches below nearest leaching trench bottom, unless otherwise specified on plan.

- ❑ Aggregate shall be placed to within twelve (12") inches of ground surface.
- ❑ Separation layer shall be placed prior to backfill: Geotextile fabric or two (2") inches straw.
- ❑ Gradient drain collector shall not share a trench with any other liquid transport piping.
- ❑ Minimum of three (3') feet separation shall be maintained to any force/sub-mains, and eight (8') feet from any lateral or leaching trench.
- ❑ If force/sub-main must cross gradient drain as part of an approved design, then the gradient drain shall be hard piped across the force/sub-main to five (5') feet on either side and backfilled with tamped dirt.
- ❑ Minimum of one (1') foot outside of basal area or mounded structure sand area shall be maintained.

7.3 Gradient Drain Gravity Discharge Segment

- ❑ Pipe diameter shall be four (4") inches.
- ❑ Pipe type:
  - ❑ Slope equal to or greater than one sixteenth ($^1/_{16}$") inch per foot:
    - ❑ Corrugated or smooth interior solid walled pipe shall be used meeting ASTM F-405, and bedded in gravel; **or**,
    - ❑ Solid SDR 35 or SCH 40 shall be used, and properly backfilled.
  - ❑ Slope less than one sixteenth ($^1/_{16}$") inch per foot:
    - ❑ Solid SDR 35 or SCH 40 shall be used, and properly backfilled.
  - ❑ For areas with less than twelve (12") inches of cover:
    - ❑ Solid schedule 40 pipe shall be used, regardless of slope.
  - ❑ Last ten (10') feet:
    - ❑ Solid SCH 40 PVC shall be used.
- ❑ No flat (0%) or rising pipe segments shall be present.
- ❑ Connections shall be solvent welded, using color primer, if PVC is used.
- ❑ Mechanical couplers shall be used for corrugated or smooth interior pipe.
- ❑ Dissimilar pipe material connections shall be made with mechanical coupling designed for this purpose. Stainless steel clamps shall be used.
- ❑ Trench shall be backfilled with soils free of large rocks. Tamped and/or mounded to offset settlement effects.
- ❑ Pipe shall be terminated at defined, pre-existing drainageway as specified on approved plan.

- ❑ Minimum six (6") inches freeboard from pipe invert to noted high water mark (or drainageway invert) shall be maintained.
- ❑ Animal guard shall be provided. Either commercial "flapper-type" device or two (2) one quarter (1/4") inch diameter bolts installed horizontally (like an equal sign (=)) shall be used. No basket type devices shall be used.
- ❑ Pipe discharge shall not create any adverse erosion conditions (May require splash block, larger rocks, or rip rap for protection).
- ❑ Gradient drain discharge shall not share a trench with any portion of a pressure pipe network.
- ❑ Any clamps used to secure rubber boot type pipe connection shall be fabricated from stainless steel.
- ❑ Minimum of three (3') feet separation shall be maintained to any force/sub-mains, and eight (8') feet from any lateral or leaching trench.

7.4 Gradient Drain Pressurized Discharge

- ❑ Gradient Drain sump basin shall be required.
- ❑ Pressure pipe shall be Schedule 40 PVC pipe, meeting/exceeding ASTM D-1785/D-2665.
- ❑ Minimum pipe diameter shall be one (1") inches; maximum pipe diameter shall be one and one half (1 $^{1}/_{2}$") inches, unless otherwise specified. Note: Pump shall operate in the middle of the corresponding pump performance curve.
- ❑ Discharge pipe shall be freeze protected by:
  - ❑ Twenty four (24") inches soil cover, **OR**;
  - ❑ Drain back of areas with less than twenty four (24") inches soil cover (Volume of drain back shall be added to net dose of twenty (20) gallons; weep hole shall be installed at proper elevation.)
- ❑ Discharge pipe shall be mechanically protected following Section 5.7.2.
- ❑ Pipe shall be properly bedded.
- ❑ Trench shall be backfilled with soils free of large rocks. Tamped and/or mounded to offset settlement effects.
- ❑ Minimum six (6") inches of freeboard shall be provided at point of discharge to noted high water mark, maximum height above grade shall be less than ten (10") inches.
- ❑ Adequate protection shall be provided at discharge to prevent erosion.(May require splash block, larger rocks, or rip rap for protection).
- ❑ Gradient drain discharge shall not share a trench with any portion of the pressure distribution pipe network.

- ❑ Minimum of three (3') feet separation shall be maintained to any force/sub-mains, and eight (8') feet from any lateral or leaching trench.

7.5 Gradient Drain Sump

See Appendix for drawing of Gradient Drain Basin, for a typical detail of sump installation.

- ❑ Circular: Minimum sump diameter shall be eighteen (18") inches.
- ❑ Rectangular: Minimum side length shall be eighteen (18") inches.
- ❑ Sump basin shall be constructed of rigid, watertight sidewall construction, extending minimum four (4") inches above original grade. Interior wall shall be smooth.
- ❑ Final grade shall be to the lid of sump and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads used).
- ❑ Sump basin shall have it's base on compacted granular fill, mortar, or concrete.
- ❑ Sump basin depth shall allow for a twenty (20) gallon **net** dose (must be increased to include drain back volume, if applicable).
- ❑ Pump shall be sized to handle anticipated flows.
- ❑ Minimum six (6") inch freeboard shall be maintained between sump basin inlet invert and sump pump "on" float.
- ❑ Horizontal glued quick disconnect shall be installed within ten (10") inches of basin top.
- ❑ Nylon lift rope shall be supplied on pump and terminated with ten (10") inches of the basin top.
- ❑ Sump/basin penetrations shall be sealed.
- ❑ Electric shall be installed per Section 8.0.
- ❑ Pump shall be a minimum of six (6") inches off the bottom, either on block or resting inside a properly designed flow inducer if turbine pump.
- ❑ Inlet piping into sump basin shall be solid wall Schedule 40 PVC pipe (ASTM D-1785 or D-2665). PVC pipe shall be continuous to the collector segment and protrudes into the basin a minimum of three (3") inches and extends across the over excavation into the collector trench a minimum of three (3') feet.

- ❑ *Only **one (1)** pipe shall penetrate* from the gradient drain into gradient drain sump, unless otherwise specified.

7.6 Interceptor Drain

An interceptor drain is a *gravity* drain that is used to collect laterally moving groundwater (up gradient) and surface water that is flowing towards a soil absorption field. These are used on sloping sites and placed on up-slope side of the absorption field and receive no flows resulting from the HSTS.

- ❑ Interceptor drain and gradient drain piping shall **not be** interconnected without a sample well on each.
- ❑ Interceptor drain discharge shall be installed per Sections 7.3 thru 7.5.
- ❑ Interceptor drain collector portion shall meet the following requirements:
  - ❑ Pipe Diameter shall be four (4") inches.
  - ❑ Minimum trench width shall be based upon type of backfill:
    - ❑ #57 stone fill, minimum trench width shall be twelve (12") inches.
    - ❑ #8 stone fill, minimum trench width shall be eight (8") inches.
  - ❑ Minimum slope shall be one sixteenth ($^1/_{16}$") inch per foot ($^1/_2$%) of pipe and trench bottom.
  - ❑ Corrugated or smooth interior slotted pipe shall be used meeting ASTM F-405.
  - ❑ Minimum depth of pipe invert/trench bottom shall be twenty-four (24") inches below ground surface on mounded or other above grade structures, or six (6") inches below nearest leaching trench bottom, unless otherwise specified on an approved plan.
  - ❑ Aggregate shall be placed to final grade, to allow surface water to enter trench and pipe.
  - ❑ Drain shall be covered with four (4") inches straw to prevent siltation of the trench.
  - ❑ Interceptor drain collector shall not share a trench with any other piping.
  - ❑ Minimum of three (3') feet separation shall be maintained to any force/sub-mains, and eight (8') feet from any lateral or leaching trench.
  - ❑ If force/sub-mains must cross an interceptor drain as part of an approved design, then the interceptor drain shall be hard piped across the force/sub-mains to five (5') feet on either side and backfilled with tamped dirt.

8 Section 8.0 Electrical System(s)

8.1 General

Electrical system(s) includes all items for a HSTS that require the use of electric power to drive or control part of the system. Items shall include but are not limited to: electric cables, electric wires, electrical conduit, junction boxes, "dry" location installation, float switch(es)/control(s), safety disconnects, service panel requirements and control panel(s). For an explanation of the applicability of the above items, see the following individual sections for the definition and specifications of each. The following items are the general requirements, as they apply to a HSTS, for electrical systems:

- ❑ Electrical permit shall be obtained from the local electrical inspection department.
- ❑ Electrical installations shall comply with conditions of the permit, regulations provided by the National Electric Code (NEC), local electrical inspection department, and these rules.
- ❑ Electrical connections shall be installed to allow for easy access, maintenance, and/or component replacement.
- ❑ Electrical installations shall be approved by the local electrical inspection department before final approval of the HSTS will be given.
- ❑ Recommended that a surge suppressor should be installed that allows protection of the HSTS electrical components.

8.2 Electrical Cable

Electrical cable is defined as a conductor with multiple wires contained in a protective sheath that enables the transmission of electrical current.

- ❑ Electrical cables shall be sized to meet the amperage and voltage requirements of electrical components being served and length of cable shall be adequate to provide service to the component.
- ❑ Directly buried electrical cable shall be rated for the application used or shall be housed within conduit.
- ❑ Electric cable crossing any excavation, tank (regardless of tank materials (e.g. - concrete, plastic, fiberglass)), or entering an electric enclosure, tank riser, pump basin, or building, shall be encased in conduit and protected from settlement. *Exception*: Cable is surrounded by gravel, protected from settlement, with Danger Tape six (6) inches directly above the cable. (Cable must still be in conduit when entering an electric enclosure, tank riser, pump basin, or building.)

- ❑ Directly buried electrical cable shall be placed upon virgin soils or bedded within compacted sand or gravel (see Section 4.0).
- ❑ Depth of burial shall be twenty four (24") inches or greater for electrical cable not encased in conduit. If less than twenty four (24") inches of cover soil, electrical cable shall be encased in conduit.
- ❑ All electrical cable conduit shall be sealed with approved sealant, or device, prohibiting transmission of gasses and vapors originating from within HSTS (e.g. - tanks).
- ❑ Conductor shall be continuous between terminals or splice boxes. No underground splices or splices inside conduit(s) shall be allowed.
- ❑ Low voltage wiring shall not share conduit with high voltage wiring.

8.3 Electric Wire

Electrical wire is defined as a conductor with a single wire that enables the transmission of electrical current.

- ❑ Electrical wire shall be sized to meet the amperage and voltage requirements of electrical components being served and length of wire shall be adequate to provide service to the component.
- ❑ All electrical wires shall be encased in conduit regardless of the burial depth or path of intended wire run.
- ❑ Electrical wire(s) encased in conduit shall be placed upon virgin soils or bedded within compacted sand or gravel. Electrical wire shall be installed in a manner that differential soil settlement will not impart forces on electrical conduit.
- ❑ All electrical cable conduit shall be sealed with approved sealant prohibiting transmission of gasses and vapors originating from within the HSTS (e.g. - tanks).
- ❑ Conductor shall be continuous between terminals or splice boxes. No underground splices or splices in conduit shall be allowed.
- ❑ Low voltage wiring shall not share conduit with high voltage wiring.

8.4 Electrical Conduit

Electrical conduit is defined as a tube or pipe used to encase electrical conductors for protection.

- ❑ Approved schedule 40/80 PVC electrical conduit shall be used within an HSTS when conduit is required.
- ❑ All connections shall be solvent welded or a mechanical watertight joint shall be used.

- ❑ All electrical conduit shall be supported by natural, undisturbed, in-situ soils or compacted sand or gravel fill.
- ❑ Electrical conduit shall be sealed with approved sealant or device, prohibiting entry of gasses and vapors into the conduit at all conduit entrances.
- ❑ No LB type connectors shall be installed below grade.
- ❑ Electrical conduit shall be used to contain electric conductors when soil cover is less than twenty-four (24") inches, regardless of cable/wire type.
- ❑ Electrical conduit shall be installed at locations where an electrical run crosses an excavation. Conduit support shall meet pipe support requirements.
- ❑ Electrical conduit shall be used for any penetration into all risers, tanks or other enclosures and shall be sealed with sealant compatible with the both materials.
- ❑ Conduit shall be sealed to be watertight before entering any J-Box(es).
- ❑ Electrical conduit shall be placed below final grade when entering tank riser or pump basin.
- ❑ Conduit (including LB type connectors) shall contain a metal shield six (6") inches above and below final grade in areas where it is leaving the protection of ground (ex. at ground surface where conduit is extended vertically to enter a control panel).

8.5 Electrical J (Splice) Box(es)

An enclosure specifically designed for electrical system application to allow joining (splicing) of wires or cables.

- ❑ All electrical J box(es) and covers shall be NEMA 4 or NEMA 4X rated. **Metal J boxes or covers shall not be accepted**.
- ❑ J Box(es) used at tanks/basins shall be located within the riser and mounted at a flood proof elevation, above original grade or shall be located according to a specific design.
- ❑ J box(es) located within tanks and/or risers shall be securely mounted, with non corrosive hardware, to the tank or riser. Any penetration created while mounting J box shall be sealed for watertightness, regardless of location. Sealant shall be compatible with both material types.
- ❑ Cord grips shall be provided for any cable entering J Box. Cord grips shall fit cable snugly.
- ❑ No metal cord grips shall be used, unless brass or stainless steel.
- ❑ “Round” or “square” cord grips shall be used with the correct type of wire.

- ❑ J box(es) shall be sealed to inhibit gasses, vapors and water from entering the J box. Any open J box penetration shall be sealed.
- ❑ J box(es) shall be opened (cover open) for inspection of the connections within J box.
- ❑ J box(es) shall be sealed immediately after an approved inspection.
- ❑ No "Plugged" connections shall be used. **Connections shall be hard wired in a J box.**
- ❑ Conduit into J box(es) shall be sealed to prevent vapor/gas/water transmission through the conduit.
- ❑ Any splice box(es) mounted within any riser of any type or within a gradient drain pump basin is **NOT** to be used to house an electrical switch or any other type of electrical disconnect (See Section 8.10).

8.6 Electrical Splices

An electrical splice is the joining of any electrical conductors:

- ❑ Electrical splices shall be waterproof. (non-waterproof electrical splice(s) will not be accepted).
- ❑ Waterproof splicing techniques shall be used;
  - ❑ Either butt-splice connectors covered in heat shrink tubing shall be used**; or**,
  - ❑ Manufactured waterproof wire nuts shall be used**; or**,
  - ❑ Heat shrink butt-splices shall be used.
- ❑ All splices shall be located in an accessible electrical J Box which shall be in a riser.
- ❑ No "Plugged" connections shall be used. **Connections shall be hard wired in a J Box.**
- ❑ Adequate wire shall be present in the J Box to allow easy connection and replacement of the component (Pump, float switches, etc.).

8.7 Dry Locations

A dry location is defined as dry if it meets any of the following conditions:

- ❑ Dry locations shall only be acceptable if they meet any of the following criteria:
  - ❑ Specified as part of a design that is stamped by a professional engineer (PE)**; or**,
  - ❑ Accepted as a dry location by the local electrical inspection department**; or**,
  - ❑ Wired using components specified by the design.

8.8 Float (Or Transducer) Switch/Control

A liquid level switch/control is a device that will activate or deactivate an electrical circuit based upon its relative position. Typically these are used in the controlling of pump activity, timed dosing activity, and alarms. A switch transmits motor amps, directly controlling a pump motor. A control transmits signal amps to various pump motor control circuitry.

- ❑ Narrow angle, signal rated float controls (or a transducer) shall be used in conjunction with motor contactors/solid state pump control relays in the control panel to operate any pumps where accuracy is needed to meet liquid level requirements in dosing tanks and/or where precision is needed in dosing.
- ❑ Float(s) shall be protected from moisture contacting bare wires or the paper insulation wrap between wires.
- ❑ Float(s)/transducers shall not be disturbed by any water stream (e.g. - weep hole spray or force main pressure bleed) within chamber.
- ❑ Float(s)/transducers shall be installed so that they are free to move up and down without interference from other float(s), discharge piping, pump, or other items within tank or basin.
- ❑ Float(s)/transducers shall be installed in a manner that any service time can be minimized.
- ❑ Float(s)/transducer setting(s) (elevation/height within the tank or basin) shall be documented on the Dose Sheet as required.
- ❑ Float(s) shall be spliced per 8.5 and 8.6 of this Section.
- ❑ Floats or transducers shall be placed on their own support tree with only one lock in position (not relying on pump discharge for support), for ease of servicing.
- ❑ Float or transducer support trees shall lock into an exact position.
- ❑ Float trees and support mechanisms shall be non-corrosive.
- ❑ Float cords or transducer tubing shall be left long enough to easily remove or adjust settings. Excess cords or tubing shall be wound and zip tied.

8.9 Service Panel

A service panel is an electrical panel that is used to distribute electricity to various circuits via breakers.

- ❑ Service panel breakers serving the control panel circuits or other HSTS circuits shall be clearly and permanently labelled as follows:
  - ❑ HSTS Controls/Alarms.
  - ❑ HSTS Pump #1 (Pump #1 is always the first pump in the treatment train).

- ❑ HSTS Pump #2.
- ❑ HSTS Pump #3.
- ❑ HSTS Blower.
- ❑ Aerobic Treatment Unit (ATU) Motor.

❑ Ground fault interrupters (GFCI's) type breakers shall not be used to provide service to the HSTS. Except for components which call for GFCI protection in an approved design.

8.10 Safety Disconnect(s)

A safety disconnect is a device that maintains a circuit open such that any component (e.g. - pump) cannot be activated during times of service.

❑ Each electrical motor shall have a safety disconnect that is approved by the local electrical inspection department.

❑ Safety disconnect(s) shall be located outdoors in an accessible location.

❑ Safety disconnect(s) shall be located within a lockable control panel, lockable service panel, or an approved motor disconnect device shall be located on outside wall at least three (3') feet above final grade.

❑ Shall be labelled properly for the device which it services.

8.11 Control Panel(s)

A control panel is an electrical component designed for HSTS applications to control the HSTS system activity.

8.11.1 General

The following items shall apply to all control panels regardless of type of panel and type of house:

❑ All control panels shall be located outdoors for convenient inspection and service.

❑ Control panel(s) shall be installed within view of the treatment tank (septic/dosing tank).

❑ Control panel shall be located for convenient viewing and access by the homeowner.

❑ Control panel shall be mounted four (4') feet to five (5') feet above final grade.

❑ Control panel shall be located on or within five (5') feet of an exterior house wall or a letter shall be provided to the Health District before final approval, signed by the homeowner, to justify the location of the panel.

❑ It is **NOT** recommended that control panels be located on exterior walls of frequently used living quarters. Occasional control panel noise may disturb occupants.

- ❑ Control Panels must be mounted and conduit installed so any settling will not distort or crack the enclosure.
- ❑ Only one control panel shall be used to operate the entire treatment system. If a secondary control panel is necessary, it must be tied into the primary controller with seamless operation, including but not limited to, having proper alarm notifications and the proper failsafe pump lockout interlinks.
- ❑ All controls must have two timers for the first pump in the system. These timers must have an "OFF" and "ON" setting with multiple and exact timing increments. The control panel will operate the first pump in the system to dose at two different rates, one for average flow and one for peak flow. These flow rates will be based off of the liquid level in the dosing tank.
- ❑ Timers must be programmable and shall be set to evenly distribute a maximum of 60% of the daily design flow spread out over a 24 hour period (Average Flow). Override timers must be set to 100% of the daily design flow in a 24 hour period (Peak Flow).
- ❑ Pumps or electrical components downstream of the first pump must be remotely monitored by the control panel. The control panel shall have pump lockout interlinks for these electrical components so that if failure occurs, the first pump in the system (the timer-operated pump) must shut down and an audio and visual alarm must be activated. The system must be setup control wise, and elevation wise, so that during any failure event, sewage/effluent can not pass to the next component unintentionally. Examples, including but not limited to, disinfection device failures, secondary pump high water alarms, aerator failures, curtain drain pump high water alarms, filter clogging, etc. are all critical control functions within the HSTS which need to have <u>separate</u> primary pump lockout interlinks (dry alarm contacts).
- ❑ With dry alarm contacts for disinfection devices, such as UV, the control panel shall be designed to monitor for circuit closure, via sensing devices, to report that the device is functioning properly.
- ❑ Motor contactors/solid state pump control relays in the control panel, shall be used in conjunction with narrow angle, signal rated float controls (or a transducer) to operate any pumps where accuracy is needed to meet liquid level requirements in dosing tanks, and/or where precision is needed in dosing. Examples, including but not limited, to Intermittent Sand Filters, and Mounds are HSTS where this is required.

- ❑ All control panels must have Elapsed Time Meters and Event Counters for each pump within the system (includes secondary pumps, excluding curtain drain pumps).
- ❑ All controls must have a peak enable and high water alarm Event Counters for every pump (excluding curtain drain pumps).
- ❑ Controls must not respond to high water events by allowing the timer-controlled pump to dose on demand. High water events must activate an audio and visual alarm to the user and record an event on the Event Counter.
- ❑ Control panels shall be equipped with a programmable function which will hold the system in peak enable mode (Peak Flow) for a minimum number of cycles after the liquid level drops below the peak enable activation point. Preliminarily, this function shall be set to hold the controller in peak enable until fifty (50%) percent of the system's surge capacity is evenly pumped away.
- ❑ Control panels must contain motor contactors/solid state pump control relays in conjunction with narrow angle, signal rated float controls (or a transducer) to operate any pumps where accuracy is needed to meet liquid level requirements in dosing tanks and/or where precision is needed in dosing. Examples including but not limited to Intermittent Sand Filters, and Mounds are HSTS where this is required.
- ❑ Low Level/Redundant Off liquid level sensors must be used on non-proprietary treatment systems. This sensor must cut power to the pump which it is protecting when the liquid level drops below the sensor. A Low Level Event Counter must record this event. Low Level Alarms must activate an audio alarm and lock ON the Visual Alarm Light until the user resets it. **Additionally, when time dosing out of a screen vault filter**, a Minimum Run Time equal to the timer "ON" setting must keep the pump running even if the liquid level drops below the Timer Enable liquid level sensor. (This will prevent short cycling of the pump and test the screen vault filter for clogging if the liquid level drops to the Low Level/Redundant Off sensor before the Minimum Run Time expires).
- ❑ Controls must contain a switch to silence an audio alarm.
- ❑ Controls should be tied into an existing house lighting circuit. If this is not possible, the control panel must have a green or yellow LED light that is always ON when power is supplied to the panel.
- ❑ Control circuits must always be on a separate circuit from other system components. In other words, the controls

cannot share a circuit with a pump, aerator, disinfection device, etc.

- ❑ A separate circuit breaker must be supplied in the system control panel for every electrical component. (Ex. a two pump system would have 3 breakers. One for the controls and one for each pump. Excludes gradient drain pumps).
- ❑ All control panels must have a Hand-Auto, Hand-Auto-Off (H-A, H-O-A) switch for each pump in the system.
- ❑ If a control panel contains a heater, it must be thermostatically controlled.
- ❑ All control panels must be UL Listed and be NEMA 4X rated.
- ❑ Electrical conduit shall be sealed with a product recommended by the control panel manufacturer to prohibit entry of gasses and vapors originating from within the HSTS to enter the control panel.
- ❑ Control panels shall contain a sticker on the interior door containing a legend of Program Logic Control Parameters and/or a legend and explanation for all Digital/LED/Light readouts within the panel.
- ❑ Control panel shall be equipped with telemetry which will alert the contracted registered maintenance provider and the Health District by phone, or internet 24 hour a day and 7 days a week, when there is a component failure, malfunction, or other alarm condition in any part of the treatment system. The telemetry shall comply with the following:
  - ❑ The units must share an existing telephone line within the dwelling, **and;**
  - ❑ The units must call a computer system which will, by use of software or other means, keep an ongoing record of all alerts, alarms, and status updates of each system, **and;**
  - ❑ The units must call into the computer system at least once per month giving an update of system status.
  - ❑ The unit must be capable of monitoring all of the treatment system's electrical/critical control devices. If any device failure should occur, the unit will send a unique signal identifying the exact component failure.
  - ❑ When an alarm/alert condition subsides, the unit shall send an all clear signal.
- ❑ It is recommend that surge suppressors are supplied in all control panels.
- ❑ Audio and visual alarms may be time delayed.

8.11.2 Stick-Built and Modular Homes with Indoor Service Panels

The following items shall apply to the aforementioned type of housing structures:

8.11.2.1 Option #1

*Recommended for replacement systems but **REQUIRED for new construction.***

- ❑ Each panel circuit shall connect to a dedicated service breaker.
- ❑ Service breakers shall be equal to control panel breakers (Based on amperage rating).
- ❑ Control circuit shall share power with an indoor lighting circuit (e.g. - light circuit for bathroom, hall, etc.) or a light emitting diode (green or yellow) shall be installed on the control panel door to indicate power to the control circuit from a dedicated service breaker.

8.11.2.2 Option #2

- ❑ Control circuit shall share power with an indoor lighting circuit (e.g. - bathroom, hall, etc.).
- ❑ Dedicated service breaker shall protect motor circuit(s).
- ❑ For systems with more than one motor, the dedicated service breaker shall be capable of handling the total starting amperage (amps) drawn by all the motors it serves.
- ❑ Circuit wiring shall be sized for the total starting amps drawn by motors and the voltage drop across the electrical circuit.

8.11.2.3 Option #3

- ❑ Light emitting diode (green or yellow) shall be installed on the panel to indicate power to control circuit from dedicated service breaker.
- ❑ Dedicated service breaker shall protect motor circuit(s).
- ❑ In cases of more than one motor, the dedicated service breaker shall be capable of handling the total starting amps drawn by all the motors it serves.
- ❑ Circuit wiring shall be capable of handling the total starting amps drawn by motors and the voltage drop across the electrical circuit.

8.11.3 Manufactured Homes (Single/Double Wide) with an Outdoor Service Panel (No access to circuits inside the house)

8.11.3.1 Option #1

*Recommended for replacement systems but **REQUIRED for new construction.***

- ❑ Each panel circuit shall connect to a dedicated service breaker (based on amperage rating).
- ❑ Service breaker(s) shall be the equal of the control panel breakers.
- ❑ A light emitting diode (green or yellow) shall be installed on the control panel door to indicate power the control circuit from a dedicated service breaker.

8.11.3.2 Option #2

- ❑ Control panel circuit shall connect to a dedicated service breaker.
- ❑ A light emitting diode (green or yellow) shall be installed on the panel to indicate power to control circuit from dedicated service breaker.
- ❑ Dedicated service breaker shall protect motor circuit(s).
- ❑ In cases with more than one motor, the dedicated service breaker shall be capable of handling the total starting amps drawn by all the motors it serves.
- ❑ Circuit wiring shall be capable of handling the total starting amps for the motors and the voltage drop across the electrical circuit.

8.11.4 Control Panel Data and Settings

The following are required for control panels that utilize an analog or digital timer mechanism to control dosing within a HSTS.

- ❑ Event counter totals, elapsed time meter reading, and timer settings shall be recorded on documentation that remains in the control panel.
- ❑ For systems that provide other system information such as number of high water alarms, number of timer override occurrences, this information shall be recorded on documentation that remains in the control panel.

8.11.5 Control Panel with Analog Timer

Control panels that use an analog (dial) timer must meet the following requirements:

- ❑ Timers shall be set to the smallest unit of time possible. (For example, if the dose time is to be one (1) minute thirty (30)

seconds and the timer is capable of being set to seconds; the timer should be set to ninety (90) seconds, NOT one and one half (1.5) minutes).

8.11.6 Control Panel with Digital Timer

Control panels that use a digital timer must meet the following requirements (This includes digital timers that are controlled through a computer interface, rather than setting adjustments on the timer itself):

- ❑ "OFF" timers shall be set in hours mode and "ON" timers shall be set in seconds mode unless otherwise specified in a proprietary treatment unit.
- ❑ Program Logic Controls Parameters shall be clearly labelled inside the control panel door.

9 Section 9.0 Disinfection and Monitoring Devices

9.1 General

Disinfection and monitoring devices are an important part of many HSTS installations which allow the end user to properly operate, manage, and maintain the onsite system. These components are often essential to easily identify and fix problems, meet regulatory requirements, or adjust settings to prevent system failure and health hazards.

9.2 Disinfection Devices

A Health District reviewed and approved commercially manufactured vessel which is designed to allow effluent to pass by and expose it to an agent which kills or inactivates disease causing organisms.

9.3 Scope and Applicability

These devices are used in an HSTS to meet water quality discharge standards or to gain depth credits in soil absorption systems.

9.4 Types of Disinfection

Currently only two types are available for use in the County. They are UV radiation and tablet chlorination. The following shall apply to both units:

- ❑ The unit shall be sized for flows of two (2x) times the daily design flow from the pretreatment device as a safety factor.
- ❑ They shall be installed according to the Health District approved manufacturer's recommendations.
- ❑ The unit shall be installed upstream of sample well/point.
- ❑ The unit shall be watertight.
- ❑ They shall be housed in an easily accessible container for convenient servicing.
- ❑ They shall be monitored by the control panel via dry alarm contacts and shall alert the operator when maintenance is needed. The control panel's dry alarm contacts for disinfection devices shall be designed to monitor for circuit closure to report that the device is functioning properly.
- ❑ When maintenance is needed, the control panel shall inactivate any primary pumps in the system until serviced is properly performed.

9.4.1 UV Disinfection

UV radiation is generated by an electrical discharge through mercury vapor which penetrates the genetic material of microorganisms and

retards their ability to reproduce. The following shall apply to UV devices:

- ❑ The unit shall be approved under NSF Standard 46 unless other Health District approved standards are met.
- ❑ Shall be installed immediately after the pretreatment component.
- ❑ When called for as part of an approved design, UV shall be installed before any soil absorption component.

9.4.2 Chlorinators

Chlorine, a powerful oxidizing agent, kills or inactivates microorganisms by oxidation of cellular wall material. The following shall apply to Chlorinator devices:

- ❑ Shall be designed to prevent tablets from being immersed in effluent.
- ❑ Shall be installed with a free flowing outlet.
- ❑ When called for as part of an approved design, shall be installed before discharging to an approved location.
- ❑ Shall never be installed before a soil absorption system or other treatment device.
- ❑ Shall use calcium hypochlorite tablets.
- ❑ Shall be stocked with 5 tablets in each feeder tube before final approval.
- ❑ Additional tablets shall be left with homeowner in their original container.
- ❑ Tablets shall be formulated for residential flows to prevent wicking.
- ❑ Shall be used in conjunction with a contact chamber and dechlorinator.

9.4.2.1 Chlorine Contact Chamber

For chlorine to properly disinfect, the chemical must be in contact with the wastewater for a given length of time. For this reason contact chambers shall be designed and installed behind chlorinators so that the wastewater flows turbulently, in a plug flow fashion, throughout the device, ensuring complete mixing. This mixing allows the chlorine to have maximum contact with the wastewater and ensures that there are no dead areas (unused portions) of the tank. The following shall apply to Chlorine Contact Chambers:

- ❑ Chamber(s) shall have a minimum of 70 gallons.
- ❑ Shall be sized to allow for a minimum of 20 minute contact time.
- ❑ Effluent shall flow in a plugged flow fashion through a labyrinth with a minimum of a 20:1 length/width ratio, unless otherwise approved.

- ❑ Shall be constructed of rigid watertight material, extending minimum four (4") inches above original grade.
- ❑ Final grade shall be to the lid of chamber and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted down with (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads).
- ❑ Shall be subject to Section 3.0 watertightness test requirements.
- ❑ Shall be designed and installed so that water does not back up to the chlorinator.

9.4.2.2 De-Chlorinators

Because chlorine is a powerful oxidizer which is harmful to humans, animals, and the environment, removal of chlorine from the waste stream is necessary. De-chlorination tablet feeders shall require the same specifications to be followed as chlorinators. The following shall apply to De-Chlorinators:

- ❑ De-chlorination tablets shall be formulated with Sodium Sulphite.
- ❑ Shall be installed downstream of contact chamber.
- ❑ Shall be installed so that water does not back up to the chlorinator.

9.5 Effluent Sampling Wells

Allows for the monitoring of treatment system effluent quality to insure compliance with regulations.

- ❑ Vessel shall be subject to requirements found in Section 3.0.
- ❑ Vessel shall have a minimum diameter of fifteen (15") inches, or shortest sidewall length of fifteen (15") inches.
- ❑ Shall be designed and installed so that effluent has a free flowing inlet.
- ❑ Shall be designed with six (6") inches of freeboard under inlet pipe.
- ❑ Inlet pipe shall extend into the basin three (3") inches.
- ❑ Outlet shall be six (6") inches above the bottom of the basin.
- ❑ Outlet pipe shall extend into the basin three (3") inches.
- ❑ Shall be installed after any disinfection device, unless otherwise stated.
- ❑ Shall be constructed of rigid watertight material, extending minimum four (4") inches above original grade.

- ❑ Final grade shall be to the lid of chamber and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted down (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads).

9.6 Access Wells/Valve Boxes

An access well/valve box is a container designed to be installed below grade that maintains an open volume at this location. Valve Boxes/Access Wells shall have lids to grade which provide access to observation ports, lateral cleanouts, valves, and other system components.

9.6.1 Specifications

The following apply to access wells/valve boxes:

- ❑ Easy access to internal components shall be provided.
- ❑ May contain multiple system components, such as observation port and flushing cleanout; however, adequate space must be provided to inspect and maintain each of the contained components.
- ❑ Shall be set upon a stable, compacted gravel base; so that lids or covers will not settle onto internal components.
- ❑ Shall be installed so that lids and covers are flush with ***settled*** finished grade. (Backfill soil around access well/valve box shall be firmly compacted and will compact no further under foot pressure).
- ❑ Wells/Boxes shall contain concrete, fiberglass, or PVC lids that lock into place.
- ❑ Wells/Boxes shall be protected from lawnmower damage.

9.7 Observation Ports

An observation port is a device that allows viewing of various infiltrative surfaces within a structure.

9.7.1 Specifications

The following apply to observation ports (See Observation Port drawing in the Appendix).

- ❑ Ports shall be constructed from three (3") inch or four (4") inch schedule 40 PVC pipe solvent welded to a PVC toilet flange base of the same diameter.
- ❑ The bottom of the toilet flange shall be removed.

- ❑ Port base shall contain four (4) slots, four (4") inches long, one eighth ($^1/_8$") to one quarter ($^1/_4$") inch wide, placed ninety (90) degrees to one another.
- ❑ Observation ports on sands/soil interface shall have slots wrapped in geotextile fabric to prevent siltation of viewing surface.
- ❑ Top of the observation port shall be terminated at a point that is three (3") inches below final grade.
- ❑ Observation port shall be fitted with **non-threaded** cap/plug that can be easily removed (thin test caps/plug).
- ❑ Port shall be made accessible in a valve box or other approved access well.

9.8 Telemetry Control Panel Requirements

Any HSTS which requires telemetry as part of it's approved design, including but not limited to, mechanical HSTS, discharging type household sewage treatment systems, reduced primary tank volumes, or systems which gained approval for use in Hamilton County by using telemetry shall have**:**

- ❑ Met the requirements of Regulation 529.10(K)(7)(a), (b),&(c).
- ❑ A control panel which shall be equipped with telemetry that will alert a contracted Registered Operator or backup Registered Operator and the Health District by phone, or internet 24/7 when there is an alarm condition within the entire treatment system. There shall be, as a condition of the maintenance agreement, a maximum of 24 hours between the time of an alarm and the arrival of a service provider at the site.
- ❑ An operable phone connection shall be hooked to the control panel at the time of final inspection (on replacement systems) and at all times thereafter (all systems).
- ❑ The telemetry system shall be capable of monitoring all of the treatment system's electrical devices/critical control devices. If device failure should occur, the panel will notify both the registered system operator and the Health District with the exact component failure.
- ❑ When an alarm/alert condition subsides, the unit shall send an all clear signal.

10 Section 10.0 Mounds/Modified Mounds/Other At-grade Structures

10.1 Definition

A mound/modified mound/other above grade structures will be referred to as structures throughout this section. These provide secondary or tertiary treatment for domestic wastewater. Domestic wastewater is distributed over the infiltrative surface of the structure for treatment and/or dispersal into site soils. These structures are used to compensate for inadequate soil conditions, site topography, and other limitations.

10.2 Scope and Applicability

Structures are applicable to soils and lots with slow permeability soils, seasonally shallow water tables, and other restrictive conditions. They are used to receive soil depth credits.

10.3 Purpose and Function

Structures provide a device to overcome certain site limitations. Two general classes of these structures exist. The first class are those structures that receive septic tank effluent. In these, the structure provides secondary treatment of the effluent, while providing a sufficient structure-soil interface to allow infiltration at a rate that can be accommodated by the native soils. Two examples of these are Mounds and Drip Micro Mounds. The second class are those structures that receive filtrate. Filtrate is septic tank effluent that has been sufficiently “cleaned” by a treatment device. These structures provide an effective method of spreading filtrate over adequate soil surface area so that the infiltration rate of the soil is not exceeded. Modified mounds (designed like a mound with less sand) provide additional treatment as the filtrate passes through the structure while modified at-grades offer less treatment within the structure and serve primarily to take advantage of the upper soil horizons.

10.3.1 Specifications

The following shall apply to the design, location, and installation of all structures.

10.3.2 General

- ❑ Structure shall not be located in low or swampy areas.
- ❑ Unless otherwise specified within an approved plan, structures shall be either time dose or follow a pretreatment device which is time dosed.

- Unless otherwise approved, interceptor drains shall be installed at the upslope toe of the structure's cover on sites with slope.
- Gradient drains shall be installed under the structure's soil cover on structures where:
  - Less than 4% site slope exists and a limiting soil condition is within twenty four (24") inches of the ground surface.
  - Sites where a limiting soil condition exists within fifteen (15") inches of the ground surface.
  - The more liberal soil loading rates are permitted to be used on existing lots (See Section 10.3.3).
  - The structures must be stacked in order to fit on an existing lot.

10.3.3 Design Guidelines

- Structures shall not be used, unless otherwise approved, on sites where less that twelve (12") inches of suitable in-situ site soils are present.
- Size shall be based on design flow rate; type of waste being treated (septic tank or pretreated effluent), and the soil conditions found at the site.
- Health District approved soil tables shall be used for soil loading rates.
  - On lots created after January 1, 2003 the more conservative soil loading rate tables shall be used.
  - On existing lots, when possible, the more conservative soil loading rate tables shall be used.
  - On existing lots, unless otherwise approved, the more liberal soil loading rates shall not be exceeded.
- Health District approved design methods and calculations shall be used in system engineering.

10.3.3.1 For Mound and Modified Mound Structures

Design shall provide:

- Compliance with Section 5.0.
- Maximum sand loading rate of .75gal/ft^2.
- Minimum infiltrative width (gravel width) of four (4') feet.
- Instantaneous orifice loading of 0.25 gallons/orifice/dose to 0.42 gallons/orifice/dose.
- Minimum infiltrative area orifice density of 6ft^2/orifice.
- Even orifice staggering and placement provides efficient infiltrative area usage with minimal "overlap".
- Mound minimum sand thickness of twenty four (24") inches.

- ❑ Modified mound minimum sand thickness shall depend upon pretreatment device used and remaining soil depth credits needed.

10.3.3.2 For Modified At-Grade Structures

Design shall provide:

- ❑ Compliance with Section 5.0.
- ❑ Minimum infiltrative width (gravel width) of two (2') feet.
- ❑ Maximum instantaneous orifice loading of .28 gallons/orifice.
- ❑ Maximum orifice spacing of two (2') feet.
- ❑ Minimum sand thickness of four (4") inches.

10.4 Basal Area Preparation

Basal Area preparation includes activities necessary to allow the construction of a structure. These activities are clearing, basal area chisel plowing and protection of this area. Clearing involves the removal of vegetation to allow the plowing of the footprint of the proposed soil absorption system. Chisel plowing opens the surface of the soil absorption area creating an interface to allow infiltration of waters into the soil profile.

10.4.1 Protection

Protection of the basal area and replacement area is extremely important through all phases of the construction process. Extreme care must be taken to avoid compaction of the basal area from HSTS construction activities or other site activities. Even with the use of low ground pressure equipment during the basal preparation, care must be used as to not smear or rut this area. The reserve (backup) area shall be held to the same protection standards as the primary area.

- ❑ Basal and reserve area shall be protected from unauthorized access by barricades or other features that limit site access.
- ❑ Material staging or any activity located nearby shall not impact the basal area.
- ❑ Sources of surface water run-on shall be identified and measures shall be taken to protect basal area from these flows.
- ❑ **No excavation shall occur in the basal area**.
- ❑ Damage to the basal area may require relocation of the structure, relocation of the entire system, and possibly re-design. Re-design fees may be charged.

10.4.2 Clearing

Clearing shall consist of vegetation removal from the footprint or basal area of the structure. All conditions in Section 2.4 shall apply.

10.4.2.1 Areas Without Trees or Brush

- ❑ See Section 10.4.2.3 for equipment requirements.
- ❑ Basal area vegetation shall be cut as close as possible to ground surface without compaction, rutting, or smearing.
- ❑ No heavy equipment shall be used.
- ❑ Clipped (loose) vegetation shall be removed from the basal area; removal methods shall not cause compaction, rutting, or smearing.

10.4.2.2 Areas With Trees or Brush

- ❑ Trees or bushes with a trunk diameter three (3") inches or larger shall be cut as close to the ground as possible, leaving the stump.
- ❑ Trees or bushes with a trunk diameter of less than three (3") inches shall either be removed by pulling them out (including stump) or they shall be cut as close to the ground as possible, leaving the stump.
- ❑ Organic debris shall be removed.
- ❑ Areas with excessive vegetative litter (e.g. – sticks/brush/leaves) shall have that litter removed in an acceptable manner (Raked/blown off).

10.4.2.3 Mechanical Clearing

- ❑ Use of mechanical means for clearing shall be subject to the same limitations that apply in Sections 10.4.2.0, 10.4.2.1, and 10.4.2.2.
- ❑ Machines with very low ground pressure of less than 4 psi can be used; for example, skid steers with rubber tracks, and/or small rubber tracked excavators.
- ❑ No rubber tire equipment shall be used, except walk behinds.
- ❑ Care shall be taken to ensure soil compaction and smearing are avoided.

10.4.3 Chisel Plowing

Chisel plowing of the basal area (infiltrative surface) creates an interface between the sand of the structure and the soil. The characteristics of the interface zone will determine the performance of the structure. The key element is to expose enough of the existing soil structure so that all of the effluent can enter the soil and begin the final phase of treatment.

Water moves through any soil by two methods: 1) flowing through pore spaces within the soil structural unit (peds) 2) flowing through void spaces created by ped arrangement (between peds). Water

movement through soil pores depends on pore size and continuity. The finer (smaller) the pore size, the slower the water movement (and vice versa). In very small pore spaces, the attractive forces between the water molecules and the individual sand, silt and clay particles that compose the soil are strong and dominant. Water molecules move from the moist particles to the dry particles very slowly. Soil with weak structure does not have well defined spaces between the soil peds. The soil's structure cannot be improved by mechanical means, so damage to the structure must be minimized during chisel plowing operations.

The moisture state of the basal area must carefully be considered prior to chisel plowing. It is possible for the soil to be too wet or too dry. If the soil is too wet, compaction and smearing of the soils is possible thus greatly reducing the quantity of infiltration across the sand/soil interface. If the soil is too dry, it is possible to pulverize the soil into dust. The dust layer results in a soil strata that has very small pore spaces and no soil structure, greatly inhibiting infiltration into the soil basal area.

10.4.3.1 Chisel Implement Guideline

- ❑ Before plowing basal area, chisel plow implement shall be tested on soil in a similar condition to the basal area to ensure it meets performance criteria.
- ❑ Tractor tire or tracks shall not lose traction and spin (Note: power requirement is approximately ten (10) horsepower per shank).
- ❑ Bucket teeth shall not be used as chisel implement.
- ❑ Rototiller(s) shall NOT be used.
- ❑ Unless otherwise specified, the following shall apply:
  - ❑ <u>Width:</u>
    - ❑ Individual chisel shanks shall be one (1") inch to two (2") inches wide.
  - ❑ <u>Spacing:</u>
    - ❑ Spacing of shanks shall be fifteen (15") inches or less, center-center. (Ideal spacing is to have shanks staggered nine (9") inches apart).
    - ❑ Soil conditions may require closer spacings, or additional passes with implement (Note: Tractor propelled implements shall be limited to one pass, see below).
    - ❑ Spacings shall allow fractured soil to flow between shanks, soil shall not be dragged.
  - ❑ <u>Length:</u>
    - ❑ Shanks shall be long enough to penetrate soil four (4") inches to six (6") inches.

- Shanks shall be long enough to prevent fractured soil and sod from being dragged by implement.

- Width of Implement:
  - Tractor hitch-mounted implements shall have an effective width equal to, or exceeding the width of tires or tracks.
  - Tractor hitch-mounted implements shall make one pass to chisel plow the effective width of the implement.
  - Backhoe and excavator arm-mounted implements shall have no minimum width requirement, *but care shall be taken to not overwork the soil*.
  - Shall allow the operator full view to monitor chiselling operation.

10.4.3.2 Chisel Plow Requirements

- Only infiltrative surface (basal area) shall be plowed.
- Buffer area between the basal area and gradient drain shall not be disturbed.
- For sites with side-side elevation difference of more than six (6") inches:
  - Chisel plowing shall be parallel to the land contour.
- For sites with side-side elevation difference less than six (6") inches:
  - Chisel plowing direction shall not matter, but the operator shall not overwork a particular area due to overlap.
- Chisel plow shall be around any remaining stumps.
- Effective depth of chisel plowing shall be four (4") inches to six (6") inches (unless written authorization was obtained to do otherwise).
- Irregular surface shall result from chisel plowing.
- **Plowed infiltrative surface shall have 60 to 75% of the soil surface broken up.**
- Bottom and sidewall of plowed groove shall be rough and open.
- Immediately after completion ***and*** acceptance by the Health District, plowed area shall be covered with a layer of sand, or other specified material.
- Chisel plowing shall not be attempted when basal soils are frozen. Guidance for saturated or extremely dry soils is given in Section 2.4 Soil Moisture Condition Planning.
- Chisel plowing shall be stopped if smearing of plowed soils or vertical groove wall is noted.

- ❑ Bucket teeth shall not be used as chisel implement.
- ❑ Rototiller(s) shall NOT be used.

10.5 Layout of Structures

This section gives specifications applying to the layout of structures for the following site conditions. They are; "flat" sites - regular shape; "flat" sites - irregular shape; sloped sites; and split/divided structures. A regular shape is a typical rectangular shaped structure, while irregular shape is a structure that deviates from a typical linear type structure. In some instances, site conditions (available area/topography) require that a structure be divided or split so that the structure meets design requirements.

10.5.1 Flat Site – Regular Shape

A regular shape reflects a straight line type structure, while a flat site is a site in which the slope of the site is less than 4%.

- ❑ Orientation is not greatly dictated by the contour of the land. Therefore, the orientation of the structure can be based on maintaining minimum isolation distance from various site features, overall parcel utilization characteristics, and owner preferences.
- ❑ Structure shall avoid crossing any type of surface water drainage course. If crossed as part of an approved plan, potential flows shall be redirected away from or around the structure.
- ❑ Maximum deviation of basal elevation directly under lateral(s) shall be six (6") inches per one hundred (100') feet of the structure.

10.5.2 Flat Site – Irregular Shape

An irregular shape is one in which an L-shaped type structure is to be installed. Special consideration must be given to these sites such that design assumptions are not violated (particularly linear loading rate, LLR). A flat site is a site in which the slope of the site is less than 4%.

- ❑ Orientation is not greatly dictated by the contour of the land. Therefore, the orientation of the structure can be based on maintaining minimum isolation distance from various site features, overall parcel utilization characteristics, and owner preferences.
- ❑ The "short" structure side dimension shall be equal in length to the dimension of "straight-line" type structure.
- ❑ The pressure piping distribution laterals shall be placed so that sideways moving water that flows perpendicularly from the lateral will "see" the "short" structure side dimension. (See figure 10.1)

- ❑ Structure shall avoid crossing any type of surface water drainage course. If one must be crossed as part of an approved plan, potential flows shall be redirected away from or around the structure.
- ❑ Maximum deviation of basal elevation directly under lateral(s) shall be six (6") inches per one hundred (100') feet of the structure.

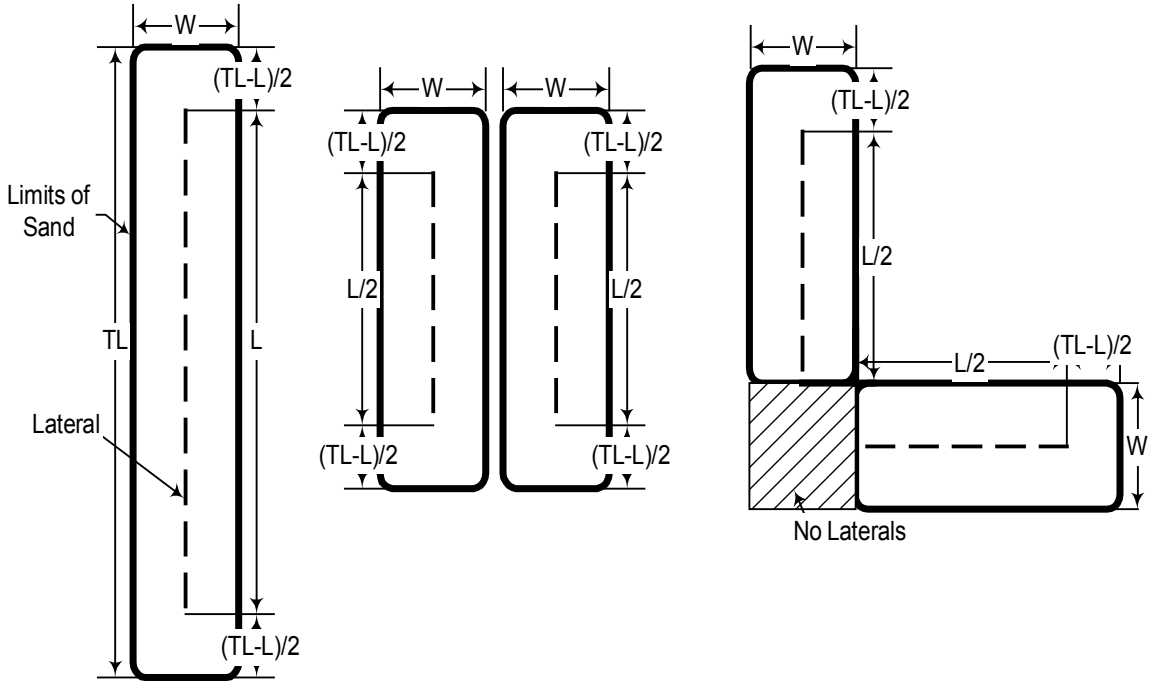


Figure 10.1 – Irregular Shape Structure. Dimension L must be the same for both structures.

10.5.3 Sloped Site

A sloping site is one in which the slope of the area on which the structure is to be placed is equal to or exceeds 4%.

- ❑ Long axis of the structure shall follow the contour of the slope.
- ❑ All isolation distance requirements shall be met.
- ❑ Structure shall avoid crossing any type of surface water drainage course. If one must be crossed as part of an approved plan, potential flows shall be redirected away from or around the structure.
- ❑ Surface water shall be redirected around the structure prior to contact with the structure's toe.

- ❑ Maximum deviation of basal elevation directly under lateral(s) shall be six (6") inches per one hundred (100') feet of the structure.

10.5.4 Split/Divided Structures

A split/divided structure is one in which the structure is divided into completely separate structures. These are typically installed due to special site conditions. These types of structures result in increased aggregate requirements for structure completion.

- ❑ Structures shall be laid out to satisfy the required linear loading rate.
- ❑ Individual structures shall be installed per Section 10.5.1 or 10.5.3 as they apply due to the site conditions.
- ❑ Installation of this type of structure shall only be as part of an approved plan.

10.6 Construction Specifications

These specifications are given as a general approach to the steps necessary to construct structures. It contains items that are specific to these types of systems, but the overall approach is applicable to many types of HSTS installations.

10.6.1 Structure Layout Procedure

The following sections are the recommended procedure to layout these types of structures. The structure must be laid out so that the basal area can be located and checked for compliance with applicable rules. The layout also serves as the starting point of the as-built plan. It serves as a critical tool for planning the overall HSTS. It allows the installer to assess what the site conditions are and what will be required to install a particular HSTS on the site. The following shall be the summary of activities for the layout of these types of system.

- ❑ Structure location shall be marked and installer verified that the layout requirements can be met.
- ❑ Other items, such as proprietary pretreatment technologies, septic tank, and dose tank, shall be located and marked. Distances and elevation changes shall be noted with respect to the other components to provide input for hydraulic calculations (or to give to pump vendors for proper pump sizing).
- ❑ Gradient drain basin, discharge line route, and discharge location shall be located. Elevational changes and distances shall be recorded to verify ability for gravity outlet, **or** provide input for hydraulic calculations (or to give to pump vendors for proper pump sizing).
- ❑ The layout shall verify that all minimum required isolation distances are met.

- ❑ Any questions shall be noted so that these may be addressed at the time of the preconstruction conference.

10.6.2 Layout of Structures Requiring a Level Upper Sand Surface

- ❑ Includes all mounds that receive septic tank effluent; **and**
- ❑ Pretreated modified mounds with two or more laterals placed side by side.

The following steps shall be followed.

Steps:

1. Generally layout mound according specifications found in Section 10.5.0 and according to site plan location with paint/flags.
2. Determine the gravel bed location within this layout and mark with paint/flags.
3. With the laser level/transit, locate the highest elevation of the ground surface within the proposed gravel bed perimeter. The sand depth, at this point, will be as specified on the approved plan. All of the remaining sand under the gravel bed will be thicker.
4. Place grade stakes in the ground around the proposed gravel bed area.
5. With the laser level/transit, mark the sand fill elevation on each grade stake based off of the elevation found in step 3.
6. Measure the height of several grade stakes from the ground surface to the marks placed in step 5.(Measure both upslope and downslope grade stakes when applicable. More measurements should be taken with dynamically sloped or irregular sloped sites.)
7. Determine the slope of the land (rise over run) in the areas where grade stake measurements were collected.
8. Properly calculate the 3 to 1 slopes away from the marked elevations on the grade stakes in these locations.(See Section 6.2)
9. Compare your answers with the structure dimensions found in the approved set of plans.
10. Measure outward from the base of every measured grade stake and repaint/flag the outer perimeter of sand at the distance which was determined to be larger from step 9.

10.6.3 Layout of Structures Allowing for a Uniform Sloping Sand Surface

- ❑ Includes drip distribution micro mounds.

The following steps shall be followed.

Steps:

1. Generally layout structure perimeter according specifications found in Section 10.5.0 and according to site plan location with paint/flags.
2. Determine the area (length & width) required which contains the specified minimum sand thickness under and around the laterals.
3. Within the general layout, place grade stakes on contour along the upper edge of the area requiring the minimum sand thickness.
4. With the laser level/transit, locate the highest elevation of the ground surface along this edge. The sand depth, at this point, will be as specified on the approved plan. All of the remaining sand along this edge will be thicker (exception is if there is a higher location downslope of the upper edge. e.g. - a “hump”).
5. Place a grade stake at this high point and mark the needed sand fill elevation on the stake.
6. With the laser level/transit, transfer the marked elevation from step 5 to all of the remaining grade stakes along the upper edge.
7. From the base of each upper grade stake, measure the plan specified distance downslope to find the lower edge of the minimum required fill thickness area. Place grade stakes at this lower boundary.
8. With the laser level/transit, locate the highest elevation of the ground surface along this lower edge. The sand depth, at this point, will be as specified on the approved plan. All of the remaining sand along this edge will be thicker (exception - if there is a hump located immediately upslope of this lower edge).
9. Place a grade stake at this high point and mark the needed sand fill elevation on the stake.
10. With the laser level/transit, transfer the marked elevation from step 9 to all of the remaining grade stakes along the lower edge.
11. Measure the height of several grade stakes from the ground surface to the marks placed in steps 6 and 10 (Measure both upslope and downslope grade stakes when applicable. More measurements should be taken with dynamically sloped or irregular sloped sites).

12. Determine the slope of the land (rise over run) in the areas where grade stake measurements were collected.
13. Properly calculate the 3 to 1 slopes away from the grade stakes in these locations.(See Section 6.2)
14. Compare your answers with the structure dimensions found in the approved set of plans.
15. Measure outward from the base of every measured grade stake and repaint/flag the outer perimeter of sand at the distance which was determined to be larger from step 14.

10.6.4 Layout of Structures Allowing for Sand to be Placed Everywhere at a Minimum Thickness

- ❑ Includes modified at-grade systems.

The following steps shall be followed.

Steps:

1. Generally layout structure perimeter according specifications found in Section 10.5.0 and according to site plan location with paint/flags.
2. Locate the gravel area (length & width) within this outer perimeter as specified in the approved plans.
3. Verify that the maximum deviation of basal elevation directly under lateral(s) will be less than six (6") inches per one hundred (100') feet of the structure.
4. Remember that laterals must be installed level from end to end. Any variations in contour under the lateral must be filled with sand to establish pipe grade.

10.7 Construction of Structures

Careful site protection and basal area protection are required for these HSTS systems. The basal area is to be protected during all phases of site development, preparation, and construction. No rubber tire equipment shall be permitted to be used within the limits of the basal area during construction, except when the basal area is being chisel plowed. **NO TRENCHING IN THE BASAL AREA!** If damage to the site and/or basal area results, the site may require:

- ❑ Relocation of the structure.
- ❑ Relocation of the entire system.
- ❑ A redesign of the structure or re-design of the system.
- ❑ Reinspection fees and re-design fees may be charged to the permit holder or applicant.

For structures that are not required to have a gradient drain installed along the down-slope side, the following restrictions apply. They are:

- ❑ No construction traffic shall be permitted on the basal area.

- ❑ No construction traffic shall be permitted on the area down slope of the structure for a minimum distance of forty (40') feet.
- ❑ All work involving equipment shall be conducted from the up-slope side of the structure.
- ❑ No piping, digging, or trenching shall be allowed on the downslope side.

For structures that have drains along both sides of the structure:

- ❑ No construction traffic shall be permitted on the area enclosed by the drains.

10.8 Aggregates

Aggregates within a structure consist of specified sand and specified gravel found in Section 4.0. The sand is the media in which biological activities occurs, thus allowing treatment of the wastewaters. The gravel serves as a more permeable layer above the sand, spreading the liquids to be treated over the sand area and provides pipe support. The following are general guidelines for the installation and storage of these aggregates.

- ❑ Aggregates shall be stockpiled in separate piles to avoid mixing of aggregates.
- ❑ Aggregates stockpiles shall be away from the basal area, allowing sufficient space for equipment operation.
- ❑ Aggregate stockpile usage:
  - ❑ Top of Pile to six (6") inches from pile bottom: This aggregate shall be placed along centerline, in the "center" of the structure (structure core), if it is clean.
  - ❑ Six (6") inches from pile bottom: This aggregate can be placed on outer edges (not including basal area) of structure as veneer, over structure "center."
- ❑ *Copies of the sand and gravel tickets shall be given to the inspector at the time of inspection.*

10.8.1 Aggregate Placement

- ❑ For structures that are "narrow" (i.e. - structure base area reachable by installer's equipment from a side), the following shall be the only option available for placement of structure aggregates and cover soils.
  - ❑ All material shall be placed from outside the basal area or from outside the drains.
- ❑ For structures that are "wide," two options are available for the placement of structure aggregates and cover soils.

Option #1:

- ❑ All material shall be placed from the outside of the basal area or from the outside of the drains.

Option #2:

- ❑ Two thirds ($^2/_3$) of the width of the basal area shall be chisel plowed.
- ❑ As much material as possible shall be placed on the chisel plowed area from outside of the nearest drain.
- ❑ Material shall be transported across the non-chisel plowed area according the following:
  - ❑ Traffic shall be perpendicular to the centerline of the structure.
  - ❑ Equipment shall be backed off of the basal area, not turned or spun.
  - ❑ Two thirds ($^2/_3$) of the sand and all of the gravel shall be placed before the remaining basal area is chisel plowed.
- ❑ The remaining one third ($^1/_3$) of basal area shall then be chisel plowed.
- ❑ The remaining material shall be placed from the outside of basal area and from the outside of the drain.

10.8.2 Sand

The sand is the treatment media on which aerobic bacteria grow to break down wastewater constituents.

- ❑ The sand shall comply with media specifications found in Section 4.0.
- ❑ Minimum final settled sand depth shall be as specified in an approved plan.
- ❑ The sand shall be placed in maximum six (6") inch lifts and compacted. Care must be taken with the initial lift. The goal is to compact the sand, not the basal soils. Do not stratify the sand particles.
- ❑ After sand placement, the structure shall be hand graded providing uniform 3 to 1 slopes and smooth slope transitions.
- ❑ Sand shall be placed adequately to support the gravel and distribution network.
- ❑ Sand shall be free of any dirt clods or other undesirable materials.
- ❑ All sand areas shall meet the minimum dimensions found on the approved plan unless system layout steps determined areas needed to be larger to accomplish 3 to 1 slopes.

10.8.3 Gravel and Laterals

This **Clean and Washed Gravel** is placed to properly support distribution laterals, evenly distribute applied wastewater, and prevent erosion of sand.

- ❑ Gravel shall comply with media specifications found in Section 4.0.
- ❑ **Gravel must be visually CLEAN or it will have to be removed**.
- ❑ Gravel thicknesses shall be minimized. Extra gravel is not acceptable. Gravel is only used to securely support the pipes.
- ❑ Three (3") inches of gravel shall be placed level on top of sand.
- ❑ Laterals shall be as specified in the approved set of plans.
- ❑ Laterals shall comply with the specifications found in Section 5.0.
- ❑ Laterals shall be completely supported and surrounded by gravel at the time of inspection.
- ❑ An additional three (3") inches of approved gravel shall be placed around and above laterals.
- ❑ Gravel shall be placed so that it completely supports the distribution laterals.
- ❑ All gravel areas shall meet the minimum dimensions found on the approved plan.
- ❑ Cleanouts shall be installed on laterals per Section 5.5.9 (slightly elevated and well supported with drainage toward laterals).
- ❑ Access wells shall be installed over all cleanouts per Section 9.6.

10.9 Geotextile (Filter) Fabric

Material placed over system to prevent siltation and migration of cover materials into the filter bed.

- ❑ Shall be placed after flushing procedure was completed, prior to final cover installation.
- ❑ Gravel or drip tubing area shall be covered with Geotextile fabric consistent with specs found in Section 4.11.
- ❑ Overlap of fabric shall be six (6") inches minimum.
- ❑ No tears in the fabric shall be allowed.
- ❑ If torn, the area shall be treated with an overlapping piece of fabric at least six (6") inches larger in all directions of the tear.

10.10 Cover

Provides protection of the structure components and prevents contact with sewage. Also offers filtration of sewer gasses.

- For structures receiving filtrate, site soils can be used.
- For structures receiving septic tank effluent, the area over the gravel or drip tubing area shall comply with Section 4.10.1 **No Exceptions**; the remaining portion of the cover shall be a good topsoil from the site or trucked in(Section 4.10.2).
- Cover soil shall be free of any rocks (larger than three (3") inches) and large roots.
- All soil clods, larger than two (2") inches in diameter, shall be broken apart.
- Cover grading shall allow for easy, trouble-free lawn care maintenance in the future.
- Cover shall be graded to drain surface water off and away from the structure.
- Cover shall be placed so that a minimum of six (6") inches of cover exists after settlement. (Maximum settled thickness shall be eight (8") inches).
- A minimum of 3 to 1 slope shall be established (Section 6.2).
- Any exposed components (e.g. valve boxes) shall have soil tamped into place so that no further settling will occur. Finished grade around such components shall be flush with their tops.
- Grass seed and straw shall be completed on the mounded and disturbed areas per Section 6.4. In some cases, sodding for immediate stabilization may be specified.

10.11 Observation Ports

Subsurface access stand pipes which allow viewing of the sand/gravel and sand/basal area surfaces for monitoring of potential plugging.

<u>Mounds/modified mounds/modified at-grades:</u>

- One shall be installed at the sand/gravel interface for every paired set of PVC distribution laterals.
- One shall be installed at the downslope edge of the sand at the sand/basal area interface for every set of PVC distribution laterals.
- Both types shall be installed in line with the first orifice of the lateral.
- Shall be constructed and installed per specs found in Section 9.7.

Drip Distribution Micro Mounds:

- ❑ One shall be installed per zone at the sand/drip tubing interface at 1/4, ½, and 3/4 along the length of the mound placed over the tubing. (Ex. if the mound is 120' long, one installed at 30', 60', and 90' along the length of the mound).
- ❑ One shall be installed per zone on the downslope edge of the sand at the sand/basal area interface at 1/4, ½, and 3/4 along the length of the mound lined up with the sand/drip tubing observation port.(Ex. if the mound is 180' long, one installed at 45', 90', and 135' along the length of the mound).
- ❑ Shall be constructed and installed per specs found in Section 9.7.

10.12 Drain Installations

- ❑ When the system design calls for gradient drains to be installed within four (4') feet of the basal area, they shall be installed before the basal area is plowed.
- ❑ When the design uses an interceptor drain, it shall be installed after final cover is placed at the upslope toe of the 3H:1V soil cover.

11 Section 11.0 Leach Trenches

11.1 Definition

A soil absorption sewage system consisting of excavated trenches and perforated four (4") inch diameter pipe with gravel, eight (8") inch diameter perforated pipe with manufacturer recommended backfill, or other approved distribution piping. These are used for the dispersal and treatment of wastewater in the surrounding native soils.

11.2 Scope and Applicability

The leach trench sewage system applies to soils and lots within the County with adequate topsoil and soil depth, sufficient lot area to accommodate the primary leach trench system and an equivalent area of replacement, and proper topography. Septic tank effluent can be distributed into leaching trenches where four feet of vertical separation results from a limiting condition. More often however, an approved pretreatment device is used to reduce the vertical separation requirements dictated by the site soils. Gravity leaching trenches are used only where greater than two (2') feet of vertical separation can be maintained (after following a pretreatment device getting 2 feet depth credit) or where being used to get maximum absorption before discharging to a pre-approved watercourse.

11.3 Purpose and Function

Effluent from the septic tank, or other approved pretreatment device, is delivered by gravity or pump to the leach trenches for final treatment and dispersal into the soil. Thus, the purpose of leach trenches are to convey effluent into the soil until total soil absorption of the effluent occurs or in some cases to maximize absorption.

11.4 Specifications

The following shall apply to the installation of leach trenches.

- ❑ See the drawings in the Appendix.

11.4.1 Sizing and Location

- ❑ Total length of leach trenches (size) required shall be based on number of bedrooms, daily design flow, and soil/site conditions.
- ❑ Health District approved soil tables shall be used for soil loading rates where 100% of the effluent is designed to be absorbed.
- ❑ Distribution pipe length shall be a result of meeting the soil's linear loading rate.

- ❑ Replacement area shall be protected and able to accommodate total length of replacement leach trenches (LT).
- ❑ LT shall not be located on:
  - ❑ Slopes in excess of 15% (Approximately 7H:1V) unless being used to maximize absorption before discharging or otherwise approved.
  - ❑ Areas where topsoil has been removed, filled over, or substantially disturbed. Unless otherwise approved or being used to maximize absorption before discharging.
- ❑ LT shall only be located on the following topography unless otherwise approved:
  - ❑ Slope crests.
  - ❑ Convex areas.
  - ❑ "Mounded" landscapes.
- ❑ LT shall be installed along natural contour.
- ❑ LT shall be laid out, along contour, and marked to control excavation.
- ❑ Maximum length of any LT shall be one hundred fifty (150') linear feet.
- ❑ Minimum LT to LT spacing shall be six (6') feet (center-to-center), unless otherwise preapproved or stated in this manual.
- ❑ Maximum filling after installation of trench to achieve constant contour elevation shall be three (3") inches.
- ❑ Gradient drain or interceptor drain shall be installed as indicated on plans per specifications, see Section 7.0 Drainage Enhancement.
- ❑ Diversion swale shall be installed as indicated on plans per Section 6.6.
- ❑ Piping for pumped systems shall enter from upslope of the LT, No pipe ditches downslope of LT shall be allowed.

11.4.2 Traditional Leach Trenches (LT)

Three types of traditional trenches exist which are: gravel trenches, gravel less trenches, and chambered trenches.

- ❑ Soil in area of LT excavation shall not be saturated or plastic during excavation procedures.
- ❑ During excavation, care shall be taken to ensure adjacent LT soils will not be disturbed and will not be compacted.
- ❑ LT excavation depth shall be eighteen (18") inches below the downslope edge contour elevation and trench bottom shall be level.
- ❑ Minor variations of original grade +/- 3 inches from contour shall be permitted.

- ❑ Filling up to three (3") inches shall be permitted and required upon final grade to ensure LT depth was eighteen (18") inches.
- ❑ Beginning and end of LT shall be at the same elevation, no exceptions.

11.4.2.1 Gravel LT

A leach line that utilizes a pipe backfilled with gravel to disperse the effluent into the surrounding soils.

- ❑ Width of gravel LT shall be a minimum of twelve (12") inches and shall be less than sixteen (16") inches.
- ❑ #57 stone complying with Section 4.5 shall be installed.
- ❑ Six (6") inches of gravel shall be placed before pipe is installed.
- ❑ Gravel fill thickness shall be twelve (12") inches to fourteen (14") inches total.
- ❑ A separation layer of geotextile fabric (section 4.11), or a minimum of two (2") inches straw shall be placed, after gravel filling is completed.
- ❑ Pipe diameter shall be four (4") inches and shall be installed with holes down.
- ❑ Any of following pipe types shall be permitted for gravel LT:
  - ❑ Three (3) hole perforated corrugated polyethylene (PE) tubing meeting/exceeding ASTM F-405.
  - ❑ Three (3) hole perforated PE pipe (2,500 lb crush) meeting/exceeding ASTM F-810.
  - ❑ Three (3) hole perforated PVC pipe meeting/exceeding ASTM F-2729.
  - ❑ Three (3) hole perforated corrugated PE pipe (smooth interior wall) meeting/exceeding ASTM F-405/AASHTO M-252.
- ❑ Ends of each pipe shall be capped.
- ❑ All couplers shall be compatible with both materials joined.
- ❑ Trenches shall be backfilled in manner so that depressions will not be created after settlement.

11.4.2.2 Gravel-less LT

A leach line that utilizes a pipe surrounded by an appropriate geotextile fabric which is backfilled with native soils or non-cohesive fill (e.g. - coarse sand).

- ❑ Gravel-less LT trench excavation width shall be eighteen (18") inches or greater if specified.
- ❑ Gravel-less LT pipe shall be eight (8") inch diameter corrugated PE tubing, meeting/exceeding ASTM F-667; Geotextile wrap shall be continuous.

- ❑ Specified pipe shall be placed in center of LT on trench bottom, and shall be uniformly supported.
- ❑ Granular backfill for pipe shall be placed per Health District approved manufacturer's recommendations.
- ❑ Cover for gravel-less LT shall be friable site soils.
- ❑ Trenches shall be backfilled in manner so that depressions will not be created after settlement.
- ❑ Manufacturer's coupling devices shall be used to join pipe segments.
- ❑ Each pipe shall have an end cap.
- ❑ Installation of gravel-less LT shall be preapproved by Health District.

11.4.2.3 Chambered LT

A chambered LT is a trench that utilizes a proprietary chamber device that is installed, in lieu of a pipe, to disperse effluent throughout a LT.

- ❑ Chambered LT's shall be sized according to soil conditions using Health District loading rate tables. The size shall not be less than standard gravel LT.
- ❑ Chamber installation shall comply with Health District approved manufacturer's recommended installation practice.
- ❑ Installation of chambered LT shall be pre-approved by the Health District.

11.4.3 Shallow Leach Trenches (LT)

A shallow trench is used in areas where indicated on the Permit-to-Install, application and/or design. Two examples are shallow gravel trenches and a shallow "half pipe" trenches.

- ❑ These shall be sized according to the site soils and waste strength to the same capacities as traditional leach trenches.
- ❑ Maximum filling, after installation shall be three (3") inches above existing grade and per approved plan.
- ❑ Soil in area of the trench excavation shall not be plastic during excavation procedures.
- ❑ During excavation, care shall be taken to ensure adjacent trench soils will not be disturbed and/or will not be compacted.
- ❑ Trench excavation depth shall be twelve (12") inches below the downslope contour elevation and trench bottom shall be level.
- ❑ Downslope edge of the trench shall be installed on contour +/- two (2") inches.

11.4.3.1 Shallow Gravel LT

A shallow leach line that utilizes a pipe backfilled with gravel to disperse the effluent into the surrounding soils.

- ❑ Width of shallow gravel LT shall be twenty-four (24") inches +/- two (2") inches.
- ❑ #57 stone complying with Section 4.5 shall be installed.
- ❑ Two (2") inches of gravel shall be placed before pipe is installed.
- ❑ Maximum gravel fill thickness shall be eight (8") inches total.
- ❑ Separation layer of geotextile fabric (section 4.11) or, a minimum of two (2") inches straw shall be placed after gravel fill is completed.
- ❑ Pipe diameter shall be three (3") inches or four (4") inches and shall be installed with holes down.
- ❑ Any of following pipe types shall be permitted for shallow gravel LT:
  - ❑ Three (3) hole perforated corrugated polyethylene (PE) tubing meeting/exceeding ASTM F-405, designed for leach trenches.
  - ❑ Three (3) hole perforated PE pipe (2,500 lb crush) meeting/exceeding ASTM F-810.
  - ❑ Three (3) hole perforated PVC pipe meeting/exceeding ASTM F-2729.
  - ❑ Three (3) hole perforated corrugated PE pipe (smooth interior wall) meeting/exceeding ASTM F-405/AASHTO M-252.
- ❑ Ends of each pipe shall be capped.
- ❑ All couplers shall be compatible with both materials joined.
- ❑ Trenches shall be backfilled so that depressions will not be created after settlement.
- ❑ Final cover over trench shall be six (6") inches. Requires a minimum of two (2") inches of cover above original grade.

11.4.3.2 Shallow Half Pipe LT

A shallow leach line that utilizes a twelve (12") inch pipe cut in half to make a mini-domed chamber to allow for dispersal of the effluent into the surrounding soils.

- ❑ Width of shallow LT shall be twelve (12") inches to sixteen (16") inches.
- ❑ Minimum LT-to-LT spacing shall be four (4') feet (center-to-center), unless otherwise preapproved.
- ❑ Pipe shall be twelve (12") inch diameter N-12 pipe (or equivalent) cut in half lengthwise which meets/exceeds ASTM F-405 or AASHTO M-252.
- ❑ Specified “half-pipe” shall be placed in center of the LT on trench bottom, creating an open dome, and shall be uniformly supported.
- ❑ Tops of “half-pipe” segments shall be level +/- one (1") inch.

- ❑ At the end of the trench, each “half-pipe” shall have a cap made from twelve (12") inch N-12 pipe end caps cut in half.
- ❑ A tight fitting and properly sized hole shall be drilled in the end cap with a hole saw to accept the header pipe.
- ❑ Pipe manufacturer’s belled ends shall be used to join pipe segments.
- ❑ Belled end couplings, joining “half-pipe” segments, shall be screwed together with three screws before the inspection and before being backfilled.
- ❑ Geotextile fabric (section 4.11) shall be placed over couplings and ends before the inspection and before being backfilled.
- ❑ Cover for shallow “half-pipe” LT shall be friable native site soils.
- ❑ Trenches shall be backfilled so that depressions will not be created after settlement.
- ❑ Final cover over “half-pipe” shall be six (6") inches. Requires a minimum of two (2") inches of cover above original grade.

11.5 Drop Boxes

A drop box utilizes a high outlet allowing a leach line lateral to be completely filled before effluent flows to the succeeding drop box. They work to ensure that the LT at the highest elevation is completely full and utilized before the next highest LT accepts effluent.

- ❑ When effluent is pumped to the drop box, the last ten (10') feet of pipe shall be properly transitioned to four (4") inch SCH 40 PVC and be sloped towards the drop box before entering the drop box.
- ❑ Drop boxes installed shall be designed for this purpose.
- ❑ Drop boxes shall be fabricated from pre-cast concrete, polyethylene, or PVC; with risers and lids fabricated from same material.
- ❑ Lids of polyethylene and PVC drop boxes shall be secured with sealant or fasteners.
- ❑ Drop box shall be installed at each inlet of any and all gravity LT.
- ❑ Drop box shall be installed level, regardless of topography.
- ❑ Drop box shall be installed on firm, natural, in-situ soil.
- ❑ Drop box shall be backfilled with native site soils; Native soils shall be **solidly** compacted around box.
- ❑ No cover shall be allowed over drop box lids for easy future maintenance/inspection.
- ❑ All pipe penetrations shall be watertight.
- ❑ All pipe terminations within drop box shall be cut squarely; allowances shall be made for future cap or plug installation within drop box.

11.5.1 Drop Boxes on Traditional Leaching Trenches

- ❑ Drop box shall be installed so that top of box is at the elevation of the contour.
- ❑ Drop box shall allow for complete flooding (keeping effluent 6" under final grade – max. 3 inches of fill) of the LT (chamber, gravel-less pipe, gravel trench) before allowing flow to the next drop box (use of flow restrictors shall be acceptable).
- ❑ Area around drop box, for eighteen (18") inches in all directions, shall not contain porous media such as sand or gravel.

11.5.2 Drop Boxes on Shallow Leaching Trenches

- ❑ Drop box shall allow for complete flooding (keeping effluent 4" under original grade) of the LT (shallow gravel, or "half-pipe") before allowing flow to the next drop box. **Use of flow restrictors shall be required.**
- ❑ Drop box shall be installed so that the invert of the overflow outlet pipe is six (6") inches below the lowest contour (downslope edge) grade on that LT.
- ❑ Flow restrictors shall be installed on every drop box outlet (overflow pipe to next LT), and shall be dialled to keep the effluent in the LT four (4") inches below the lowest original contour (downslope edge) grade on that LT.
- ❑ If the top of the drop box will not be above original grade, then six (6") inch drop box risers shall be used and shall be properly installed and sealed on top of drop box. Final grade must be flush with and slope away from the box lids.
- ❑ Area around drop box, for thirty-six (36") inches in all directions, shall not contain porous media such as sand or gravel.

11.6 Headline Pipe (Septic Tank/Pretreatment Unit to Drop Box)

The headline pipe shall be a solid walled pipe serving to convey effluent from the septic tank/pretreatment unit to a drop box by gravity (Section 5.0 Applies).

- ❑ Four (4") inch diameter, solid schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 shall be used.
- ❑ All joints shall be solvent welded, and color primer shall be used.
- ❑ Headline pipe shall be uniformly supported over length of pipe.
- ❑ Minimum slope shall be one eighth ($^1/_8$") inch per foot (1%).

- ❑ Pipe shall extend into drop box one (1") inch to one and a half ($1^1/_2$") inches.
- ❑ When effluent is pumped to the drop box, the last ten (10') feet of pipe shall be properly transitioned to four (4") inch SCH 40 PVC and be sloped towards the drop box before entering the drop box.

11.7 Headline Pipe (Drop Box to Drop Box)

The following apply to this portion of the headline pipe:

- ❑ **Virgin earth dams shall be kept in place**. Pipe overdig shall not be acceptable.
- ❑ Four (4") inch diameter, solid schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 shall be used.
- ❑ All joints shall be solvent welded, and color primer shall be used.
- ❑ Headline pipe shall be uniformly supported with virgin soil over length of pipe.
- ❑ Pipe shall be backfilled and rigorously compacted with friable clayey soils.
- ❑ Pipe shall extend into drop box one (1") inch to one and a half ($1^1/_2$") inches.
- ❑ Slope of pipe will be dependant upon site topography, but will not travel uphill unless:
  - ❑ For flat sites, where drop box lids are installed at the same elevation, headline pipe may run uphill from box to box with the understanding that the invert of the inlet elevation shall not be higher than the properly installed previous drop box outlet invert elevation.

11.8 Header Pipe

The header pipe is a solid walled pipe that serves to convey effluent from a drop box to a LT.

- ❑ Four (4") inch diameter, solid schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 shall be installed, unless otherwise specified.
- ❑ Header pipe to LT pipe (or chamber) transition shall be completed with a coupler that is compatible with both pipe materials.
- ❑ Length of header pipe shall not be less than:
  - ❑ Eighteen (18") inches for traditional LT, after drop box penetration.
  - ❑ Thirty-six (36") inches for shallow LT, after drop box penetration.
- ❑ Header pipe may either be laid flat or laid so that gentle fall, back to drop box results.

- ❑ Header pipe shall be installed so that effluent enters the leaching trench before overflowing to the next drop box.
- ❑ Header pipe shall be uniformly supported with virgin soil.
- ❑ Pipe shall be backfilled and rigorously compacted with friable clayey soils.
- ❑ Pipe shall extend into drop box one (1") inch to one and a half ($1^1/_2$") inches.

12 Section 12.0 Subsurface Sand Filter

12.1 Definition

A subsurface sand filter (SSF) is a secondary treatment device installed below the ground surface. A SSF is normally preceded by a primary treatment device (e.g. - septic tank) and sometimes an approved pretreatment device. A SSF treats the sewage, and the effluent from the SSF discharges to a proper watercourse.

12.2 Scope and Applicability

SSF's are conventional discharging household sewage treatment systems which shall only be used on properties having a valid open Permit To Install approved prior to January 1, 2003.

12.3 Purpose and Function

The primary purpose of a SSF is to further reduce the amount of suspended solids and the biological oxygen demand (BOD) in the wastewater.

12.4 Specifications

The following shall apply to installation of the SSF.

12.4.1 General

- SSF size shall be based on number of bedrooms, daily design flow, and waste strength; two hundred forty square feet (240 ft^2) per bedroom required.
- Width shall be based upon the number of laterals, considering lateral-lateral spacing and edge clearance distance.
- SSF shall be installed so that top of upper gravel layer was at or below existing grade.
- Layout of SSF shall be generally parallel to the land contour, so that the maximum cover shall not be exceeded.
- Overall shape of SSF shall be rectangular, length shall be greater than width.
- Width of the SSF shall be divisible evenly by three (3) (e.g., 12, 15, etc).
- Number of laterals shall be determined by dividing the width by three (3).

12.4.2 Distribution Piping

Distribution piping shall include all piping associated with the conveyance of wastewater from the primary treatment through to the distribution of the wastewater over the surface of the SSF. The following shall be included: headline pipe, distribution box and distribution laterals.(Section 5.0 Applies)

12.4.3 Headline Pipe

A pipe utilized for the conveyance of wastewater from the primary treatment device or pretreatment unit to the distribution box of the SSF.

- ❑ Headline pipe shall be four (4") inch diameter, Schedule 40 PVC (meeting/exceeding ASTM D-1785/D-2665) which shall be installed with pipe markings visible.
- ❑ All connections shall be solvent welded.
- ❑ Headline pipe shall enter at upstream end of SSF (side entry not permitted).
- ❑ Headline minimum slope shall be one eighth ($^1/_8$") inch per foot (1%).
- ❑ Pipe shall extend into distribution box one (1") inch to one and a half ($1^1/_2$") inches.
- ❑ When effluent is pumped to the distribution box, the last ten (10') feet of pipe shall be properly transitioned to four (4") inch SCH 40 PVC and shall be sloped toward the d-box before entering the d-box.

12.4.4 Distribution Box (D-Box)

A device with two or more outlets located at the same elevation used to equally distribute effluent throughout a secondary sewage treatment system.

- ❑ Distribution box shall be installed at termination of headline.
- ❑ Distribution box shall be set level.
- ❑ Distribution shall be supplied with riser(s) and lid to final grade.
- ❑ Final grade shall be to lid of distribution box and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8") feet).
- ❑ Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid shall be provided; Either heavy concrete (minimum weight sixty (60) pounds) or bolted (three (3) stainless steel, $^3/_{16}$ inch hex heads or S3 recessed square heads used).
- ❑ All outlet inverts shall be at the same elevation.
- ❑ Piping within distribution box shall not permit preferential flow from inlet to any outlets.

12.4.5 Distribution Lateral(s)

A network of gravity flow pipes designed to spread wastewater effluent over the entire surface of the SSF.

- ❑ Distribution laterals shall be four (4") inches in diameter, unless otherwise specified.
- ❑ Distribution laterals shall be three (3) hole perforated pipe meeting/exceeding any of the following:
  - ❑ Perforated polyethylene tubing (2,500 lb crush) meeting/exceeding ASTM F-810; b)
  - ❑ Perforated PVC pipe meeting/exceeding ASTM F-2729
  - ❑ Perforated corrugated polyethylene N-12 pipe (smooth interior wall) meeting/exceeding ASTM F-405 or AASHTO M-252.
- ❑ Distribution laterals shall be installed level (0% slope); ***No rise permitted.*** (Maximum allowable fall is limited to two (2") inches)
- ❑ Centerline of lateral to edge (excavation wall) distance shall be eighteen (18") inches.
- ❑ Centerline of lateral to centerline of lateral distance shall be three (3') feet.
- ❑ Distribution laterals shall be interconnected with the proper fittings forming closed loop at the terminal end.
- ❑ Top of the distribution lateral shall be two (2") inches below the top of the gravel. Therefore, the invert of distribution laterals shall be six (6") inches below upper gravel surface.
- ❑ Distribution laterals pipe shall extend into the d-box one (1") inch to one and a half ($1^1/_2$") inches.

12.4.6 Filter Bed

A series of layered aggregates, installed below grade, constructed to provide secondary treatment of the wastewater within this bed.

- ❑ Bottom of filter shall be sloped providing gravity flow towards collector line and towards the discharge line; minimum slope shall be one eighth ($^1/_8$") inch per foot (1%).
- ❑ Three (3) level layers of aggregate shall be installed:
  - ❑ Upper layer shall be a minimum of twelve (12") inches of settled and approved #57 stone (See section 4.5).
  - ❑ Middle layer shall be a minimum of eighteen (18') inches of settled and approved sand (See Section 4.8.1).
  - ❑ Lower layer shall have a minimum settled thickness of twelve (12") inches, adjacent to sidewall; thickness shall increase due to slope requirements of filter base (See section 4.5).

- ❑ Sand and gravel tickets shall be given to the Health District before final approval is obtained. Approval to cover may be denied, if tickets are not provided.

12.4.7 Collection Line

The collection line serves to collect effluent from under the filter bed.

- ❑ Collection Line shall have a diameter of four (4") inches, and shall be schedule 40 PVC pipe, meeting/exceeding ASTM D-1785/D-2665 or shall be SDR 35 PVC pipe meeting/exceeding ASTM F-2729.
- ❑ Collection line shall be three (3) hole perforated pipe and shall be installed in the center of and running the length of the filter bed, except for the last one (1') foot, which does not contain holes.
- ❑ Collection line to discharge line transition shall occur one (1') foot inside of downstream edge of SSF filter bed; Transition connection shall be SCH 40 PVC.
- ❑ Minimum slope of the collection line shall be one eighth ($^1/_8$") inch per foot (1%).
- ❑ The beginning of the collection line shall be marked with a pipe, 2"x2" stake, or rebar; adjacent to distribution box. This marker shall rest on top of collection line and shall be vertical.

12.4.8 Discharge Line

The discharge line serves to convey the filter effluent, collected by the collector line, to the final discharge location, via gravity (Section 5.0 Applies). The specifications found here shall apply to any discharge pipe.

- ❑ Discharge line shall have a diameter of four (4") inches, and shall be schedule 40 PVC pipe, meeting/exceeding ASTM D-1785/D-2665.
- ❑ Discharge line portion shall be solid wall pipe.
- ❑ Collector line to discharge line transition shall occur one (1') foot inside of downstream edge of SSF filter bed; Transition connection shall be SCH 40 PVC.
- ❑ Minimum slope of discharge line shall be one eighth ($^1/_8$") inch per foot (1%).
- ❑ Discharge line shall be uniformly supported over entire length; no dirt clods, rocks or other similar material shall be used to support the pipe.
- ❑ Clean Out (C/O) shall be provided within six (6') feet of end of filter bed, joining discharge pipe with a sanitary tee, sweeping upstream.

- ❑ C/O shall be constructed from four (4") inch diameter, schedule 40 PVC pipe, with a *threaded* four (4") inch PVC cap.
- ❑ All C/O's shall extend a minimum of ten (10") inches above grade.
- ❑ C/O's shall be provided for every one hundred (100') feet of discharge line; if line segment is more than one hundred (100') feet but less than two hundred (200') feet, C/O shall be at the midpoint.
- ❑ Discharge line shall terminate at the flow line of specified receiving swale or waterway.
- ❑ Minimum of six (6") inches of freeboard between discharge invert and receiving waterway shall be provided.
- ❑ Commercial "swing gate" animal guard; or two (2) one quarter ($^1/_4$") inch bolts placed horizontally shall be provided (like an equal sign (=)). Drain baskets shall not be permitted.

12.4.9 Cover

- ❑ A separation layer of geotextile fabric (section 4.11), or a minimum of two (2") inches straw shall be placed, after top gravel placement is completed.
- ❑ Cover thickness shall not be less than six (6") inches, but shall not be more than eighteen (18") inches.
- ❑ For sites which will be re-graded per a site development plan, the areas adjacent to the filter bed shall be graded to final grades before inspection. This provides evidence to the inspector that the maximum of eighteen (18") inches cover thickness will not be exceeded.
- ❑ Cover soil shall permit the filter bed to breath. Heavy clay soils shall not be used for cover.
- ❑ Cover soils and other areas of disturbance due to the installation of the SSF shall be seeded and mulched per section 6.4.
- ❑ Final grading shall prevent surface water run-on problems to the SSF.

13 Section 13.0 Intermittent Sand Filters

13.1 Definition

An intermittent sand filter (ISF) is a secondary treatment device installed above or below the original ground surface. An ISF is always preceded by a primary treatment (e.g. dosing septic tank) or other approved pretreatment device. Intermittent sand filters provide biodegradation and decomposition of wastewater constituents by bringing the wastewater into close contact with a well developed aerobic biological community attached to the surfaces of the filter media. This process needs to allow for unsaturated downward flow of the effluent through the filter media. Proper function requires influent to the filter to be distributed evenly over the media in controlled, uniform doses. In order to achieve accurate dosing, these systems require a timer controlled pump with associated pump chambers, electrical components, and distribution network. ISF's work best with a large number of small doses spread out evenly over a 24 hour period. The treated effluent is collected in the bottom of the filter and passed either by gravity or pressure to a suitable soil absorption system, or is properly disinfected and discharged to a pre-approved watercourse.

13.2 Scope and Applicability

This section will cover the requirements for the sizing, layout and installation of ISF's. Several types of ISF's exist which can be used as part of an approved design. They are unlined, lined, and above grade intermittent sand filters. When designed, installed and maintained properly intermittent sand filters produce effluent that will receive a two foot depth credit for soil absorption systems and will meet current discharge standards after proper disinfection.

13.3 Specifications

The following shall be the general requirements for all ISF's

13.3.1 General

- ISF size shall be based on number of bedrooms, daily design flow, and waste strength. Typically one hundred and twenty square ($120ft^2$) per bedroom, or one ($1ft^2$/gal.) square foot per gallon shall be used. The minimum size of an ISF shall be $360ft^2$ regardless of daily design flow.
- When pretreated to 30mg/L BOD_5 and 30mg/L TSS the size of the filter may be reduced by half, with a minimum of $180ft^2$.

- ❑ Where possible, the ISF laterals shall be installed at an elevation higher than the septic/dosing tank riser lids.
- ❑ Minimum orifice density shall be $5ft^2$ per orifice.
- ❑ Laterals shall be spaced at either twenty four (24") inches or thirty (30") inches on center and based on approved design.
- ❑ Orifices shall be spaced at two (2') foot on center.
- ❑ Orifices shall be one eighth (1/8") inch diameter and shall be properly drilled to specs.
- ❑ Laterals shall be three quarter (3/4") inch SCH 40 PVC.
- ❑ All pressure piping used shall meet Section 5.0 and per approved design.
- ❑ Laterals shall be run parallel to the filter length.
- ❑ Length of the filter shall be generally parallel to the land contour.
- ❑ When being pumped to the next system component, a pump basin shall always be located outside the filter with a free flowing inlet. Effluent shall not be stored in the bottom of the filter as a reservoir.

13.4 Unlined Intermittent Sand Filters (UISF)

UISF's are effective sewage treatment devices used to produce very high quality effluent which meets or exceeds discharge standards for BOD_5 and TSS . With proper disinfection, fecal coliform reduction will closely approach 100%. These filters are installed shallow to allow for some soil absorption and maximum oxygen transfer. UISF's are used on sites where discharging to a well defined drainage way is the only available option.

13.5 Lined Intermittent Sand Filters (LISF)

LISF's are used as a pretreatment device prior to a soil absorption system. Liners are used to keep additional surface and groundwater from overloading a downstream treatment component. Occasionally, filters are also lined to prevent erosion or slippage of a hillside

13.6 Above Grade Intermittent Sand Filters (AISF)

AISF's were developed to maximize soil absorption while maintaining high treatment quality. They are installed within the upper soil horizons or completely above ground. Being elevated out of seasonal groundwater allows for any unabsorbed effluent to be collected and transferred to an additional soil absorption component. UISF's are often used on sites where little room exists for complete on lot absorption and /or a poor discharge point exists. These filters are also commonly used on new construction of existing lots of record where discharging is the only option. AISF's shall always contain an interceptor drain at the toe of the upslope cover. This drain shall start at twenty four (24") inches deep unless otherwise specified.

13.7 Liners

When a design calls for a liner it shall comply with the following:

PROPERTY	TEST METHOD	VALUE
Thickness	ASTM D1593 Paragraph 9.1.3	30 mil Minimum
Specific Gravity (Min)	ASTM D792 Method A	
Minimum Tensile Properties (Each Direction)	ASTM D882	
Breaking Factor (pounds/inch width)	Method A or B (1 inch wide)	69
Elongation at Break (percent)	Method A or B	300
Modulus at 100% Elongation (pounds/inch width)	Method A or B	27
Tear Resistance (Pounds, Minimum)	ASTM D1004 Die C	8
Low Temperature	ASTM D1790	-20^{o}F
Dimensional Stability (Each direction, percent change maximum)	ASTM D1204 212^{o}F, 15min.	+/-5
Water Extraction	ASTM D1239	-0.35% max.
Volatile Loss	ASTM D1203 Method A	0.7% max.
Resistance to Soil Burial (percent change maximum in original value)	ASTM D3083	
Breaking Factor		-5
Elongation at Break		-20
Modulus at 100% Elongation		+/-10
Bonded Seam Strength (factory seam, breaking factor, ppi width)	ASTM D3083	55.2
Hydrostatic Resistance	ASTM D751 Method A	82

Table 13.1 – PVC Liner Properties. (Adopted from Washington State Department of Health, Recommended Standards and Guidelines for Performance, Application, Design and Operation and Maintenance. July 1, 2000.)

- ❑ Patches, repairs, and boots shall be of the same physical properties as the liner parent material.
- ❑ Patches, repairs, and boots shall be installed following the Health District approved manufacturer's requirements.
- ❑ Boots shall be installed and sized correctly for any pipes penetrating the liner.
- ❑ Stainless steel band clamps shall be used to seal boots to the pipe.
- ❑ Boot sleeves shall be directed outward with clamps located outside of the filter.
- ❑ Boots shall be properly bedded in sand.
- ❑ The final cut size of the liner shall be carefully determined and ordered to generously fit the liner box geometry without bridging or excess straining of the liner material.
- ❑ Excess liner shall be trimmed so the about one (1') foot drapes over the edge of the liner box.
- ❑ Underdrain outlet boot shall be installed so that effluent will not pond in the filter bottom.

13.7.1 Filter Box

When a liner is used it shall be contained in a supporting perimeter frame that complies with the following:

- ❑ Supporting frame material shall be untreated 2" x 4" lumber.
- ❑ Studs shall be a maximum thirty (30") inches on center.
- ❑ Top and bottom plates shall be installed.
- ❑ Minimum thickness seven sixteenth (7/16") inch untreated OSB or plywood shall be used.
- ❑ Filter box size shall match ISF dimensions.
- ❑ Height of box shall be thirty two (32") inches, unless otherwise specified.
- ❑ Nails shall all be driven from the inside out and shall not protrude toward the liner.
- ❑ Nail heads shall not be sticking out.
- ❑ No sharp objects shall be protruding toward the liner.
- ❑ Liner box shall be plumb and square.
- ❑ Temporary supports shall be in place for bracing the top of box to the surrounding soil.
- ❑ Top of box shall extend to the ground surface or above.
- ❑ Holes cut through plywood to accept piping and boots shall be large enough to prevent boot abrasion.

13.8 Layout and Excavation of UISF's and LISF's

ISF's are typically rectangular in shape and are therefore easily adapted to both flat and sloping sites. Larger filters often become more square and are less adaptable to severely sloping sites.

- ❑ Layout of the length of the filter bed shall be as parallel as possible to the site contour.
- ❑ The depth of the filter shall allow for a minimum of one eighth (1/8") inch per foot slope to the next system component.
- ❑ The highest point of the ground surface around the perimeter of the filter shall be used to set excavation depth.
- ❑ Pit shall be excavated so that the bottom is level or falls toward the discharge end.
- ❑ Depth of an ISF's shall be thirty four (34") inches from the highest ground surface, unless otherwise specified in an approved plan.
- ❑ Excavated soil spoils shall be placed around the perimeter of the filter to berm up the surrounding area to be level with highest perimeter ground surface. Only soils free of rocks shall be used for this purpose.
- ❑ Bermed areas shall be properly compacted and shall establish a proper 3H:1V slope (Section 6.2).
- ❑ Maximum berm height shall be thirty (30") inches.
- ❑ Pit walls shall be vertical before proceeding.
- ❑ Pit dimensions shall be the size on the approved plan for unlined filters and one foot larger in all directions for lined filters.

13.9 Installation of UISF's and LISF's Components

Unlined Filters can skip to section 13.9.2. Lined filters will require the installer to perform the following additional steps.

13.9.1 Lined Filters

Care should be taken to install the liner in the proper conditions. Liner placement in cold weather will likely result in liner cracking and disapproval. Keeping the liner in a warm environment prior to unfolding and placement will make the material more pliable.

- ❑ Two (2") inches minimum levelling sand shall be placed in the bottom of the excavation.
- ❑ Levelling sand shall be raked to create a level uniform surface with no low points.
- ❑ Liner box shall be installed so that the top plate is level around the perimeter and is at or above the highest ground level.
- ❑ Temporary anchors shall be installed to the top of the liner box to the surrounding soil for additional support.
- ❑ Follow requirements found in section 13.7.1.
- ❑ 30 mil PVC liner shall be installed following section 13.7.
- ❑ Liners shall be carefully installed so that no unnecessary folds are evident.

- ❑ Corners shall be carefully tucked so no stretching occurs.
- ❑ Liner shall be draped over the supporting frame. The liner shall be in full contact with the bottom and sides and no bridging shall be present.
- ❑ Additional liner shall be cut off so that about one foot drapes the edge of the box.
- ❑ Patches, repairs, and boots shall be installed to Section 13.7.
- ❑ **On lined filters with a gravity discharge to a secondary treatment system (Ex. leaching trenches, wetland, etc.) a liner box drain shall be installed in the excavation around the liner box which shall collect ground water from around the liner and discharge it away from the secondary treatment system. The drain shall follow similar specifications for gradient drains.**
- ❑ As the filter is filled with aggregate, the over-dig outside of the liner box shall be filled to an equal elevation with sand fill material.
- ❑ The discharge pipe, immediately outside of the filter, shall be backfilled with clay and rigorously compacted for a minimum of eight (8') feet. Compacted area shall be at least eighteen (18") inches thick.

13.9.2 Material Placement

The following are general guidelines for the installation, movement, and storage of aggregates and other components.

- ❑ Aggregates shall be stockpiled in separate piles to avoid mixing.
- ❑ Aggregates stockpiles shall be kept away from the system, allowing sufficient space for equipment operation.
- ❑ Copies of the sand and gravel tickets shall be given to the inspector at the time of inspection and before the system gets final approval.
- ❑ Equipment buckets shall be cleaned and free of dirt/fines.
- ❑ Aggregate stockpile usage:
  - ❑ Top of Pile to six (6") inches from pile bottom: This aggregate shall be placed inside of filter if clean.
  - ❑ Six (6") inches from pile bottom: This aggregate shall not be placed in filter.

13.9.3 Underdrain, Drain Pipe and Vents

- ❑ Underdrain piping shall either be four (4") inch Class 125 PVC pipe with one quarter (1/4") inch slots, four (4") inches on center, or shall be four (4") inch SDR 35 three hole pipe.

- ❑ Drains pipes shall be installed level or sloping to the outlet with the holes/slots alternatively positioned to the left and right**, and;**
  - ❑ For lined filters, the drain pipe shall be placed on the liner.
  - ❑ For unlined filters, the drain shall be placed on two (2") inches of additional #57 aggregate.
- ❑ Four (4") inch tees shall be installed on the underdrain piping with SCH 40 PVC or SDR 35 stand pipes vents installed to above final grade at the beginning, middle, and end of each underdrain.
- ❑ Stand pipe vents shall be installed plumb and connected to the underdrain with the appropriate glued fittings.
- ❑ The tops of the stand pipe vents shall be fitted with a vent cap/plug and shall be flush with finished settled grade.
- ❑ Underdrain piping shall be installed in the center width-wise of filter bed.
- ❑ For filters wider than fifteen (15') feet, two or more evenly spaced underdrains shall be required.
- ❑ Underdrains shall be installed either level or sloping towards the discharge end of the filter.
- ❑ Underdrains shall extend from end to end of the filter bed.
- ❑ One (1') foot before exiting the filter, underdrain piping shall be switched, with the correct fitting, to solid four (4") inch SCH 40 PVC meeting ASTM D-2665/D-1785.

13.9.4 Bottom Gravel

Allows sand to drain freely while keeping the treatment media from migrating to the bottom of the filter (See 13.9.3 for underdrain placement).

- ❑ On <u>unlined</u> filters two (2") inches of #57 aggregate shall be placed before the under drain is installed.
- ❑ A six (6") inch layer of #57 aggregate, meeting the requirements of section 4.0, shall be placed level and around the under drain piping at the bottom of the filter.
- ❑ A two (2") inch layer of #8 aggregate, meeting the requirements of section 4.0, shall be placed level above the #57's.

13.9.5 Air Coil

Allows for the introduction of supplemental air into a sand filter to help in rejuvenation if overloading has occurred. Constructed of polyethylene drip tubing, air coils have evenly placed emitter outlets every two (2') feet.

- ❑ Tubing shall be a minimum of one hundred and fifty (150') feet for up to a 600ft^2 filter.

- ❑ Tubing shall be serpentined, in a outward spiral, terminating at one end of the filter bed.
- ❑ Tubing shall be uniformly spaced throughout filter.
- ❑ Tubing shall be laid so that kinking does not occur.
- ❑ Tubing shall be placed directly on top of the bottom layers of gravel aggregate.
- ❑ The beginning of the tubing shall be capped with the appropriate fitting.
- ❑ Tubing end shall be brought to grade with ½" SCH 40 PVC and shall be capped with a threaded adaptor.
- ❑ The 1/2" SCH 40 air coil stand pipe shall be made accessible by housing it below final grade in a valve box.

13.9.6 Sand

The sand is the treatment media on which aerobic bacteria grow to break down wastewater constituents.

- ❑ The sand shall comply with the media specifications found in section 4.0.
- ❑ The sand shall be placed in maximum six (6") inch lifts. It shall be wetted and properly compacted. Care must be taken not to stratify sand particles.
- ❑ Final settled sand depth shall be twenty four (24") inches, unless otherwise specified in an approved plan.
- ❑ Sand shall be completely level throughout the bed.
- ❑ Sand shall be at, or slightly above the top of the liner box.
- ❑ Sand shall be free of any dirt clods or other undesirable materials.

13.9.7 Observation Ports

Subsurface access stand pipes which allow viewing of the sand surface for monitoring of potential plugging.

- ❑ Shall be installed on top of the sand surface.
- ❑ One shall be installed for every (180) ft^2 of filter area.
- ❑ When multiple ports are required, they shall be installed in opposite quadrants of filter.
- ❑ Observation ports shall be constructed and installed per specs found in Section 9.7.
- ❑ Observation ports shall be terminated below final grade and shall be housed within a valve box.

13.9.8 Top Gravel and Laterals

This **Clean and Washed Gravel** is placed to properly support distribution laterals, evenly distribute applied wastewater, and prevent erosion of sand.

- ❑ Gravel shall comply with media specifications found in Section 4.0.

- **Gravel shall be visually CLEAN or it will have to be removed**.
- Gravel thicknesses shall be minimized. Extra gravel shall not be acceptable. Gravel is only used to securely support the pipes.
- Three (3") inches of gravel shall be placed level on top of sand.
- Laterals, orifices, and orifice shields shall be placed according to approved plan, and per Section 5.0.
- An additional three (3") inches of approved gravel shall be placed around and above the laterals.
- Cleanouts shall be installed per Section 5.5.9 (slightly elevated and well supported with drainage toward laterals).
- Access wells shall be installed over all cleanouts per Section 9.6.

13.9.9 Filter (Geotextile) Fabric

Material placed over system to prevent siltation and migration of cover materials into the filter bed.

- Top gravel shall be covered with Geotextile fabric consistent with specs found in Section 4.11.
- Overlap of fabric shall be six (6") inches minimum.
- No tears in the fabric shall be allowed.
- If torn, the area shall be treated with an overlapping piece of fabric at least six (6") inches larger in all directions of the tear.

13.9.10 Cover

Provides protection of the sand filter components an prevents contact with sewage. Also offers filtration of sewer gasses.

- Cover material over the gravel area shall comply with Section 4.10.1 **No Exceptions**.
- The outside of the filter may be graded with a lesser quality topsoil.
- Cover shall be graded to drain surface water off and away from the filter.
- Settled cover thickness shall be six (6") inches to eight (8") inches.
- 3H:1V slope shall be established around the filter(Section 6.2).
- Any exposed components (ex. valve boxes, vents) shall have soil tamped into place so that no further settling will occur. Finished grade around such components shall be flush with their tops.
- Diversion swale and/or interceptor drain upslope of the filter shall be installed. (Interceptor drain required on AISF's)

- ❑ Grass seed and straw shall be completed on and around the ISF and disturbed areas per Section 6.4. In some cases, sodding for immediate stabilization may be specified.

13.10 Layout of AISF

AISF's are rectangular in shape and are therefore easily adapted to both flat and sloping sites. The following steps shall be used to layout an AISF.

Steps:

1. Determine whether the approved system is to be built on top of the existing grade or slightly excavated into the upper soil horizons.
2. Determine whether the upper sand surface is to be installed level, or sloping with the site from side to side.
3. Generally locate the center of the filter bed (area containing top gravel) according to the site plan in an area with the most consistent slope along the length of the bed.
4. Using flags, layout the straight length of the upper edge of filter bed(area containing top gravel) as parallel as possible to the site contour.
5. Measure downslope, the width of the top gravel area, to locate the lower edge of the top gravel area. Mark with grade stakes.
6. Using a laser/transit, determine the highest ground elevation along the upper edge of the proposed top gravel area. The sand depth, at this point, will be as specified on the approved plan. All of the remaining sand along this edge will be thicker.
7. Place a grade stake at this point and mark the needed material fill elevation.(This is the fill needed after the specified amount of soil has been removed, if applicable {see step 1}, and bottom gravel added.)
8. With the laser level/transit, transfer the marked elevation from step 7 to all of the remaining grade stakes along the upper edge.
9. If the sand surface was designed to be level (step 2) skip to step 12.
10. Locate the highest elevation of the ground surface along the proposed lower edge of the top gravel area. The sand depth, at this point, will be as specified on the approved plan. All of the remaining sand along this edge will be thicker.
11. Place a grade stake at this point and mark the sand fill elevation (This is the fill needed after the specified amount of soil has been removed, if applicable {see step 1}, and bottom gravel added).

12. With the laser level/transit, transfer the marked elevation from step 7 or step 11 to all of grade stakes along the proposed lower edge of the top gravel.
13. Measure the height of several grade stakes from the ground surface to the marks placed in steps 8 and 12. (Measure both upslope and downslope grade stakes. More measurements should be taken with dynamically sloped or irregular sloped sites).
14. Determine the slope of the land (rise over run) in the areas where grade stake measurements were collected from step 13.
15. Properly calculate the 3 to 1 slopes away from the grade stakes in these locations.(See Section 6.2)
16. Compare your answers with the structure dimensions found in the approved set of plans.
17. Measure outward from the base of every measured grade stake and repaint/flag the outer perimeter of the area to be excavated/plowed at the distance which was determined to be larger from step 14.
18. Along the downslope edge of the outer perimeter to be excavated/plowed, find the flag which is farthest from the area containing the top gravel.
19. Using the laser/transit record the ground elevation at this point and move all of the lower excavation area flags to the same contour elevation.
20. This is the final perimeter of the area to be excavated/plowed.
21. The sides and lower edge of the excavated/plowed areas will be excavated four (4") inches deeper to accommodate perforated drainage tubing and surrounding gravel.
22. Verify that the depth at the lower edge of the filter will allow for a minimum of one eight (1/8") inch per foot slope to the next system component.

13.11 Preparation of the AISF

Above Grade Intermittent Sand Filters shall either be shallowly excavated into the site soils or shall be built completely above the existing grade.

<u>When built above the existing grade:</u>

- ❑ The area within the perimeter, laid out in Section 13.10, shall be properly prepared and chisel plowed following the guidance in Section 10.
- ❑ Along the sides and downslope perimeter of the layout, a drainage trench shall be excavated eight (8") inches deep

and shall be sloped at one sixteenth (1/16") inch per foot minimum to the Adjust Level Sump.

- ❑ The downslope drainage trench shall follow contour.

When the AISF area is to be shallowly excavated:

- ❑ The area within the perimeter, laid out in Section 13.10, shall be excavated to the depth specified on the approved plan (usually 8").
- ❑ Along the sides and downslope perimeter of the layout, a drainage trench shall be excavated four (4") inches deeper than the excavation and shall be sloped at one sixteenth (1/16") inch per foot minimum to the Adjust Level Sump.
- ❑ The downslope drainage trench shall follow contour.

13.11.1 Material Placement

Shall follow the general guidelines in Section 13.9.2.

13.11.2 Underdrain, Drainage Trench and Drainpipe

- ❑ A two (2") inch to four (4") inch layer of #8 aggregate, meeting the requirements of Section 4.0, shall be placed within the excavation/chisel plowed area.
- ❑ Two (2") inches of #8 aggregate, shall be placed under the drainpipe installed within the drainage trench. Additional gravel shall be placed around and over the drainage pipe. Aggregate within and around the drainage trench shall terminate two (2") inches below the original grade.
- ❑ Any of following pipe types shall be permitted for the 3"-4" drainpipe:
  - ❑ Three (3) hole perforated corrugated polyethylene (PE) tubing meeting/exceeding ASTM F-405, designed for leach trenches.
  - ❑ Three (3) hole perforated PE pipe (2,500 lb crush) meeting/exceeding ASTM F-810.
  - ❑ Three (3) hole perforated PVC pipe meeting/exceeding ASTM F-2729.
  - ❑ Three (3) hole perforated corrugated PE pipe (smooth interior wall) meeting/exceeding ASTM F-405/AASHTO M-252.
- ❑ End of each drainpipe shall be capped.
- ❑ All couplers shall be compatible with both materials joined.
- ❑ Underdrain shall be sloping towards the lower perimeter drainage trench.
- ❑ Drainage Trench shall be sloped toward the discharge end at one sixteenth (1/16") inch per foot minimum. Drainage pipe shall follow the same grade.

- One foot before exiting the filter drainage trench, the drainage piping shall be switched, with the correct fitting, to solid four (4") inch SCH 40 PVC meeting ASTM D-2665/D-1785.
- Upon exiting the drainage trench, the discharge pipe, immediately outside of the filter, shall be backfilled with clay and rigorously compacted for a minimum of eight (8') feet. Compacted area shall be at least eighteen (18") inches thick.

13.11.3 Adjust Level Sump

A watertight basin which controls the level of effluent within the toe (drainage trench) of the AISF. This device acts like a drop box installed on leaching trenches, allowing effluent to completely fill the trench before overflowing. This device shall:

- Be constructed of rigid watertight materials with the ability to withstand deflection during backfilling procedures.
- Extend a minimum of four (4") inches above original grade.
- Have final grade to the lid of sump and shall have a minimum uniform slope away of 16H:1V (or six (6") inches of fall in eight (8') feet).
- Contain a secure (capable of holding 300 pounds with minimal deflection), insulated, child-proof lid; Either heavy concrete (minimum weight sixty (60) pounds) or bolted (three (3) stainless steel, $^{3}/_{16}$ inch hex heads or S3 recessed square heads used).
- Be based on compacted granular fill compliant with Section 4.0.
- Be connected to the AISF by a four (4") inch SCH 40 PVC pipe which shall be backfilled and rigorously compacted with clay for a minimum of eight (8') feet. Compacted area shall be at least eighteen (18") inches thick.
- The AISF discharge shall extend into the sump a minimum of two (2") inches and shall immediately be elbowed upwards to an elevation one (1") inch below the elevation of the gravel in the AISF' drainage trench.
- The Adjust Level Sump inlet pipe elevation shall be installed so that water will not back up into the drainage trench. Additional piping shall then be connected to the Adjust Level Sump inlet pipe to control the liquid level in the drainage trench.
- Outlet pipe shall be installed at a lower elevation than the inlet pipe.

13.11.4 Air Coil

Allows for the introduction of supplemental air into a sand filter to help in rejuvenation if overloading has occurred. Constructed of polyethylene drip tubing, air coils have evenly placed emitter outlets every two (2') feet.

- ❑ Tubing shall have a minimum of one hundred and fifty (150') feet for up to a 600ft^2 filter.
- ❑ Tubing shall be serpentined, in a outward spiral, terminating at one end of the filter bed.
- ❑ Tubing shall be uniformly spaced underneath of the top gravel area.
- ❑ Tubing shall be laid so that kinking does not occur.
- ❑ Tubing shall be placed directly on top of the bottom layer of aggregate.
- ❑ The beginning of the tubing shall be capped with the appropriate fitting.
- ❑ Tubing end shall be brought to grade with ½" SCH 40 PVC and shall be capped with a threaded adaptor.
- ❑ The 1/2" SCH 40 air coil stand pipe shall be made accessible by housing it below final grade in a valve box.

13.11.5 Sand

The sand is the treatment media which aerobic bacteria grow on to break down wastewater constituents.

- ❑ The sand shall comply with media specifications found in section 4.0.
- ❑ The sand shall be placed in maximum six (6") inch lifts. It shall be wetted and properly compacted. Care must be taken not to stratify sand particles.
- ❑ Final settled sand depth shall be as specified on the approved plan.
- ❑ If the design is for a level sand surface then the sand shall be completely level throughout the bed.
- ❑ If the design is for a sloping sand surface then the sand shall be sloped evenly following the layout procedures in Section 13.10.

13.11.6 Observation Ports

Shall follow specs found in Section 13.9.7.

13.11.7 Top Gravel and Laterals

This **Clean and Washed Gravel** is placed to properly support distribution laterals, evenly distribute applied wastewater, and prevent erosion of sand.

- ❑ Where the sand surface is designed to be sloping the laterals shall:
  - ❑ Contain a properly sized flow control device on each lateral. (ex. flow control orifices/high pressure PVC gate valves installed within an access well which extends to final grade).
  - ❑ Be fed from the downslope side of the manifold which allows for freeze protection by drainback.
  - ❑ Be installed level from end to end and at the same elevation as the other lateral installed on the opposite side of the manifold.
- ❑ Gravel shall comply with media specifications found in Section 4.0.
- ❑ **Gravel shall be visually CLEAN or it will have to be removed**.
- ❑ Gravel thicknesses shall be minimized. Extra gravel shall not be acceptable. Gravel is only used to securely support the pipes.
- ❑ Three (3") inches of gravel shall be placed level on top of sand.
- ❑ Laterals, orifices, and orifice shields shall be placed according to approved plan, and per Section 5.0.
- ❑ An additional three (3") inches of approved gravel shall be placed around and above the laterals.
- ❑ Cleanouts shall be installed per Section 5.5.9 (slightly elevated and well supported with drainage toward laterals).
- ❑ Access wells shall be installed over all cleanouts per Section 9.6.

13.11.8 Filter Fabric

Shall be installed per Section 13.9.9.

13.11.9 Cover

Shall comply with Section 13.9.10.

13.12 Additional Inspection

An additional inspection of the ISF shall be scheduled by the installer following the protocol in the Appendix. This inspection shall coincide with another scheduled system inspection or additional inspection fees will be incurred. The inspection will be scheduled by the installer for the Health District to view the liner in place (if applicable) with the bottom gravel, underdrain, and air tubing installed.

14 Section 14.0 Aerobic Household Sewage Treatment System

14.1 Definition

Aerobic Household Sewage Treatment Systems (AHSTS) means any system which utilizes the principle of oxidation in the decomposition of sewage by introduction of air (oxygen) into the wastewater for a sufficient period of time to result in adequate treatment.

14.2 Scope and Applicability

These standards and specifications shall apply to the design, construction, and installation of AHSTS. AHSTS provides primary and secondary wastewater treatment. When used as a pretreatment device prior to soil absorption, AHSTS may receive a one (1') foot or two (2') feet soil depth credit. Discharging aerobic wastewater treatment systems must have a proper preapproved discharge point in order to be permitted. No discharge will be permitted where an approvable soil absorption system can be sited.

14.3 Purpose and Function

An AHSTS is sometimes used to pretreat household wastewater to meet the soil absorption system standards for a particular site, or to properly treat sewage to meet discharge effluent quality standards. Both of which help protect human health and the environment.

14.4 Design Criteria

All AHSTS installations must comply with the following:

- ❑ The AHSTS must be a preapproved unit which has undergone a Health District review process before being installed. This approval process will, at minimum, involve the AHSTS manufacturer to supply:
  - ❑ Adequate research and testing data showing that the unit will produce an effluent quality meeting, or exceeding BOD_5 of 10mg/L and TSS of 12mg/L, 95% of the time.
  - ❑ A satisfactory explanation, in writing, on how they intend to meet the requirements of this section and this manual.
  - ❑ Installation documentation with accurate drawings of the AHSTS in a format consistent with this manual.
- ❑ The system shall be proceeded by a timer controlled dosing tank sized according to section 3.0. A time dosed aerobic system is a AHSTS that uses a control panel with a

programmable timer (See control panels in section 8.11.0) to provide equalized small quantities of filtered septic tank effluent to an aerobic treatment unit throughout a 24 hour day.

- ❑ Shall be subject to all criteria found within this manual, but most specifically Section 3.0 and Section 8.0.
- ❑ An aeration failure sensor, which checks for the proper amount of air being supplied to the system, shall be supplied and connected to the system control panel.
- ❑ When discharging, this type of HSTS will be considered on a case by case basis by the Health District, and will only be used if:
  - ❑ A properly designed filter based (ISF's) discharging system cannot be feasibly sited.
  - ❑ The AHSTS control panel shall be supplied with telemetry which will call the service provider and the Health District in the event of system component failure(s).
- ❑ The treatment device must be approved under NSF's Standard 40 most current testing procedures.
- ❑ The AHSTS must contain as part of its design, or be fitted with, a positive filtration device before discharging.
- ❑ AHSTS minimum treatment capacity shall be five hundred (500) gallons, **or** one hundred twenty (120) gallons per bedroom, or sized according to regulation, whichever is greater.
- ❑ All AHSTS access points for maintenance and tank pumping shall have risers and lids extending a minimum of two (2") inches above final grade.
- ❑ Riser minimum diameter shall be eighteen (18") inches (24" if a pump is contained within the tank).
- ❑ When discharging to an approved location, an AHSTS must have a approved disinfection device (Section 9.0).
- ❑ The unit shall be installed to Health District approved manufacturer's specifications.

14.5 Installation and Location

AHSTS shall be installed as follows:

- ❑ AHSTS shall be installed in location shown on site plan.
- ❑ Where possible, the AHSTS' inlet shall be placed upslope of the timer controlled dosing tanks riser lids.
- ❑ Discharge lines shall be installed to the area identified on the site plan.
- ❑ The unit shall be installed to Health District approved manufacturer's specifications.

14.6 Materials and Specifications

Generally, AHSTS systems are a proprietary design. It is imperative that the manufacturer's installation guidance shall be used with the following conditions.

- AHSTS shall be approved by ODH for installation in Ohio. (Contact the Health District for a list of AHSTS approved by ODH).
- All upflow filters must be the manufacturer's recommended type, unless otherwise specified by the Health District.
- Aeration disinfection device shall be the manufacturer's recommended type and also shall meet the Health District's disinfection standards and specifications.

15 Section 15.0 Puraflo® Peat Biofilters

15.1 Definitions

A Puraflo® Peat BioFilter (PPBF) is a proprietary secondary treatment device installed at or above the ground surface. PPBF provide wastewater treatment by pumping effluent over a natural Irish peat media which has large pore spaces, high surface area, and a long retention time. This process requires unsaturated downward flow of the effluent through the peat filter media. Proper function calls for influent to the filter be distributed over the media in controlled, uniform doses. In order to achieve accurate dosing, these systems require a timer controlled pump with associated pump chambers, and electrical components. The treated effluent is collected from the bottom of the Puraflo® module(s) and is passed either by gravity or a pump to a suitable soil absorption system, or when discharging, is properly disinfected and outletted to a preapproved watercourse.

15.2 Scope and Applicability

This section will cover the requirements for the sizing, layout and installation of Puraflo® PBF's. When designed, installed and maintained properly, PPBF's will produce effluent that will receive a two foot depth credit for soil absorption systems, and will meet current discharge standards after proper disinfection.

15.3 Specifications

The following shall be general requirements for all Puraflo® Peat Biofilters:

- ❑ Shall be sized at one module per one hundred and twenty (120) gallons, unless otherwise specified on an approved plan.
- ❑ Modules' distribution laterals shall be placed above of the septic/dosing tank riser lids, where possible.
- ❑ Module(s) shall be set so that eighteen (18") inches of the filter is above original grade, unless specified as part of an approved design.(Areas without high water tables)
- ❑ In no case shall the modules be set deeper than the underside of their lid lip.
- ❑ Installation location shall **NEVER** cover module lids with dirt.

15.4 Pad and Module Placement

- Excavation shall consist of a **level** area for modules 18" deep by 8' wide and 27' long for a 3 bedroom. (Add 8' to length for a 4 bedroom. Deduct 8' from length for a 2 bedroom. The pad **must be level**.
- The excavated area shall be levelled with clean #8 or #57 stone to a minimum thickness of six (6") inches.
- The elevation of top of gravel pad shall be higher than the invert of the force main at the pump tank for proper drain back (1/8"/ft. min.).

15.5 Set Module(s)

- The white diamond on each lid's corner represents the force main connection side of the module(s). The modules' white diamonds shall all be installed on the same side.
- Using the 4 rope handles, the first module shall be placed on the levelled area with its end two (2') feet off and facing the short edge of the gravel base.
- All four sides of the module shall be level using a four (4') foot carpenter's level placing it on the first indentation down from bottom of the lid. (Do not level on top of lids.)
- Following the same procedures, each module shall be set one (1') foot apart and level with each other while squarely aligning them in a straight row (lined up straight).

15.6 Force Main Assemblies

- Connection to module shall be made with one (1") inch Flexible SCH. 40 PVC back to the two (2") inch force main.
- Force mains between modules, and to the pump tank, shall be two (2") inch SCH 40 PVC.
- A twelve (12") inch piece of two (2") inch SCH 40 PVC pipe shall extend past the last module connection and shall be capped with a two (2") inch SCH 40 fitting.
- The force main shall be installed level within the gravel pad area with twenty four (24") inches minimum cover.
- The pipes shall be levelled and secured with gravel so they don't move when backfilled with dirt**.**

15.7 Drain Pipe Assemblies

- ❑ All threaded pipe fittings shall be connected to modules and treated with PVC pipe dope or teflon tape.
- ❑ Plugs on the bottom of the modules on the force main side shall be coated with pipe dope or teflon tape and reinstall to prevent leakage.
- ❑ Both drain connections on module shall be used (opposite side from force main). Connections shall be made with short piece of one (1") inch Flexible SCH. 40 PVC and male threaded adaptor.
- ❑ Pipe shall be slope away from modules to the two (2") inch drain line at one eighth (1/8") inch per foot minimum.
- ❑ Drain connection between modules shall be two (2") inch SCH 40 PVC.
- ❑ Connections from one (1") inch flexible PVC to two (2") inch rigid PVC shall be made with 2"x1"x2" pressure tee.
- ❑ Two (2") inch PVC drain line shall be sloped toward drainfield/pump basin at eighth (1/8") inch per foot minimum and shall be bedded in gravel (top & bottom) so they don't move when backfilled with dirt.
- ❑ A twelve (12") inch piece of two (2") inch SCH 40 PVC pipe shall extend past the last module connection and shall be capped with a two (2") inch SCH 40 fitting.

15.8 Backfill & Grade

- ❑ Settled backfill around modules shall be to a height just under the lip of the modules.
- ❑ Backfill grade shall be no steeper than 3H:1V.
- ❑ Backfill shall be graded to prevent infiltration of surface water and shall provide positive drainage away from the modules and drainfield.
- ❑ Final layer of six (6") inches suitable topsoil, capable of supporting vegetative growth, shall be placed.
- ❑ Seed and straw shall be completed on the required areas per Section 6.4. In some cases, sodding for immediate stabilization may be specified.
- ❑ Channel in lids shall be drill with a ½" drill bit and shall be filled with stone level with the lid.

16 Section 16.0 Recirculating Media Filters

16.1 Definition

Any approved device where septic tank effluent is pumped over a media for treatment. The resulting filtered effluent stream is split, part of which returns to the septic tank, and the remaining portion is transferred either by gravity or a pump to a suitable soil absorption system, or is properly disinfected and discharged to a preapproved watercourse.

16.2 Scope and Applicability

These standards and specifications shall apply to the design, construction, and installation of Recirculating Media Filters (RMF). RMF's provides primary, secondary, and sometimes tertiary wastewater treatment. When used as a pretreatment device prior to soil absorption, certain RMF receive a one (1') to two (2') soil depth credit. Additionally, many of these type of filters adequately denitrify wastewater for use in sandy and/or fast soil conditions. Discharging treatment systems must have a proper preapproved discharge point in order to be permitted. No discharge will be permitted where an approvable soil absorption system can be sited.

16.3 Purpose and Function

A RMF is sometimes used to pretreat household wastewater to meet the soil absorption system standards for a particular site, or occasionally to properly treat sewage to meet discharge effluent quality standards. Both of which help protect human health and the environment.

16.4 Design Criteria

All RMF installations must comply with following:

- ❑ The RMF must be a preapproved unit which has undergone a Health District review process before being installed. This approval process will, at minimum, require the RMF manufacturer to supply:
  - ❑ Adequate research and testing data showing that the unit will produce an effluent quality meeting or exceeding BOD_5 of 10mg/L and TSS of 12mg/L, 95% of the time.
  - ❑ A satisfactory explanation, in writing, of how they intend to meet the requirements of this section and this manual.
  - ❑ Installation documentation with accurate drawings of the RMF in a format consistent with this manual.

- ❑ The unit shall be proceeded by a timer controlled dosing tank, sized according to Section 3.0, unless otherwise authorized.
- ❑ Shall be subject to all criteria found within this manual.
- ❑ When discharging, this type of HSTS will be considered on a case by case basis by the Health District, and will only be used if:
  - ❑ A properly designed filter based (ISF's) discharging system cannot be feasibly sited.
  - ❑ The RMF control panel shall be supplied with telemetry which will call the service provider and the Health District in the event of system component failure(s).
- ❑ When discharging to an approved location, a RMF must have a approved disinfection device (Section 9.0).
- ❑ The unit shall be installed to Health District approved manufacturers specifications.

16.5 Installation and Location

RMF shall be installed as follows:

- ❑ RMF and components shall be installed in location shown on site plan.
- ❑ Where possible, the RMF laterals shall be installed at an elevation higher than the septic/dosing tank riser lids.
- ❑ Discharge lines shall be installed to the area identified on the site plan.
- ❑ The unit shall be installed to Health District approved manufacturers specifications.

16.6 Materials and Specifications

It is imperative that the manufacturer's installation guidance be used with the following conditions.

- ❑ RMF shall be approved by ODH for installation in Ohio. (Contact the Health District for a list of RMF approved by ODH).
- ❑ Disinfection device shall be the manufacturer's recommended type and shall also meet the Health District's disinfection standards and specifications.
- ❑ When being pumped to the next system component, a pump basin shall always be located outside the filter with a free flowing inlet. Effluent shall not be stored in the bottom of the filter as a reservoir.

17 Section 17.0 American Manufacturing® Drip Distribution

17.1 Definition

A pre-engineered drip distribution packaged unit supplied by American Manufacturing® which includes but is not limited to the Control Panel, Pump, Floats, Float tree, Discharge Assembly, Hydraulic Unit with Heater, Drip Tubing with Fittings, Flexible PVC Pipe, Air Release and Check Valves.

17.2 Scope and Applicability

These standards and specifications shall apply to the design, construction, and installation of American Manufacturing® Drip Distribution Systems (AMDDS). When a drip distribution is sized properly it will receive a one (1') foot soil depth credit for its ability to equally distribute effluent over the surface of the soil treatment media.

17.3 Purpose and Function

An AMDDS is sometimes used to evenly distribute filtered septic tank effluent or treated effluent over the surface of the treatment media. The process by which the system functions shall be fully automatic and shall not require the owner to flush laterals or filters like other Low Pressure Pipe (LPP) Distribution Systems.

17.4 General

All drip system shall:

- ❑ Be designed by factory trained and authorized personnel only.
- ❑ Have been reviewed and approved for manufacture's hydraulic requirements by either the manufacturer or the manufacture's representative. This manufacturer approval shall accompany the proposed system application for installation.
- ❑ Use only the Health District approved components supplied by American Manufacturing® or its distributor and materials found within this manual.
- ❑ Be installed by a contractor who is certified by the manufacturer.
- ❑ Be installed as shown on the Health District approved site plan.
- ❑ Be installed in accordance with this manual.

17.5 Dosing Tank

A separate dosing tank shall follow the septic tank which shall be:

- ❑ Designed to have a minimum volume equal to ODH specifications for septic tanks.
- ❑ Sized according to the Health District approved plan set.
- ❑ Installed according to the site plan.

17.6 Pumping Unit

The pump shall be a turbine style as supplied by the manufacturer.

- ❑ Pump shall be housed in the flow inducer with the collar extended into the tank riser and securely fastened with non-corrosive fasteners.
- ❑ Pump discharge to the Hydraulic Unit shall be one and a half (1.5") inch SCH 40 PVC.
- ❑ The discharge assembly shall contain no weep holes.
- ❑ The discharge assembly shall have the following installed within ten (10") inches of the riser lid:
  - ❑ A brass swing check valve;
  - ❑ A shut off valve;
  - ❑ A pressure rated true union disconnect.

17.7 Floats

The system shall operate as a four float system as supplied by the manufacturer.

- ❑ The floats shall be set in accordance with the approved plan set to achieve the appropriate volumes between floats in the tank.

17.8 Hydraulic Unit

This flow control and filtering unit contains the disk filters, solenoid valves, and heater pad which allows the system to function properly. This unit shall be:

- ❑ Installed as indicated on the site plan.
- ❑ Located less than ten (10') feet from the control panel.
- ❑ Located less than ten (10') feet horizontally from the pump.
- ❑ Installed with all pipes entering and exiting the unit elbowing vertically down 90 degrees to a minimum of thirty (30") inches prior to extending away from the unit.(except backwash line)
- ❑ Insulated by surrounding the valve box with dirt to the lid.
- ❑ Installed so that positive drainage away from the valve box of 16H:1V (six (6") inches of fall in eight (8') feet) will be achieved.

- ❑ Flush return piping to septic tank shall be installed so that backwash water will be returned to the building sewer with a minimum of one eight (1/8") inch per foot (1%) slope.
- ❑ Additionally insulated by blue board Styrofoam, bagged Styrofoam peanuts, or equal.

17.9 Controls and Electrical

Shall comply with this manual and the following additional specifications:

- ❑ The control panel shall be located within ten (10') feet of the hydraulic unit.
- ❑ The alarm shall be on a separate circuit within the home.
- ❑ The Hydraulic Unit's control wiring (umbilical) and the Heater Pad wiring shall be run through PVC conduit to the control panel with no splices and shall be connected to the terminal strip provided.
- ❑ The field wiring in the control panel shall contain a minimum of a three (3") inch loop to prevent disconnection from the panel in the event of settling.

17.10 Supply and Return Piping

Includes the piping between the Hydraulic Unit to the drip tubing and septic tank. The following requirements shall apply:

- ❑ Piping shall comply with Section 5.0.
- ❑ Shall be installed with a minimum of thirty (30") inches soil cover.
- ❑ Shall be cut using PVC cutters and shall not be sawed.
- ❑ Recommended to be tested for leaks before backfilling.
- ❑ Shall be installed in accordance with the approved site plan.
- ❑ If a dense vegetation cannot be established prior to the first exposure to cold weather, then pipe trenches shall be mulched with straw a minimum of six (6") inches thick.
- ❑ Zones with a static lift of greater than ten (10') feet from the Hydraulic Unit to the top of the drain field shall have check valve on the zone supply pipes just after the Hydraulic Unit if, at startup, it is determined that water is draining back through the unit after the pump shuts off. An alternate assembly shall be installed on the zone return line, if necessary. The check valves shall be housed under an insulated valve box with lid to grade.

17.11 Manifolds

Includes the piping between the supply and return lines to the drip tubing and the associated fittings. The following requirements shall apply to manifolds:

- ❑ Piping shall comply with Section 5.0.

- ❑ Flexible piping shall be Schedule 40 flex pipe.
- ❑ Shall be cut using PVC cutters and shall not be sawed.
- ❑ Recommended to be tested for leaks before backfilling.
- ❑ Shall be installed in accordance with the approved site plan.
- ❑ Top feed manifold must be used on sites where upper laterals may drain down to lower laterals.
- ❑ The main supply and return lines (installed minimum 30" deep) shall feed the shallow Top Feed Manifolds with a single vertical section of insulated SCH 40 PVC pipe. Top Feed Manifolds must be properly insulated with a minimum ½" Styrofoam insulation.
- ❑ Top feed manifolds shall be placed at the high point of each zone at a depth equal to that of the drip tubing. The manifold shelf shall have ½" or $^{3}/_{4}$"(check plan) SCH. 40 rigid PVC lateral feed and return lines running perpendicular to the drip tubing and then elbowed into the tubing horizontally with flex PVC tubing. The shallow lateral supplies and returns will drain into the tubing after each zone dose.
- ❑ Air release valves shall be placed below the final grade within a valve box, but at an elevation above the highest drip line in each zone on both the Supply and Return Manifolds.
- ❑ Check valves shall be placed on return manifolds after the air release valve before connecting to the return line.
- ❑ Where Top Feed Manifolds will not drain, therefore requiring the use of Side Feed Manifolds:
  - ❑ The supply and return rigid manifold piping shall be installed with thirty (30") inches of cover;
  - ❑ Twelve (12") inches of cover shall be required between the highest point of the ½" black flexible PVC pipe and final grade. This may require additional cover to be placed over the header ditch. This additional cover must be properly tapered to the site. Flex pipes must also be properly insulated with a minimum ½" Styrofoam insulation.
- ❑ If the dosing tank is placed such that the off float level is at a higher elevation than any drip tubing, then remote zone valves shall be installed. Alternatively, if supply line drain down will not result in large volumes of water flowing to the drip tubing, then an anti-siphon valve may be utilized. The placement of either will be determined by the manufacturer and the Health District.

17.12 Valve Boxes

Subsurface access wells housing system components with lids to grade.

- ❑ Shall be used to house the Hydraulic Unit, air release valves, check valves, and remote zone valves.
- ❑ Shall comply with Section 9.6.
- ❑ Valve Box for the Hydraulic Unit, remote zone valves and check valves shall be insulated by the installer with blue board, bagged Styrofoam peanuts, or equal.
- ❑ Valve box for the Hydraulic Unit shall have a two (2") inch SCH 40 minimum screened drain which has slope to a daylight outlet.

17.13 Drip Tubing

Half (1/2") inch polyethylene tubing with 120psi rating containing pressure compensating turbulent flow emitters which operate at a consistent flow rate between 7 - 70 psi.

- ❑ Tubing shall contain emitters every two (2') feet, unless otherwise specified.
- ❑ Tubing ends should be taped prior to installation to prevent debris from entering.
- ❑ Connectors used shall be made specifically for the tubing and supplied by the manufacturer.
- ❑ Shall be installed according to the approved plan set.
- ❑ Spacings shall be as specified on the approved plans.
- ❑ Maximum length of the drip tubing shall be in accordance with the approved set of plans and within the Manufacturer's hydraulic requirements.
- ❑ Individual drip tubing laterals shall be connected to the manifolds as specified on the approved plans.
- ❑ Drip tubing shall be connected to the manifolds via angled vertical sections of the manufacturer supplied SCH 40 flex pipe and fittings.
- ❑ Flex pipe shall be properly insulated and supported before backfill.
- ❑ Drip tubing shall maintain a separation of two (2') feet minimum from the supply, return, and manifold trenches.
- ❑ All loops connecting drip tubing shall be done with supplied ½" PVC flex pipe and elevated slightly (1"-2") so that they drain into the drip tubing after the pump shuts off. Elevated areas shall be well supported.
- ❑ Site shall be prepared using guidelines found in Sections 2 and Section 10.

When being plowed in:

- ❑ Proposed drip runs shall be temporarily painted along contour to assist the installer in holding to contour.
- ❑ Tubing shall be installed using a vibratory plow which lays the tubing in, a trencher, or by hand.
- ❑ Tubing shall be installed on contour +/- two (2") inches in one hundred and fifty (150') feet.

When being installed on a sand bed:

- ❑ Section 10.6.3 shall be used or a method similar to Section 10.6.2 for the layout following the approved plan set.
- ❑ Shall follow Section 10 requirements.
- ❑ Sand shall create a level area for tubing installation end to end.
- ❑ Tubing shall be installed on created sand contour +/- one half (½") inch.
- ❑ Tubing shall be held in place via a Health District approved method (ex. A wooden jig every ten (10') feet or less).
- ❑ Tubing shall be completely supported with sand.
- ❑ Tubing shall be covered with geotextile fabric (Section 4.11).

17.14 Cover

Additional trucked in topsoil used to final grade areas over the top of the drip system.

- ❑ For mounded drip systems, they shall comply with:
  - ❑ Section 10.10
- ❑ For plowed in drip systems, they shall comply with:
  - ❑ Sections 4.10.1 or 4.10.2.
  - ❑ Any micro-topography irregularities shall be filled in and graded evenly with the surrounding natural conditions either by hand, or with light tracked equipment only.
- ❑ All areas disturbed areas shall be seeded and strawed to Section 6.4

17.15 System Start-Up

The system shall be started up by the manufacturer, or the manufacturer's representative following the Health District approved guidelines. A completed start-up worksheet shall be obtained by the Health District prior to final system approval.

18 Section 18.0 Pressurized Leach Beds

18.1 Definition

A soil absorption sewage system consisting of shallow excavated pit which is filled with sand for treatment and gravel to distribute the wastewater flowing from pressurized laterals. These are used for the dispersal and treatment of wastewater in the underlying native soils.

18.2 Scope and Applicability

The leach bed sewage system applies only to existing lots where no other onsite system can fit and the soil is judged to be adequate to remove the wastewater constituents. Septic tank effluent can be distributed into a leach bed where four (4') feet of vertical separation remains under the treatment sand. More often however, a denitrifying pretreatment device which is also able to achieve 10 BOD_5, 12 TSS and <1000 CFU of Fecal Coliform is used to reduce the vertical separation requirements dictated by the site soils.

18.3 Purpose and Function

Effluent from the septic tank or other approved pretreatment device is pumped to a pressurized distribution system within the leach bed for additional treatment in the sand which absorbs into the surrounding soil. Therefore, the purpose of leach bed is to treat effluent before absorption into the soil.

18.4 Specifications

The following shall apply to the installation of a leach bed.

18.4.1 Sizing and Location

- ❑ Leach bed shall not be located in low or swampy areas.
- ❑ Size shall be based on number of bedrooms, daily design flow, type of waste being treated (septic tank or pretreated effluent), and the soil conditions found at the soil/sand interface.
- ❑ Health District generated soil tables shall be used for soil loading rates.
- ❑ Where possible, the leach bed laterals shall be installed at an elevation higher than the septic/dosing tank riser lids.
- ❑ Minimum lateral orifice density shall be $6ft^2$ per orifice.
- ❑ Laterals shall be spaced at either twenty four (24") inches to thirty six (36") inches on center and shall be based on approved design.

- ❑ Orifices shall be spaced at eighteen (18") inches to thirty six (36") inches on center and shall be based on the approved design.
- ❑ Orifices shall be one eighth (1/8") inch diameter and properly drilled.
- ❑ Laterals shall be three quarter (3/4") inch SCH 40 PVC.
- ❑ All pressure piping used shall meet Section 5.0 and per approved design.
- ❑ Laterals shall be run parallel to the filter length.
- ❑ Length of the filter shall be generally parallel to the land contour +/- eight (8") inches.
- ❑ Depth of excavation and treatment sand shall be determined by soil conditions and effluent quality. The following shall apply:
  - ❑ When distributing septic tank effluent, maximum excavation depth shall be twenty four (24") inches.
  - ❑ When distributing septic tank effluent, minimum sand depth shall be twelve (12") inches.
  - ❑ When distributing an approved pretreated effluent, maximum excavation depth shall be thirty six (36") inches.
  - ❑ When distributing an approved pretreated effluent, minimum sand depth shall be six (6") inches.
  - ❑ The top of the sand shall be installed so that it is no deeper that 12" from the ground surface.
  - ❑ If fast soils (coarse sands and/or gravels) underlie extremely restrictive soils (compacted soils or, weak/massive structured clays) then these poor soils shall be removed and sand shall be used to bring the excavation depth back to within twelve (12") inches from final grade. For this to occur, the system must be pretreated to the required standard and the soil absorption rate shall not be increased.

18.5 Layout and Excavation of a Leach Bed

Leach beds are typically rectangular in shape and are therefore easily adapted to both flat and sloping sites.

- ❑ The length of the filter bed shall be laid out as parallel as possible to the site contour; +/- eight (8") inches shall be allowed.
- ❑ The highest point of the ground surface around the perimeter of the filter shall be used to set the excavation depth.
- ❑ Pit shall be excavated so that the bottom is level and roughened.
- ❑ No soil smearing within the excavation shall be allowed.

- ❑ Excavated soil spoils shall be placed around the perimeter of the filter to berm up surrounding area to be level with highest perimeter ground surface.
- ❑ Proper 3H:1V slope shall be established on bermed areas(Section 6.2).
- ❑ Maximum berm height shall be eight (8") inches.
- ❑ Pit walls shall be vertical before proceeding.
- ❑ Pit dimensions shall be the size on the approved plan.
- ❑ Depth of the filter shall be in accordance with the approved plan and Section 18.4.1.

18.6 Material Placement

The following are general guidelines for the installation, movement, and storage of aggregates and other components.

- ❑ Aggregates shall be stockpiled in separate piles to avoid mixing.
- ❑ Aggregates stockpiles shall be away from system, allowing sufficient space for equipment operation.
- ❑ Equipment buckets shall be cleaned and free of dirt/fines.
- ❑ Copies of the sand and gravel tickets shall be given to the inspector at the time of inspection and before the system shall receive final approval.
- ❑ Aggregate stockpile usage:
  - ❑ Top of Pile to six (6") inches from pile bottom: This aggregate shall be placed inside of the filter, if clean.
  - ❑ Six (6") inches from pile bottom: This aggregate shall not be placed in the filter.

18.7 Sand

The sand is the treatment media on which aerobic bacteria grow to break down wastewater constituents.

- ❑ The sand shall comply with media specifications found in Section 4.0.
- ❑ The sand shall be placed in maximum six (6") inch lifts. It shall be wetted and properly compacted. Care must be taken not to stratify sand particles.
- ❑ Final settled sand depth shall be within twelve (12") inches of the ground surface, and the thicknesses shall be as specified on the approved plan and shall comply with Section 18.4.1.
- ❑ Sand shall be completely level throughout the bed.
- ❑ Sand shall be free of any dirt clods or other undesirable materials.

18.8 Observation Ports

Subsurface access stand pipes which allow viewing of the sand and soil surface for monitoring of plugging or overloading.

- ❑ Shall be installed on the top of the sand surface and excavated grade surface.
- ❑ One shall be installed on both surfaces for every 300ft^2 of filter area.
- ❑ When multiple ports are required, they shall be installed in opposite quadrants of the filter.
- ❑ They shall be constructed and installed per specs found in Section 9.7.
- ❑ Ports shall be terminated below final grade and shall be housed within a valve box.

18.9 Top Gravel and Laterals

This **Clean and Washed Gravel** shall be placed to properly support distribution laterals, evenly distribute applied wastewater, and prevent erosion of sand.

- ❑ Gravel shall comply with media specifications found in Section 4.0.
- ❑ **Gravel shall be visually CLEAN or it will have to be removed**.
- ❑ Gravel thicknesses shall be minimized. Extra gravel shall not be acceptable. Gravel is only used to securely support the pipes.
- ❑ Three (3") inches of gravel shall be placed level on top of sand.
- ❑ Laterals, orifices, and orifice shields shall be placed according to approved plan, and per Section 5.0.
- ❑ An additional three (3") inches of approved gravel shall be placed around and above laterals.
- ❑ Cleanouts shall be installed per Section 5.5.9 (slightly elevated and well supported with drainage toward laterals).
- ❑ Access wells shall be installed over all cleanouts per Section 9.6.

18.10 Filter (Geotextile) Fabric

Material placed over system to prevent siltation and migration of cover materials into the filter bed.

- ❑ Top gravel shall be covered with Geotextile fabric consistent with specs found in Section 4.11.
- ❑ Overlap of fabric shall be six (6") inches minimum.
- ❑ No tears in the fabric shall be allowed.

18.11 Cover

Provides protection of the sand filter components an prevents contact with sewage. Also offers filtration of sewer gasses.

- ❑ Cover material over the gravel area shall comply with Section 4.10.1 for septic tank effluent or 4.10.2 for pretreated effluent. **No Exceptions**.
- ❑ Areas around the outside of the filter may be a lesser quality topsoil.
- ❑ Cover shall be graded to drain surface water off and away from the filter.
- ❑ Settled cover thickness shall be six (6") inches to eight (8") inches.
- ❑ 3H:1V slope shall be established around the filter(Section 6.2).
- ❑ Any exposed components (ex. valve boxes) shall have soil tamped into place so that no further settling will occur. Finished grade around such components shall be flush with their tops.
- ❑ A diversion swale and/or interceptor drain shall be provided upslope of the filter.
- ❑ Grass seed and straw shall be completed on the and around the Pressurize Leach Bed and disturbed areas per Section 6.4. In some cases, sodding for immediate stabilization may be specified.

18.12 Additional Inspection

An additional inspection of the pressurize leach bed shall be scheduled by the installer following the protocol in the Appendix. This inspection shall coincide with another scheduled system inspection or additional inspection fees will be incurred. The inspection will be scheduled by the installer for the Health District to view the properly excavated leach bed pit.

19 Section 19.0 Systems Checkout Procedure

19.1 Completion Certification Documentation

The following checklist items will assist in completing the final set-up of the HSTS after installation.

19.1.1 Start-Ups

The Start-Up Shall

- ❑ Be completed by the responsible party.
- ❑ Be completed before the final inspection.
- ❑ Confirm that all components are operating as designed and specified.
- ❑ Confirm that all controls are operating as designed and specified.

19.2 Start-Up Documentation

Control panel function check-out shall be;

- ❑ Completed before inspections by the Health District.
- ❑ The sole responsibility of the Permit-To-Install holder.
- ❑ Documented with a checklist from the manufacturer's representative **or** documented with a checklist provided by the Health District.
- ❑ Certified by the Permit-To-Install holder's signature and date on the checklist, and a copy shall be given to the Health District before final approval.

19.3 Check-Out Documentation

For the Check-Out, the requirements for the power supply shall be implemented by:

- ❑ Pump testing and documentation shall be tested using electric service from the local power grid, OR,
- ❑ A generator may be used to supply power only for testing the controls.

<u>The documentation for Check-Out:</u>

- ❑ Shall be completed, signed, and dated by the Responsible Party.
- ❑ Shall be completed before calling for the final inspection.
- ❑ Shall document the system has been started successfully.
- ❑ Shall document that all components are operating as designed and specified.
- ❑ Shall document that all controls are operating as designed and specified.

- ❑ Shall document the amperage, voltage, date and time for all pumps in the HSTS.
- ❑ Shall document flow rates, squirt heights, dose volumes, run times, and all other monitored parameters of the system. Dates of the readings shall be recorded with the monitored parameters.
- ❑ Completed document copy shall be given to the Health District before final approval.

19.4 Measuring and Adjusting Operating Head of Pressurized Systems

Operating head shall be:

- ❑ Measured at the ends of the distribution laterals, unless the designer has been given approval for another method.
- ❑ Measured with full open gate valve and full pressurization. This measurement shall be recorded on checkout documents before adjustment, if a gate valve was used.
- ❑ Set to Section 5.9.1 or design specifications.
- ❑ Adjusted using PVC high pressure gate valves, unless other approved flow control device was used.
- ❑ Read directly in a clear pipe or tubing supplied by the installer which is threaded into every clean out at the end of all laterals, **or** measured similarly with a calibrated pressure gauge. Final settings shall be witnessed by the Health District.
- ❑ For pipe or tube measurements:
  - ❑ Operating head shall be measured from the top of the distribution lateral.
  - ❑ Shall be measured to the nearest inch.
  - ❑ Shall be measured with clear tubes on every lateral clean out.
- ❑ Measured after the system was flushed, and weep holes were drilled (See Section 5.14 Flushing Procedures).
- ❑ Measured with the liquid level within the tank's normal operating range. This shall be above the low level alarm, but below the high water alarm.
- ❑ Recorded in the control panel for original and adjusted squirt height.

19.5 Flow Rates

The flow rate(s) shall be:

- ❑ At the specified flow rate, **or** within the acceptable range of flow rates with a specified minimum flow rate.
- ❑ Recorded in the control panel and on checkout documentation.

Flow rate shall be determined by using one of the following methods:

- ❑ A flow meter that is part of the system.
- ❑ "Timed Draw Down" methods.
- ❑ Other approved method.

19.6 Required Net Dose Volumes

The required net dose volume is the volume of liquid that shall be applied to the distribution laterals or proprietary device to maximize treatment.

- ❑ Proprietary pretreatment devices - installer shall refer to Health District approved product guidelines for recommended net dose volumes. Settings must maximize treatment; **or**,
- ❑ Dose volume shall be five (5) times the total lateral volume, unless otherwise specified; **and**,
- ❑ Net dose shall provide one quarter (0.25) $^{gallon}/_{orifice/dose}$ to (0.42) $^{gallon}/_{orifice/dose}$ and shall be based on the approved design.
- ❑ Drainback volume shall be properly incorporated into the net dose volume to derive the total dose required.

19.7 Dose Volumes

Dose volumes shall be set as specified by the design and shall be controlled by either:

- ❑ A timer controlled pump run time, at a known flow rate; **or**
- ❑ Float switches set to pump a known volume of liquid.

19.8 Programmable Timer Settings

Programmable timers:

- ❑ Shall be set up to meet design specifications.
- ❑ ***Settings shall be recorded in the panel service record*** and on checkout documentation.
- ❑ Shall provide baseline information for monitoring the system operation.

19.9 Event Counters and Elapsed Time Meters

Counters, elapsed time meters, and other monitored parameters totals:

- ❑ Shall be recorded in the panel service record and the checkout documentation.
- ❑ Shall provide baseline information for monitoring systems operation.

19.10 Control Panels with Analog Timers

These shall have:

- ❑ Timers which shall be set to the smallest unit of time possible.
- ❑ Controls which shall NOT be set to respond to high water alarm events by pumping on demand.
- ❑ Controls which shall be set to respond when daily usage exceeds the system's design.

19.11 Control Panels with Digital Timers

These shall have:

- ❑ Controls which shall NOT be set to respond to high water alarm events by pumping on demand.
- ❑ Controls which shall be set to respond when daily usage exceeds the system's design.

19.12 As-Built Documentation

As-built documentation shall be:

- ❑ Signed and dated by the responsible party and a copy shall be given to the Health District.
- ❑ Neat and legible.
- ❑ Completed using symbols and methods given in this manual.
- ❑ Reasonably scaled.
- ❑ A record that the homeowner and/or maintenance service provider is able to use effectively.

20 Appendix 20.0 Inspection Protocol

This appendix section contains specifications and recommendations that are specific to Hamilton County. This sections shall be used to supplement Sections 1.0 thru 19.0 of this manual. All of the items contained in the previous sections shall apply.

20.1 Inspection Protocol For All Systems

The following will be the inspection protocol used by the Health District, and shall be followed by the installer, for all HSTS inspections. The following items listed for each inspection point shall be completed by that inspection point. Failure to complete an item for that inspection point may result in disapproval and a red tag. Up to four (4) inspections are required for HSTS installed in Hamilton County. ***Note that inspections must be scheduled by the installer. It is recommended that system inspections be called in by 9:30am the day before the inspection is to take place. Calling in inspections after that timeframe may not guarantee an inspection on the desired day. Preconstruction conferences should be scheduled several days in advance. Inspections will only occur during normal business hours as set by the Health District. Due to the need to keep neat and accurate records, inspections will not be performed in the rain.***

1. **Inspection #1 - Preconstruction Conference**: Shall occur before any excavation begins. Prior to this inspection the contractor shall:
   - ❑ Have a valid Permit-to-Install (PTI).
   - ❑ Be familiar with relevant Health District guidance and specifications (this manual).
   - ❑ Have reviewed all information found on, or attached to, the site plan.
   - ❑ Have reviewed all notes and recommendations on the HSTS Application, site plan, and Permit.
   - ❑ Be familiar with Health District approved, technology-specific guidance and specifications provided by product vendors.
   - ❑ Have completed the layout survey and excavation plan, with a paper copy which shall be given to the Health District; verifying that the system can be installed as designed; **or,**
     - ❑ Have contacted the system designer to review problems.
     - ❑ Be prepared to discuss any questions.

2. Inspection #2 - Basal Area Prep/Technology Specific Inspection/Partial Component Installation Inspection/ Watertightness Test:

- ❑ Basal area shall be prepared to the Health District's specifications.
- ❑ Refer to the end of each treatment device section, within this manual, for technology specific inspections (e.g. Intermittent Sand Filters & Pressurized Leach Beds).
- ❑ For partial component installation, follow same protocol found under Inspection #3.
- ❑ *Option "A "* - The Watertightness Field Test Certification Procedure shall have been started previously to allow final watertight test.

3. Inspection #3 - System Components Installed/ Watertightness Test:

- ❑ All system components shall be installed, open for inspection and ready for cover (**THIS INCLUDES PROPER PIPE BEDDING!!!**).
- ❑ Lateral flushing procedure shall be completed. ***It is recommended that the entire system operating heads and system flow rates are pre-checked by the installer before cover is placed.***
- ❑ *Option "B"* - The Watertightness Field Test Certification Procedure shall have been started previously to allow final watertight test.

4. Inspection #4 - System Checkout:

- ❑ Installer **Must** be present for this inspection.
- ❑ All necessary work for final approval of the system shall be completed.
- ❑ Final grading of the system shall be completed.
- ❑ System seeded and straw placed to specifications, as required.
- ❑ Operating head(s) shall be checked, set and documented.
- ❑ Clear acrylic pipes (3/4"-1" diameter and 6' long each) shall be threaded into every lateral clean out and shall be ready for Health District witnessed Squirt Height Test.
- ❑ Ample water shall be available within the tank(s) to quickly perform **all** checkout procedures with Health District present.

- ❑ Floats or pressure transducers shall be set to Health District guidelines (See Dose Sheet).
- ❑ All control panel functions shall be tested, verified and documented.
- ❑ All required installation and start-up documentation shall be completed, signed, and dated, by the installer with copies made for the Health District (as-builts, dosing sheets, timer setting sheets, owner/installer replacement system interview and signoff sheet etc.).
- ❑ Service record form (within control panel) shall be dated, all monitored parameters recorded, and initialled; service record shall be left in control panel.
- ❑ All system warranty information, homeowner manual(s), as-built copy, installation and maintenance information, videos, etc. shall be packaged, clearly labelled, and in a secure location within the home.

21 Appendix 21.0 Installer Registration

21.1 Definition

An Installer is any person who installs or is in the business of installing or repairing a household sewage treatment system (HSTS) or any component part thereof, including but not limited to, septic tanks, aerobic systems, biofilters, soil absorption systems, piping, or disinfection devices. Accordingly, any person or firm that performs the services of an installer or repairer must hold a valid installer's registration. Homeowners installing their own sewage systems shall be registered with the Health District. Further, a person who excavates for an HSTS, but does not install the system component parts, is not an installer. In this case, the registered installer is still responsible for the excavation, and all parts of the system.

21.2 Registration Application Process

Any person wishing to be registered as an installer must submit once per year, starting every January 1st, the following:

- ❑ A surety performance bond from an "A" rated company, which shall run in favour of the Hamilton County Board of Health. The bond amount may be set yearly by the Hamilton County Board of Health.
- ❑ The bonding company's Certificate of Compliance to issue insurance in the State of Ohio.
- ❑ A Certificate of Liability.
- ❑ A completed application form provided by the Health District.
- ❑ A non-returnable application fee.

21.3 Installer Responsibilities

An installer shall:

- ❑ Be responsible for all parts of the HSTS for which he/she holds the permit.
- ❑ Comply with all requirements of this manual, Household Sewage Regulation 529, and the Ohio Administrative Code, as well as any addition information found on the Application to Construct, Installation Permit and approved site plans.
- ❑ Maintain accurate records of HSTS installations for which they install.
- ❑ Obtain a **valid** Installation Permit prior to starting work on an HSTS.
- ❑ Be familiar with the treatment system before starting installation.

21.4 Registered Installer List

The Health District will maintain a regularly updated list of Registered Installers. This list may contain certifications or qualifications which select installers may hold, validating their abilities to properly install certain HSTS components. These accreditations may come from:

- The Ohio Onsite Wastewater Association (OOWA)
- The National Onsite Wastewater Recycling Association (NOWRA)
- The Nation Environmental Health Association (NEHA)
- The Ohio State University's Soil Environment Technology Learning Lab. (SETLL)
- The Ohio Land Improvement Contractors Association (OLICA)
- Factory Approved Training Courses for specific technologies.

21.5 Installation Permit Limits

Installers may be limited to having a maximum number of open Installation Permits at one time. Permits expire one year after issuance by the Health District. Once a job has been started, it must be completed before it will be dropped off of installer's list. If the permit expires within this time period, the installer must repay the current Installation Permit fee. If the installer is not finishing the job, then another Registered Installer must have obtained the Installation Permit for that job before it will be dropped off their list. Installers may not obtain any new Installation Permits if they have any previously permitted jobs that remain "open" longer than two years, if it was within the installer's means to finish.

21.6 Penalties, and Registration Revocation or Suspension

An Installer will be penalized by paying four times (4x) the current Installation Permit fee for:

- Installing or working on a system without a valid Installation Permit.
- Installing or working on a system without a valid Registration.

Additionally, the Board of Health may suspend or revoke any Installer's Registration for failure to comply with this manual or Regulation 529, provided, however, that prior to such suspension or revocation, the Health District shall have given notice, in writing, to the registration holder describing the alleged failure(s) to comply and allowing opportunity for a preliminary hearing before the Health Commissioner and a formal hearing before the Board of Health. Some examples of failure to comply shall be:

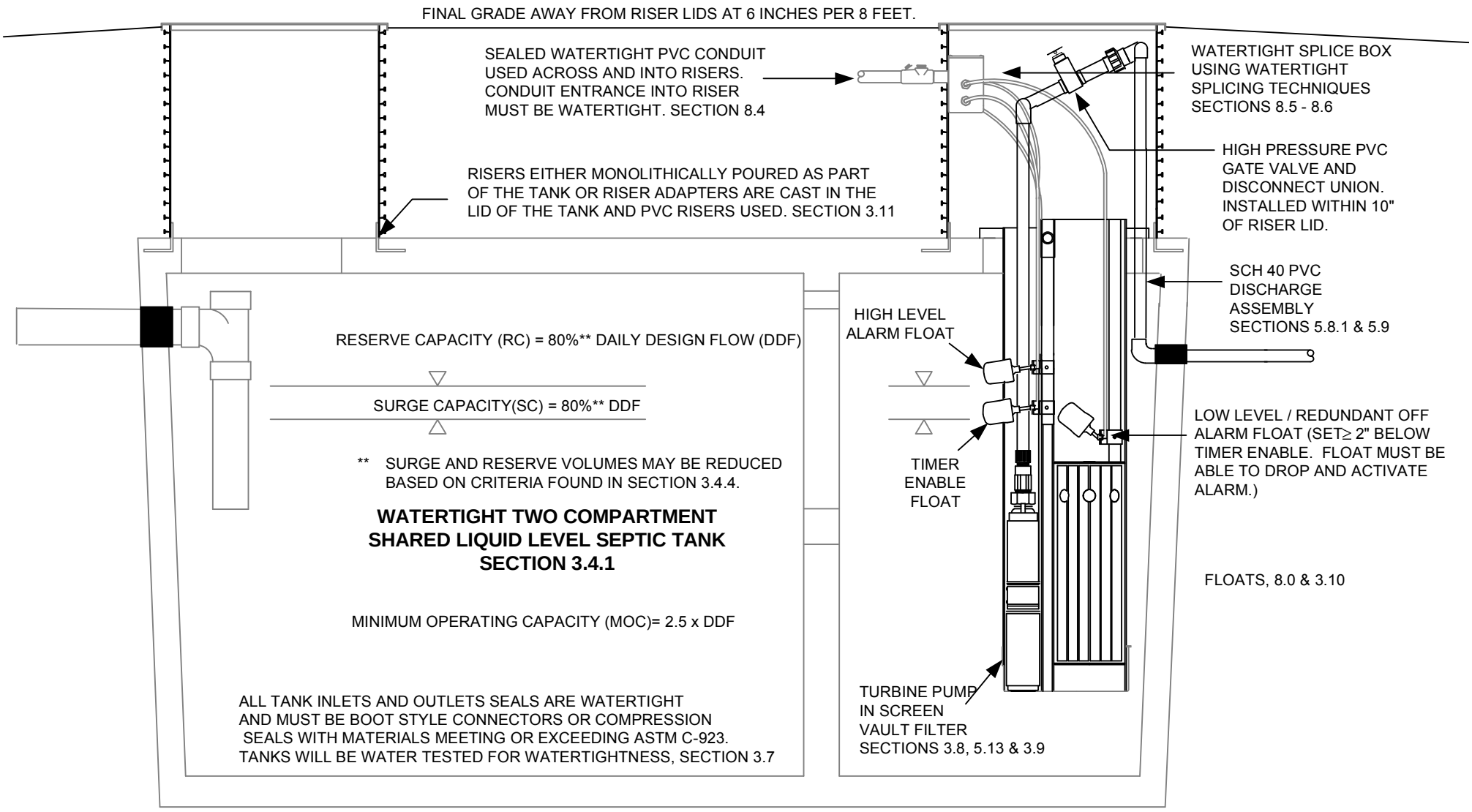
- ❑ Falsifying any information or documentation given to the Health District.
- ❑ Three disapproved inspections on one installation, if the reason(s) for disapproval were within the installer's means to correct.
- ❑ Four disapproved inspections within one year, if the reason(s) for disapproval were within the installer's means to correct.
- ❑ Covering a HSTS or any of it's components without Health District inspection and/or approval.
- ❑ Installing a HSTS or any of it's components without a valid Installation Permit.
- ❑ Any other condition demonstrating the installer's consistent or blatant disregard for the requirements within this manual or Regulation 529.

22 Appendix 22.0 Drawings

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCPH within the STS design. When used, if conflicts exist between this manual and Ohio Administrative Code 3701-29, the state code shall prevail. STS contactors shall follow the approved STS design.

TIME DOSED SEPTIC TANK WITH SCREEN VAULT FILTER

SECTION 3.0



ALL TANKS MUST BE BEDDED ON, AND BACKFILLED WITH GRAVEL MEETING HEALTH DISTRICT APPROVED MANUFACTURERS SPECIFICATIONS.

Profile View

Not to Scale

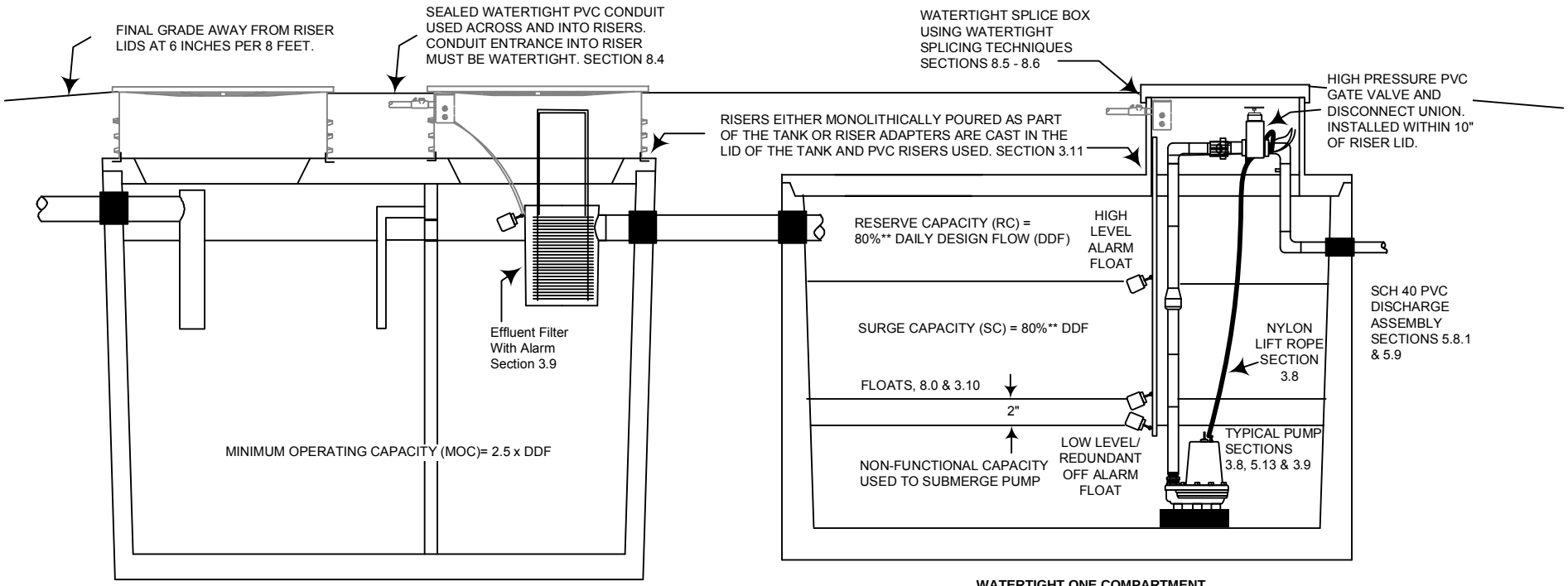
HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
PRIMARY TREATMENT TANKS			
Title: TIME DOSED SEPTIC TANK WITH SCREEN VAULT FILTER			
Drawn By: CMG	Date: 1/31/05	Revision #: 4.0	

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCPH within the STS design. When used, if conflicts exist between this manual and Ohio Administrative Code 3701-29, the state code shall prevail. STS contactors shall follow the approved STS design.

Septic Tank And Dosing Tank Configuration

SECTION 3.0

ALL TANK INLETS AND OUTLETS SEALS ARE WATERTIGHT
AND MUST BE BOOT STYLE CONNECTORS OR COMPRESSION
SEALS WITH MATERIALS MEETING OR EXCEEDING ASTM C-923.
TANKS WILL BE WATER TESTED FOR WATERTIGHTNESS, SECTION 3.7



WATERTIGHT TWO COMPARTMENT INDIVIDUAL LIQUID LEVEL SEPTIC TANK SECTION 3.4.0

WATERTIGHT ONE COMPARTMENT DOSING TANK SECTION 3.4.0

** SURGE AND RESERVE VOLUMES MAY BE REDUCED BASED ON CRITERIA FOUND IN SECTION 3.4.4.

ALL TANKS MUST BE BEDDED ON, AND BACKFILLED WITH GRAVEL MEETING HEALTH DISTRICT APPROVED MANUFACTURERS SPECIFICATIONS.

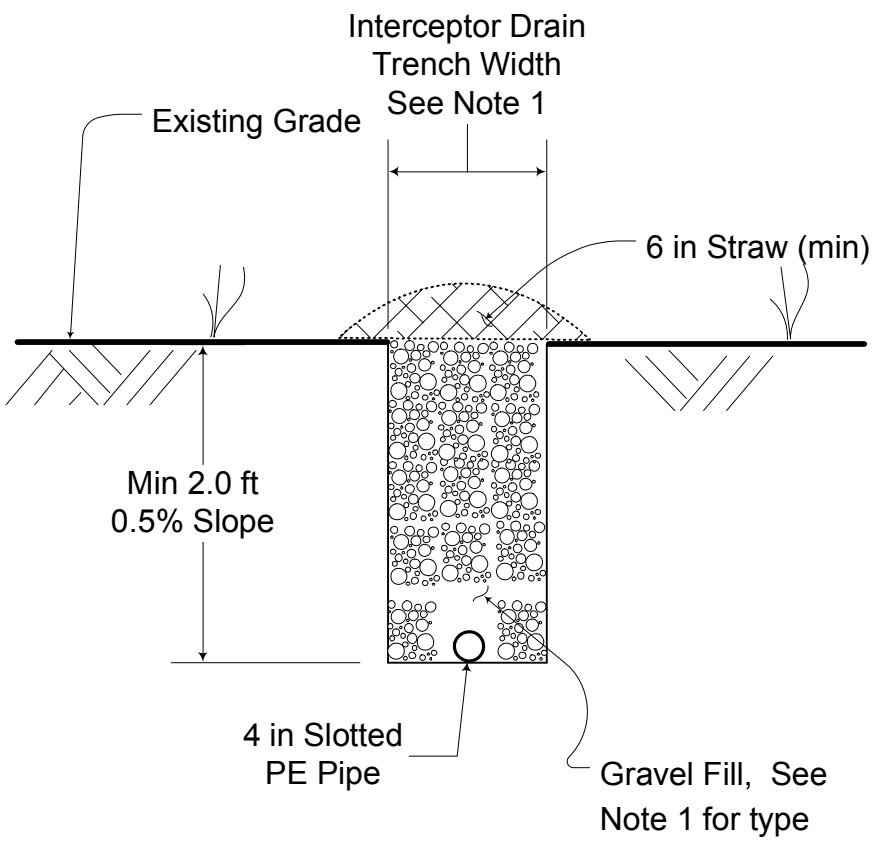
Profile View

Not to Scale

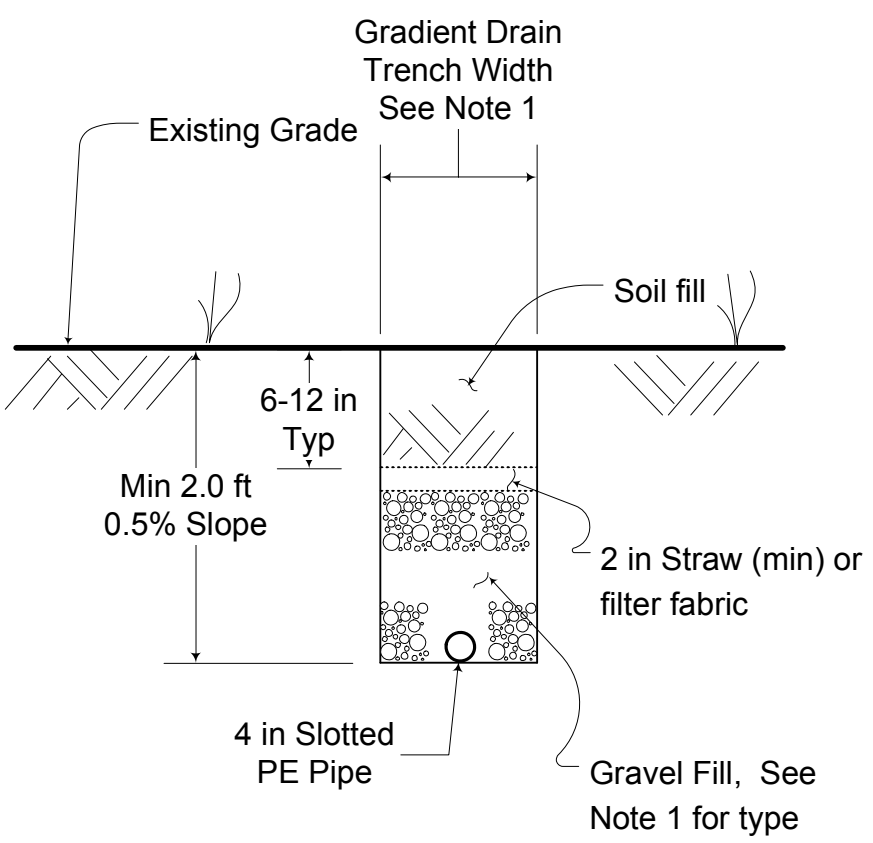
HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
PRIMARY TREATMENT TANKS			
	Title: Septic Tank And Time Dosing Tank Configuration		
	Drawn By: CMG	Date: 1/31/05	Revision #: 2.0

Drainage Enhancement

Section 7.0

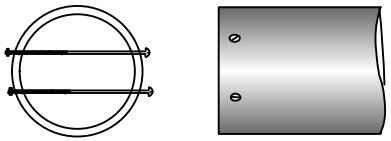


(See Section 7.6 for Interceptor Drain Collector Portion Specifications)



(See Section 7.2 for Gradient Drain Collector Portion Specifications)

1. The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 and 7.6 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.
2. **Gravity Discharge Segment**- 4" pipe used dependent on the following:
   - ***Slope - >1/16" per ft.***
     -Corrugated or smooth interior solid walled pipe meeting ASTM F-405 and bedded in gravel**; or,**
     -Solid SDR 35 or SCH 40 properly backfilled.
   - ***Slope - <1/16" per ft***.
     -Solid SDR 35 or SCH 40 properly backfilled.
   - ***Areas with < 12" cover***.
     -SCH 40 PVC used regardless of slope.
   - ***Last 10' of Discharge Segment.***
     -SCH 40 PVC with animal guard.
3. A minimum of 3' separation to any pressure main, and 8' from any lateral or leaching trench must be maintained to a gradient drain. A minimum of 3' separation to any pressure main, and 5' from any lateral or leaching trench must be maintained to a interceptor drain.
4. If a pressure main must cross a drain collector segment as part of an approved plan, then the drain is hard piped across the pressure main to 5' on either side, and is backfilled with tamped dirt.



4" SCH 40 PVC With 1/4" Nuts
And Bolts (Corrosion Resistant)

ANIMAL GUARD DETAIL

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality	
Drainage Enhancement	
Title: Interceptor and Gradient Drains	
Drawn By: CMG	Date: 1/31/05
	Revision #: 2.0

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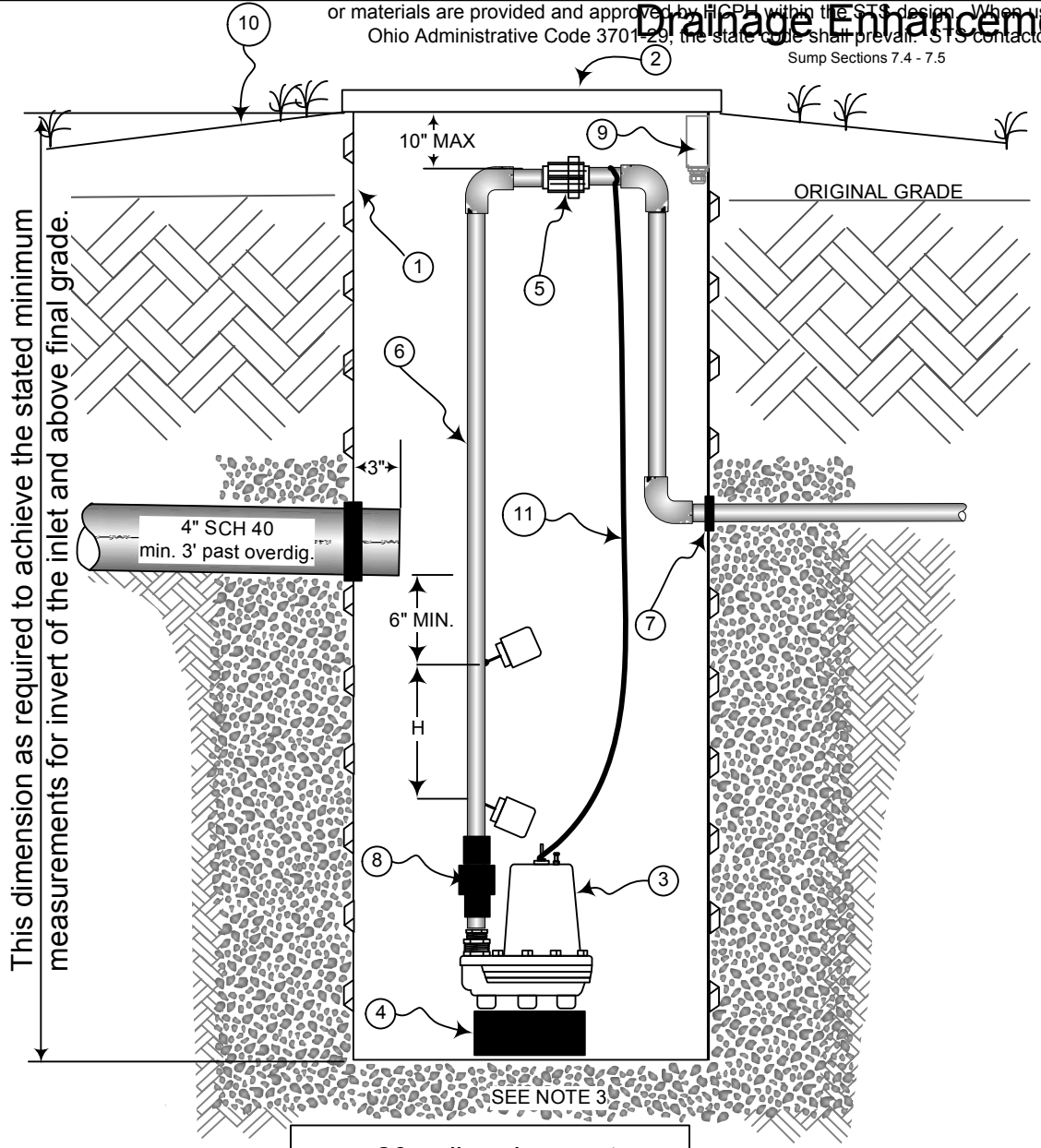
Drainage Enhancement

Sump Sections 7.4 - 7.5



#	DESCRIPTION
1	Gradient Drain Pump Vault - 18" Min. Road Drain Tile Or One Piece Manufactured Concrete Or Sealed Seam Unit.
2	Child Proof Cover - Heavy Concrete Lid Or 3/16" Hex/#3S Bolt Down Fiberglass / Plastic Lid.
3	Drainage Pump - Sized To Meet Inflow Volumes And Ability To Overcome Head Requirements.
4	6"(min.) Concrete Block
5	Glued Union Or Quick Disconnect
6	Min.1" - 1-1/2" SCH 40 PVC With Pressure Rated Fittings.
7	All Pipe Penetrations Are Sealed From Gravel And Dirt With Product Meant For This Intended Application.
8	Check Valve - Where Required By Pump Manufacturer or Installation Situation.
9	NEMA 4x Electrical Enclosure With Properly Fitted Cord Grips And Sealed Electrical Wire Inlet. Leave Enough Cord For Easy Removal Pump. Installed Above Original Grade.
10	Final Grade - Sloped Away From Sump Basin
11	Lifting Rope - Nylon Marine Grade

Notes:

1. The 'ON' Switch For The Pump Is To Be Min. Of 6" Below the Invert Of The Inlet Pipe.
2. Multiple Drain Tiles Are To Be Connected Together Outside Of The Sump. Only One Penetration Should Be Made Into The Basin.
3. If A Bottomless Sump Basin Is Used, Gravel Must Be Used To Line The Bottom Of The Vault.
4. Electrical Wiring And Connections To Be Made Per Local and National Electric Codes.

20 gallon dose net	
Sump Diameter	Distance H
24 Inch	10"-11"
21 Inch	13"-14"
20 Inch	15"-16"
18 Inch	18"-19"

Profile View
Not to Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

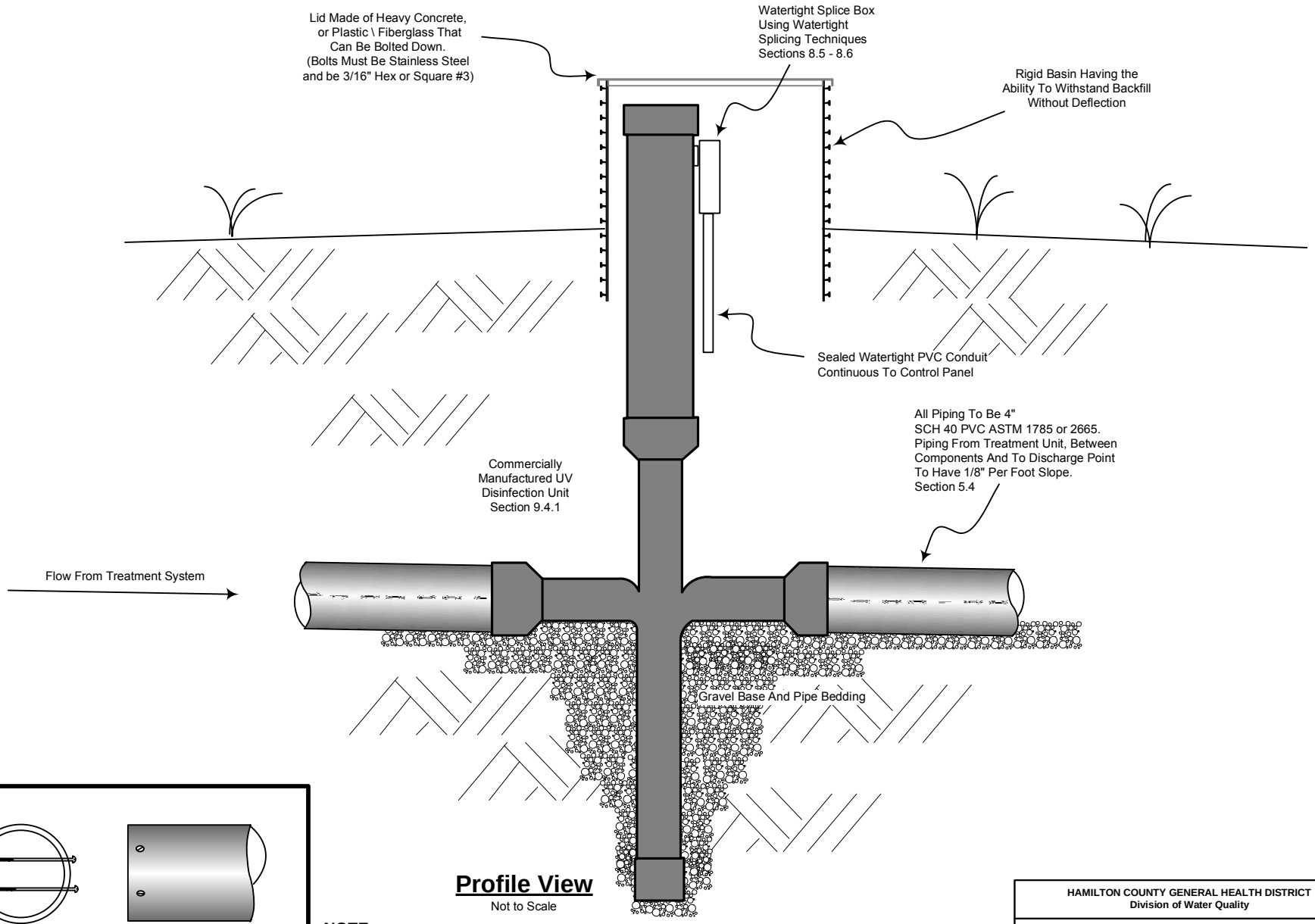
Drainage Enhancements

Title: **GRADIENT DRAIN SUMP**

Drawn By: CMG | Date: 1/31/05 | Revision #: 3.0

Ultraviolet Disinfection Device

Section 9.4.1



Profile View

Not to Scale

4" SCH 40 PVC With 1/4" Nuts And Bolts (Corrosion Resistant)

ANIMAL GUARD DETAIL

NOTE:

Disinfection Devices Must Be Tied Into The HSTS Control Panel. If Maintenance Is Needed The Controls Must Shut Down The Primary System Pump And Sound An Alarm. See Section 9.4. All Components Must Be Installed To Health District Approved Manufacturers Specifications. Additionally System Components and Piping Must Be Properly Bedded.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Disinfection Device

Title: Ultraviolet Disinfection Device		
Drawn By: CMG	Date: 1/31/05	Revision #: 2.0

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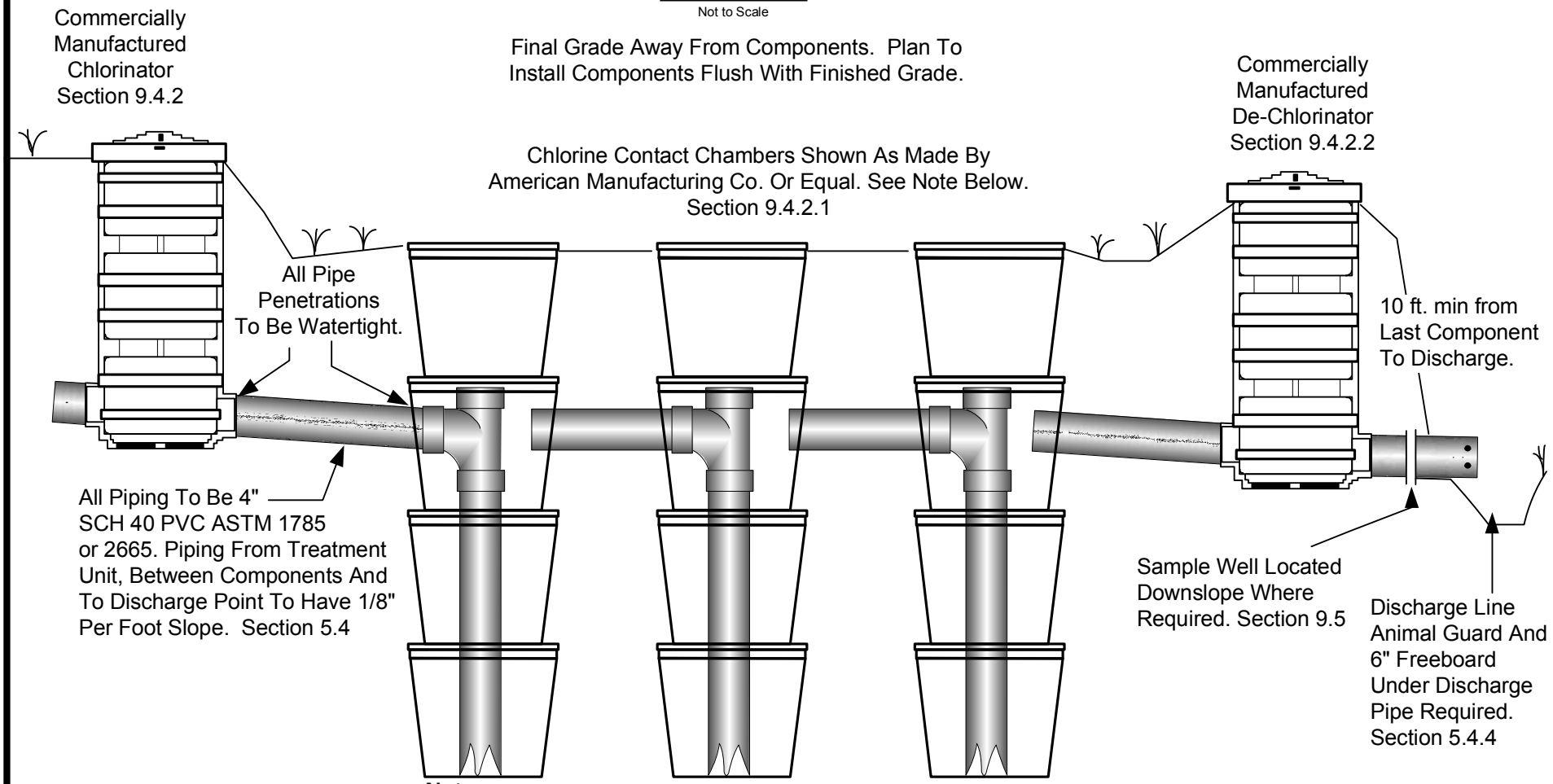
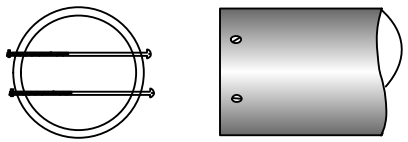
TYPICAL CHLORINATOR, CHLORINE CONTACT CHAMBER AND DECHLORINATOR

Section 9.4.2 - 9.4.2.2

Profile View

Not to Scale





4" SCH 40 PVC With 1/4" Nuts And Bolts (Corrosion Resistant)

ANIMAL GUARD DETAIL

Notes:

Contact Chamber May Be Replaced With One Made By The Installer Or Other Manufacturer. See Section 9.4.2.1 For Requirements. Disinfection Devices Must Be Tied Into The HSTS Control Panel. If Maintenance Is Needed The Controls Must Shut Down The Primary System Pump And Sound An Alarm. See Section 9.4

Chlorine Tablets To Be Calcium Hypochorite And Formulated For Residential Flow Rates. Dechlorination Tablets To Be Sodium Sulfite.

All Components Must Be Installed To Manufacturers Specifications. Additionally System Components and Piping Must Be Properly Bedded.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Disinfection Components

Title: TYPICAL CHLORINATOR, CHLORINE CONTACT CHAMBER AND DECHLORINATOR		
Drawn By: CMG	Date: 1/31/05	Revision #: 4.0

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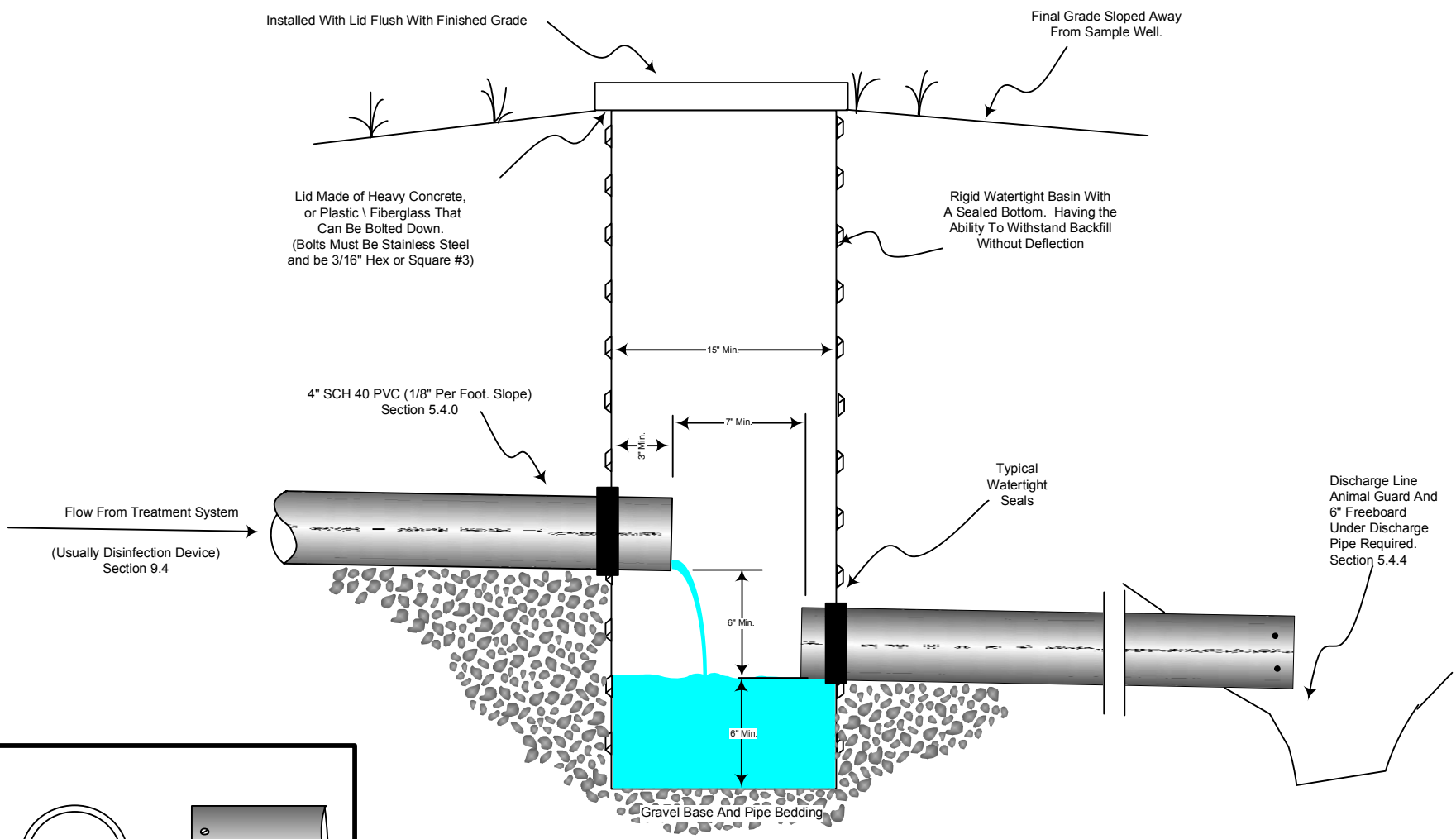
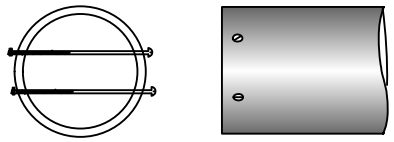
Typical Sample Well

Section 9.5



Profile View

Not to Scale



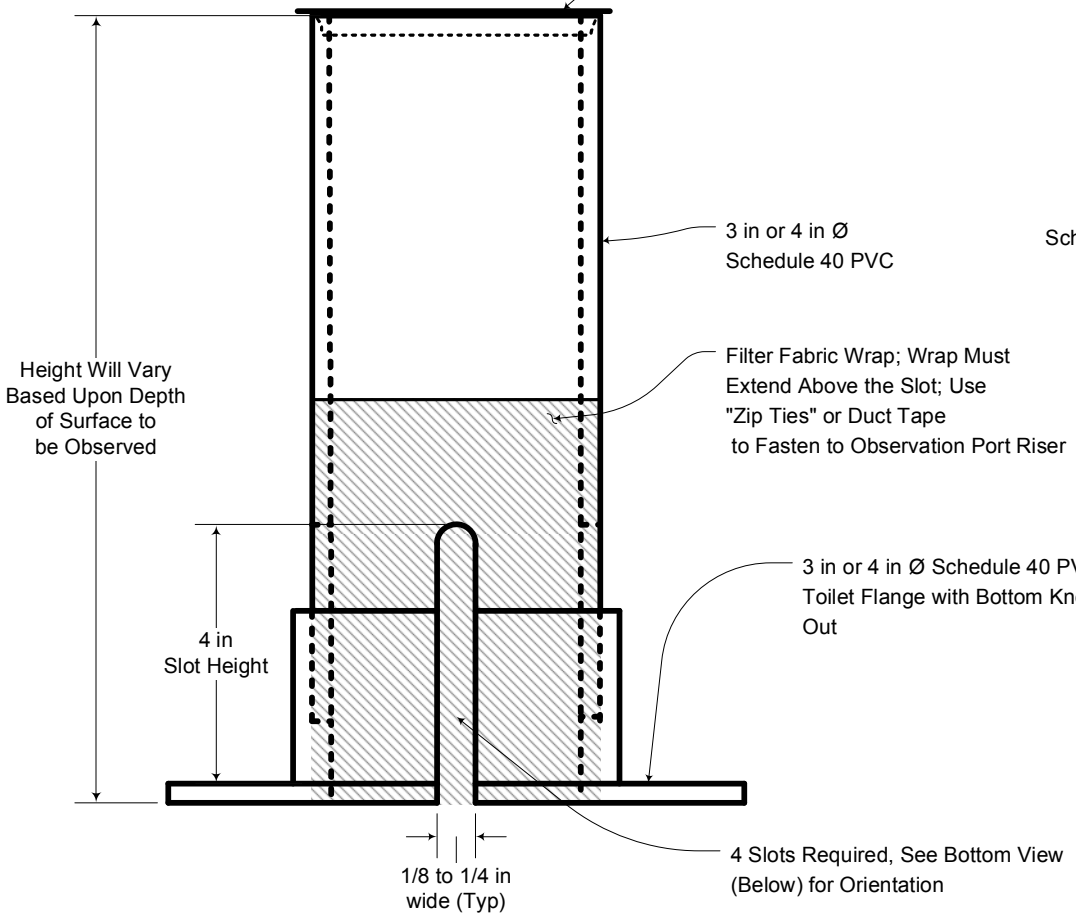
4" SCH 40 PVC With 1/4" Nuts And Bolts (Corrosion Resistant)

ANIMAL GUARD DETAIL

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality	
Monitoring Devices	
Title: SAMPLE WELL	
Drawn By: CMG	Date: 1/31/05
Revision #: 4.0	

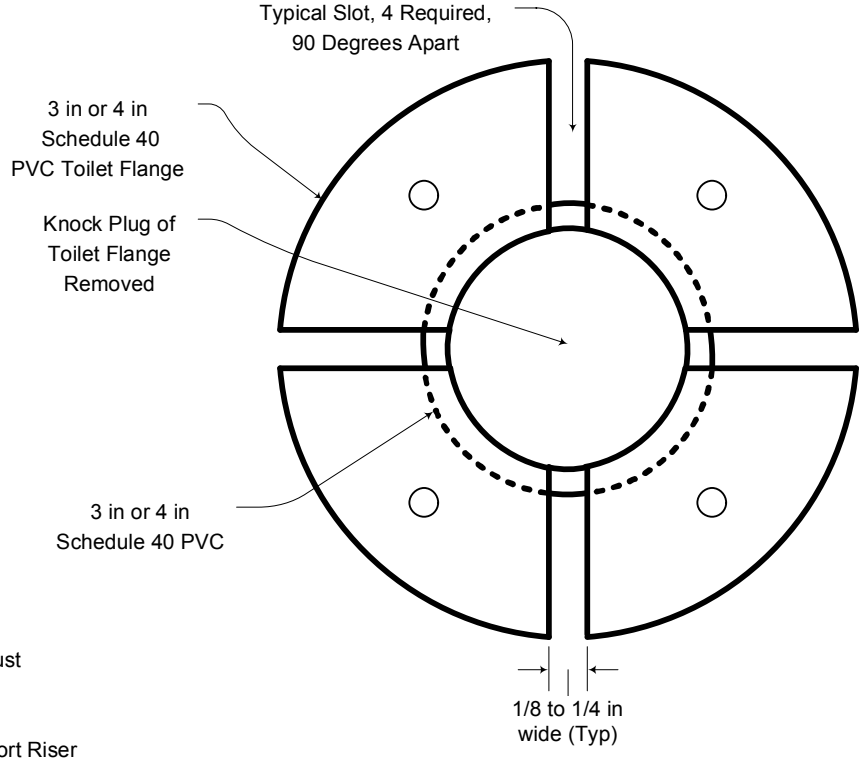
Observation Ports

Section 9.7



Elevation View

(No Scale)



Bottom View

(No Scale)

Ø = Pipe Diameter

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Monitoring Devices			
	Title: **Observation Port**		
	Drawn By: CMG	Date: 1/31/05	Revision #: 2.0

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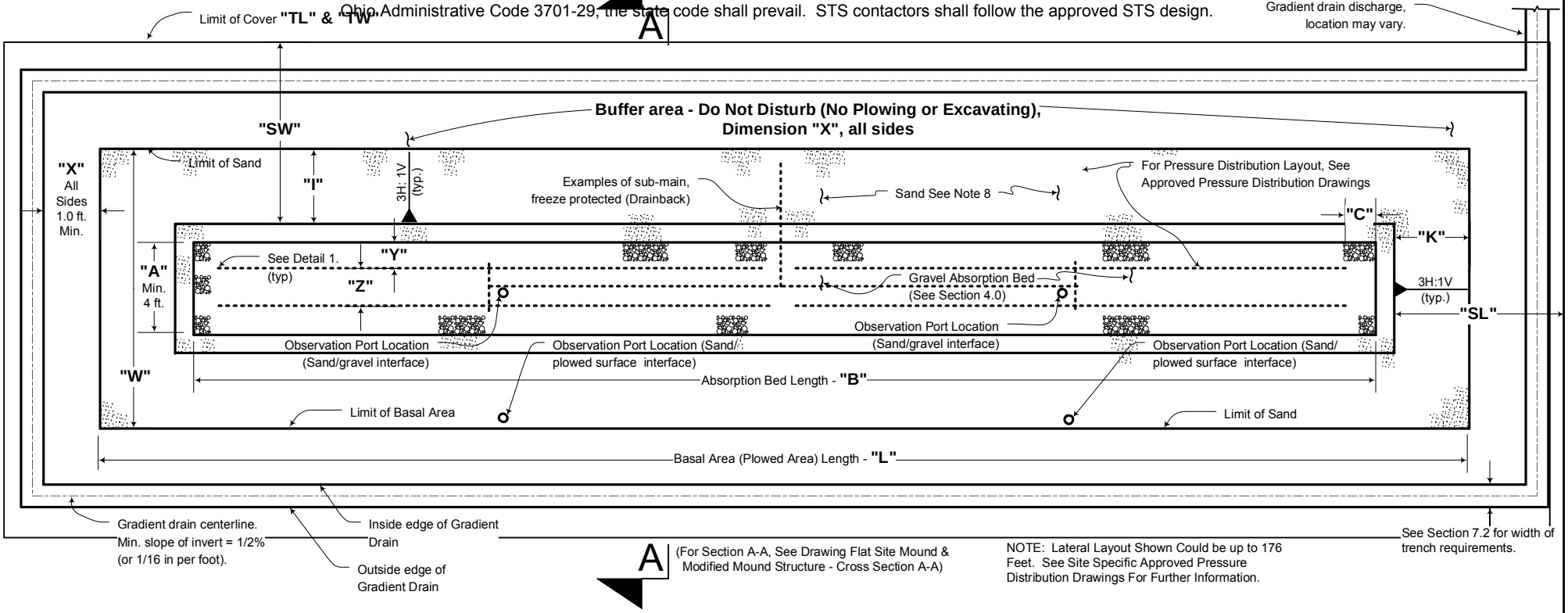
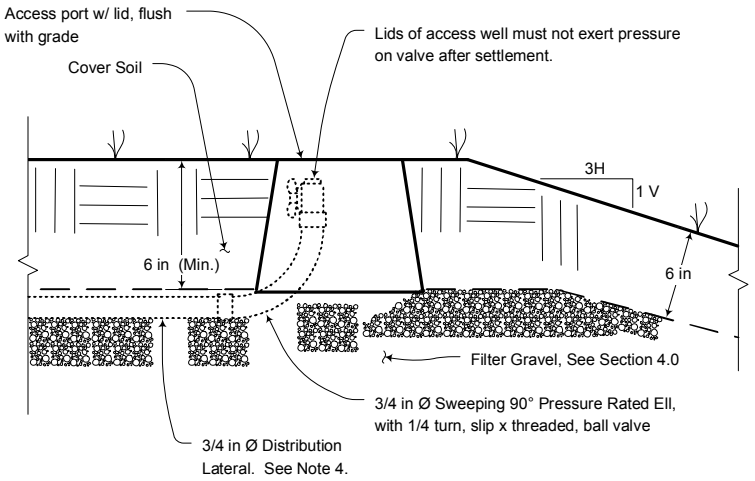


NOTE: Lateral Layout Shown Could be up to 176 Feet. See Site Specific Approved Pressure Distribution Drawings For Further Information.

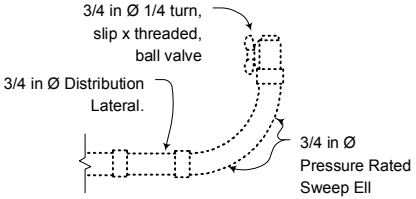
Flat Site Mound & Modified Mound Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)



Lateral Cleanout Setup

(No Scale)

Ø = Pipe Diameter

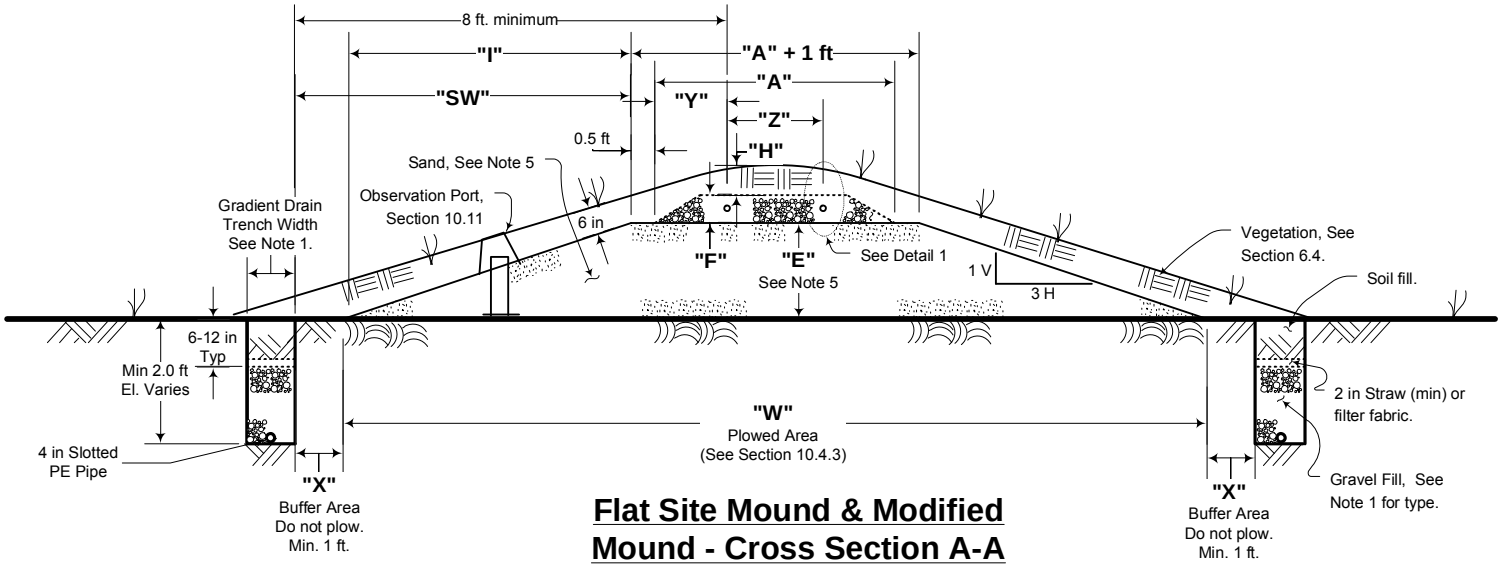
Notes:

1) Observation ports to be located per Section 10.11.
2) See Approved Plan for dimensions of various mound components.
3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.
4) Orifice spacing and orientation varies. See Approved Pressure Distribution Drawings for further information.
5) Sub-main(s) are to be sloped at a minimum of 1% (1/8 in per ft) to promote drainage back towards the force main after dosage completion.
6) Drains do not share a trench with pressure mains. Isolation distance is 3' minimum. If they must cross as part of an approved plan, then the drain is hard piped to 5' on either side of the pressure main and backfilled with tamped dirt. Interceptor drain maintains 5' from any distribution lateral. Curtain Drain maintains 8' from any distribution lateral. Both drain types maintain at least 12" from any basal area sand fill.
7) Sub-main(s) are to be sloped at a minimum of 1% (1/8 in per ft) to promote drainage back towards the force main after dosage completion.
8) Sand type complies with Section 4 (Table 4.2). Sand thickness is dependent on Approved Plan. Minimum sand thickness is based on the highest elevations found under the gravel area. Top of sand area is to be level.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Flat Site Mound & Modified Mound Structure - General Plan

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0



(See Section 7.2 for Gradient Drain - Collector Portion specifications)

Flat Site Mound & Modified Mound - Cross Section A-A

(No Scale)

Notes:

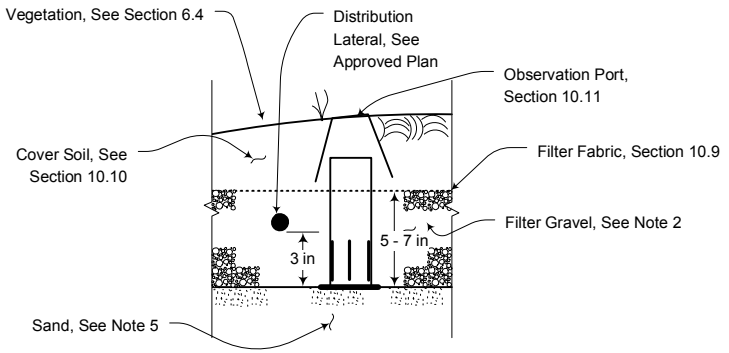
1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.

2) The specified aggregate(s) in this component are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The sub-mains and force main must be sloped to allow drainback to the point where two (2) feet of cover over the mains is maintained. The minimum slope of the force main and sub-mains for drainback is 1% (1/8 inch per foot). The mains must not penetrate the basal area.

4) The thickness of gravel above the lateral depends upon the orientation of the orifices. If the orifices are required to be at the 6 O'Clock position (Down), the laterals are to be installed flat. The gravel thickness is to be such that the distribution lateral is covered, but no more than 1 inch below the surface of the gravel. If the orifices are required to be at the 12 O'Clock position (Up), the laterals are to be installed at a minimum slope of 0.83% (1 in per 10 ft) sloping back (draining back) to the manifold. The thickness of gravel over the top of the lateral will vary, but the minimum thickness below the manifold (lowest point) is 3 inches.

5) Sand type complies with Section 4 (Table 4.2). Sand thickness is dependent on Approved Plan. Minimum sand thickness is based on the highest elevations found under the gravel area. Top of sand area is to be level.



Detail 1

(No Scale)

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Flat Site Mound & Modified Mound - Cross Section A-A			
	Drawn By: CMG	Date: 1/31/05	Revision #: 2.0

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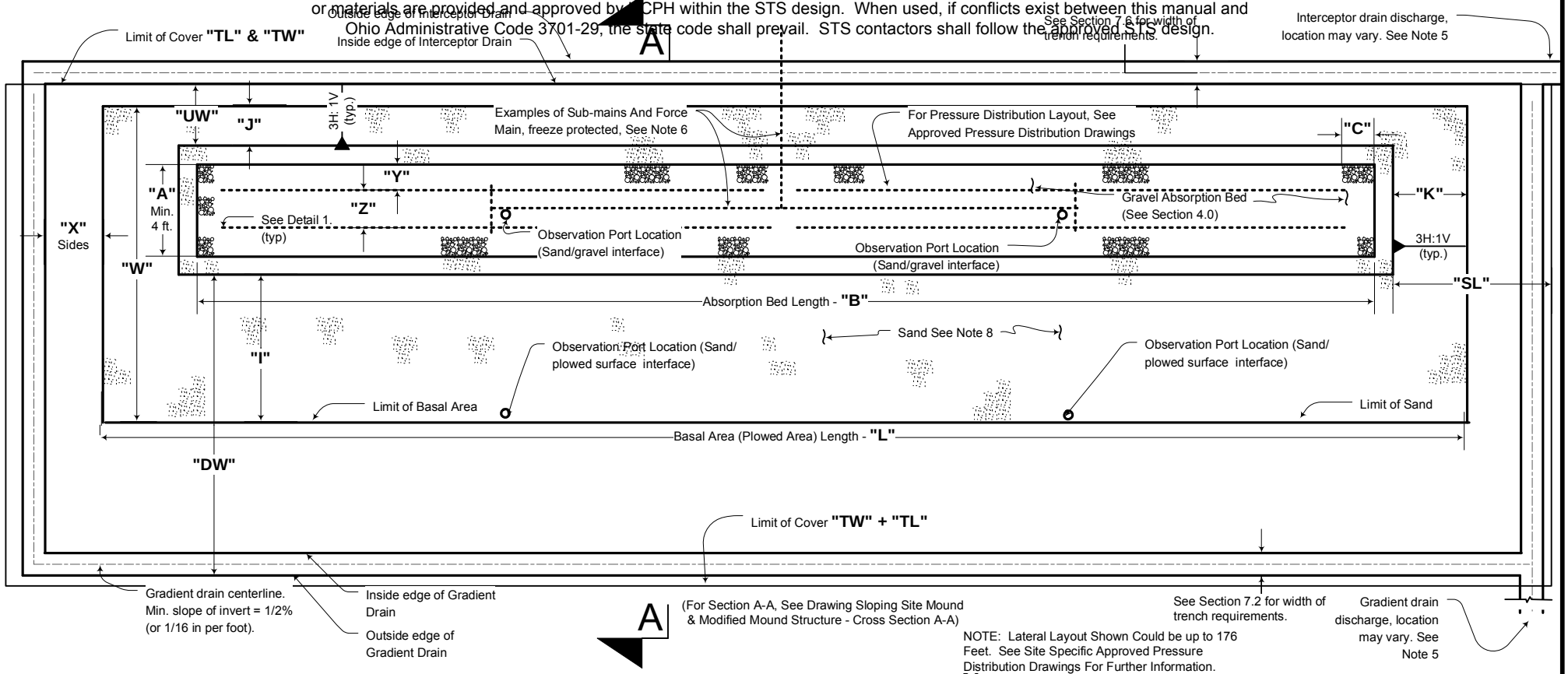


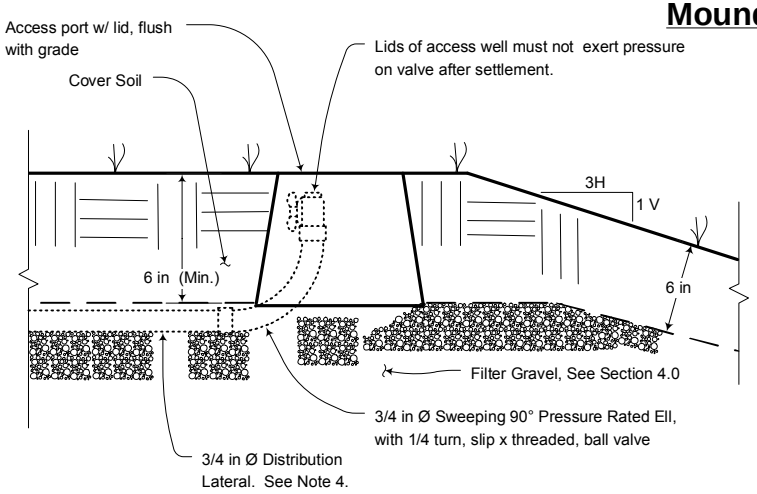
NOTE: Lateral Layout Shown Could be up to 176 Feet. See Site Specific Approved Pressure Distribution Drawings For Further Information.

Sloping Site Mound & Modified Mound Structure - General Plan

(No Scale)

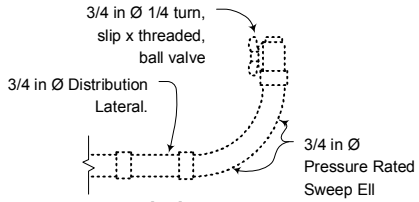
Notes:

1) Observation ports to be located per Section 10.11.
2) See Approved Plan for dimensions of various mound components.
3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.
4) Orifice spacing and orientation varies. See Approved Pressure Distribution Drawings for further information.
5) Interceptor Drain and Gradient Drain **Do Not** share a common discharge line without a sample well on each.
6) Drains do not share a trench with pressure mains. Isolation distance is 3' minimum. If they must cross as part of an approved plan, then the drain is hard piped to 5' on either side of the pressure main and backfilled with tamped dirt. Interceptor drain maintains 5' from any distribution lateral. Curtain Drain maintains 8' from any distribution lateral. Both drain types maintain at least 12" from any basal area sand fill.
7) Sub-main(s) are to be sloped at a minimum of 1% (1/8 in per ft) to promote drainage back towards the force main after dosage completion.
8) Sand type complies with Section 4 (Table 4.2). Sand thickness is dependent on Approved Plan. Minimum sand thickness is based on the highest elevations found under the gravel area. Top of sand area is to be level.



Detail 1 - Lateral Cleanout

(No Scale)



Lateral Cleanout Setup

(No Scale)

Ø = Pipe Diameter

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Sloping Site Mound & Modified Mound Structure - General Plan			
	Drawn By: CMG	Date: 1/31/05	Revision #: 3.0

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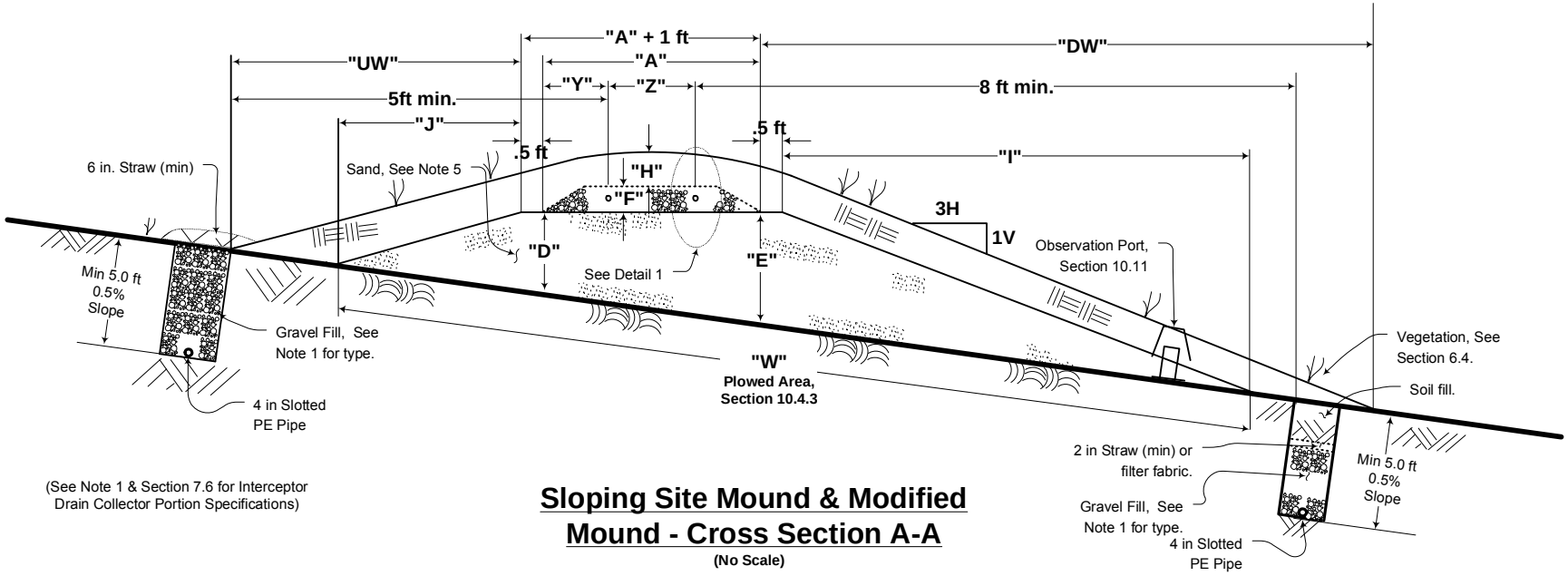


(See Note 1 & Section 7.6 for Interceptor Drain Collector Portion Specifications)

(See Note 1 & Section 7.2 for Gradient Drain Collector Portion Specifications)

Sloping Site Mound & Modified Mound - Cross Section A-A

(No Scale)

Notes:

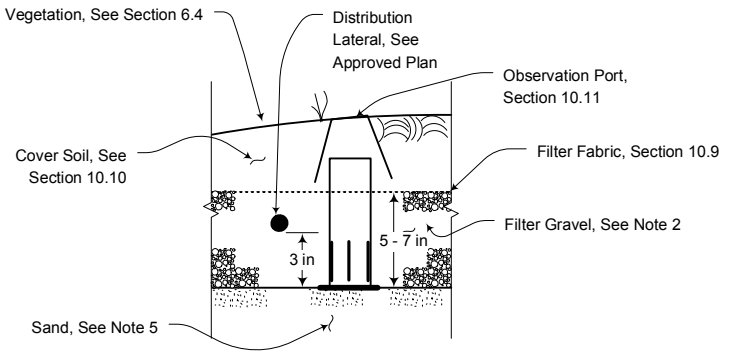
1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 & 7.6 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.

2) The specified aggregate(s) in this component are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The sub-mains and force main must be sloped to allow drainback to the point where two (2) feet of cover over the mains is maintained. The minimum slope of the force main and sub-mains for drainback is 1% (1/8 inch per foot). The mains must not penetrate the basal area.

4) The thickness of gravel above the lateral depends upon the orientation of the orifices. If the orifices are required to be at the 6 O'Clock position (Down), the laterals are to be installed flat. The gravel thickness is to be such that the distribution lateral is covered, but no more than 1 inch below the surface of the gravel. If the orifices are required to be at the 12 O'Clock position (Up), the laterals are to be installed at a minimum slope of 0.83% (1 in per 10 ft) sloping back (draining back) to the manifold. The thickness of gravel over the top of the lateral will vary, but the minimum thickness below the manifold (lowest point) is 3 inches.

5) Sand type complies with Section 4 (Table 4.2). Sand thickness is dependent on Approved Plan. Minimum sand thickness is based on the highest elevations found under the gravel area. Top of sand area is to be level.



Detail 1

(No Scale)

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Sloping Site Mound & Modified Mound - Cross Section A-A

Drawn By:	Date:	Revision #:
CMG	1/31/05	2.0

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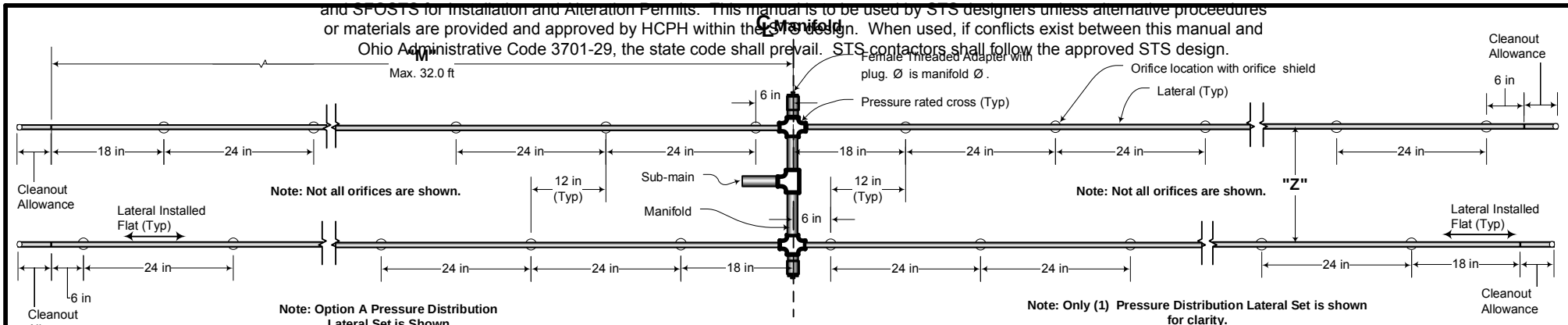
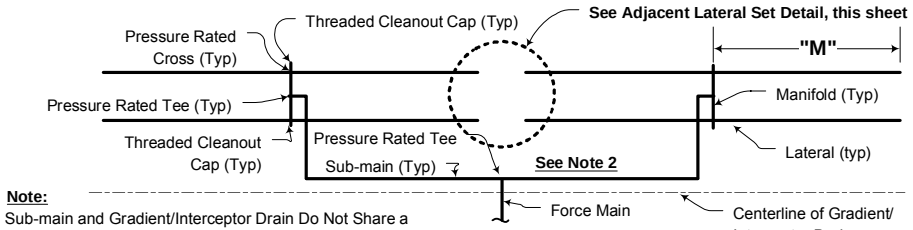


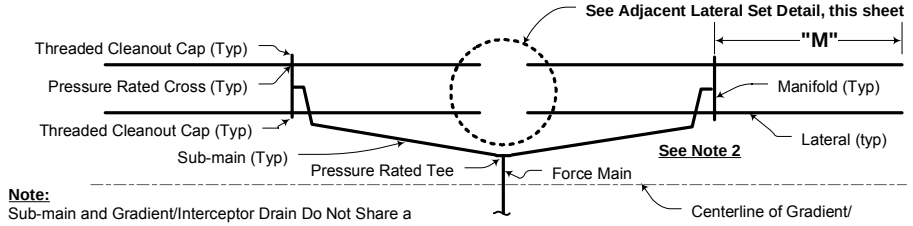
Typical Lateral Set Layout

(No Scale)



Note:
Sub-main and Gradient/Interceptor Drain Do Not Share a Common Trench. See Section 5.8.2. Drawing is simplified to allow clarity of lateral layout.

Pressure Distribution Layout - Option A

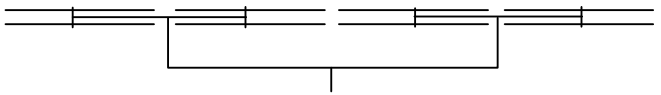


Note:
Sub-main and Gradient/Interceptor Drain Do Not Share a Common Trench. See Section 5.8.2. Drawing is simplified to allow clarity of lateral layout.

Pressure Distribution Layout - Option B

Lateral Layout Options

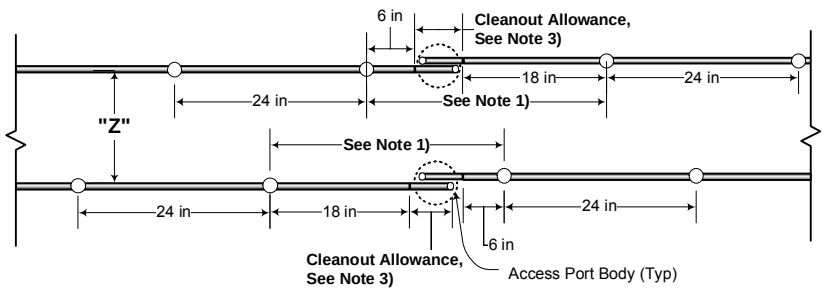
(No Scale)



Layout Used For Systems Up To 256 Ft Long

Notes:

1) This dimension may vary, but can be no less than 24 in. (Same as orifice center to center spacing)
2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. The minimum slope for drainback is 1% (1/8 in per ft).
3) Laterals may overlap or abut in these location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply.
4) Refer to the approved plan set to determine exact lateral layout. Information given here is for reference only.
5) Laterals are 3/4" SCH 40 PVC and laid level within gravel with lateral clean outs slightly elevated and well supported.
6) Orifices are 1/8" and drilled on a press with a "Dreamer" bit. Burred or improperly sized orifices will result in disapproval.
7) Orifice orientation is in the 6 o'clock position.
8) Sub-mains must be installed at the same elevation as other sub-mains within the system. Additionally, equal amount of drainback should result. See Section 5.0, Piping.



Adjacent Lateral Set Layout

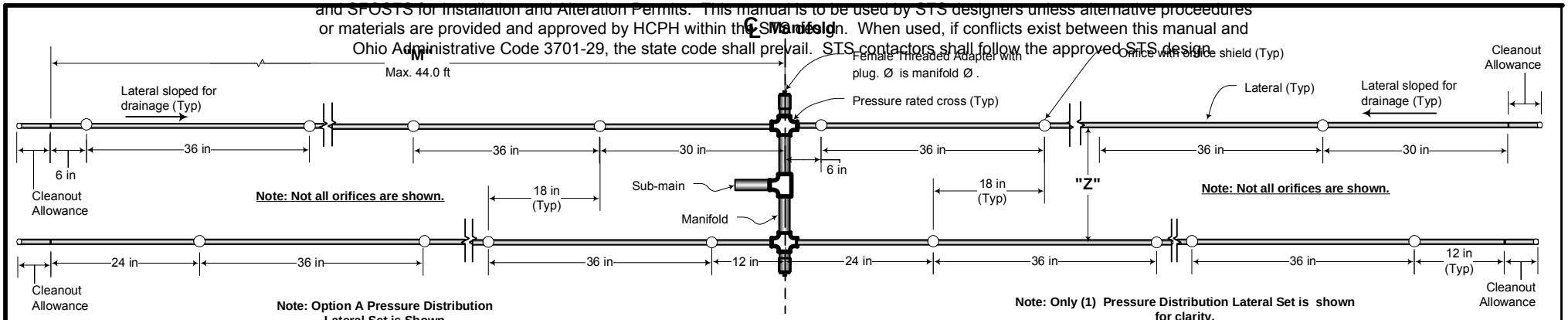
(No Scale)

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Mound & Modified Structure Pressure Distribution Network Detail (Two Foot Orifice Spacings)

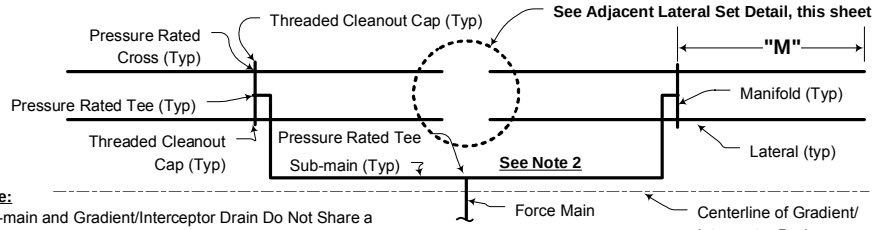
Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SPOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCPH within the STS design. When used, if conflicts exist between this manual and Ohio Administrative Code 3701-29, the state code shall prevail. STS contactors shall follow the approved STS design.



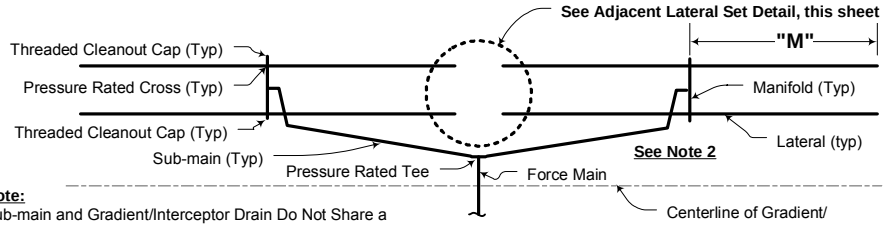
Typical Lateral Set Layout

(No Scale)



Note:
Sub-main and Gradient/Interceptor Drain Do Not Share a Common Trench. See Section 5.8.2. Drawing is simplified to allow clarity of lateral layout.

Pressure Distribution Layout - Option A

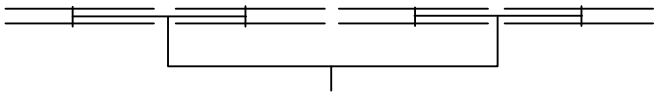


Note:
Sub-main and Gradient/Interceptor Drain Do Not Share a Common Trench. See Section 5.8.2. Drawing is simplified to allow clarity of lateral layout.

Pressure Distribution Layout - Option B

Lateral Layout Options

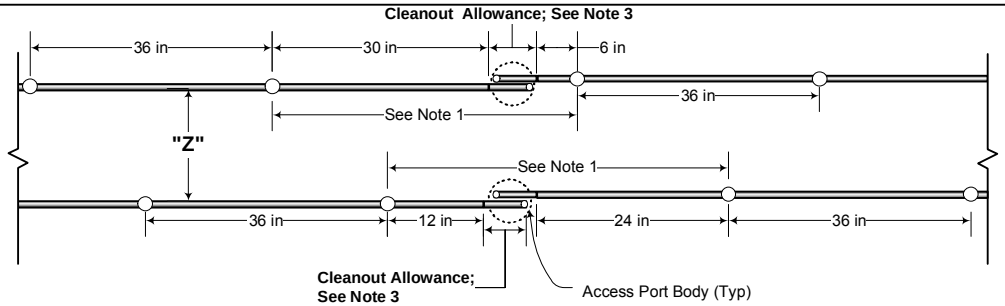
(No Scale)



Layout Used For Systems Up To 352 Ft Long

Notes:

1) This dimension may vary, but can be no less than 36 in. (Same as orifice center to center spacing)
2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. The minimum slope for drainback is 1% (1/8 in per ft).
3) Laterals may overlap or abut in these location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply.
4) Refer to the approved plan set to determine exact lateral layout. Information given here is for reference only.
5) Laterals are 3/4" SCH 40 PVC and sloped a minimum of 1in. in 10ft. (0.83%) back to the manifold. Laterals and clean outs are firmly bedded in compacted aggregate.
6) Orifices are 1/8" and drilled on a press with a "Dreamer" bit. Burred or improperly sized orifices will result in disapproval.
7) Orifice orientation is in the 12 o'clock position (up).
8) Sub-mains must be installed at the same elevation as other sub-mains within the system. Additionally, equal amount of drainback should result. See Section 5.0, Piping.



Adjacent Lateral Set Layout

(No Scale)

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Mound & Modified Structure Pressure Distribution Network Detail (Three Foot Orifice Spacings)

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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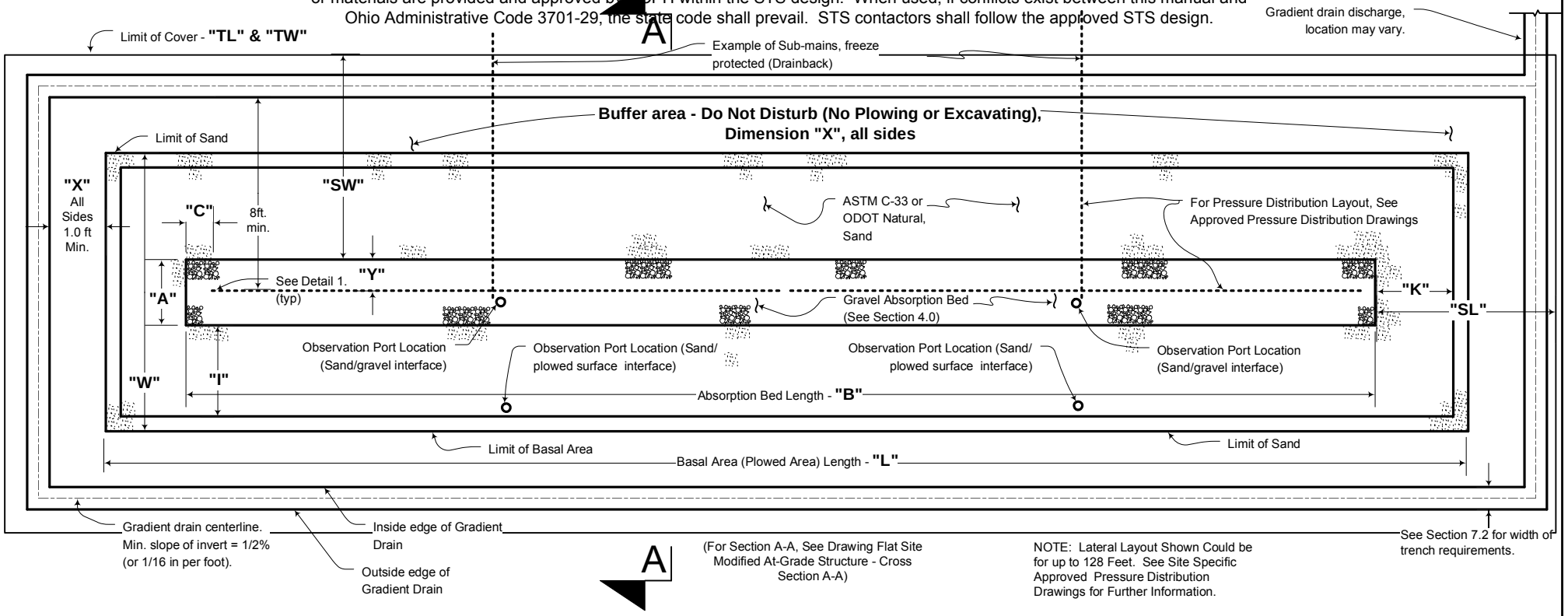
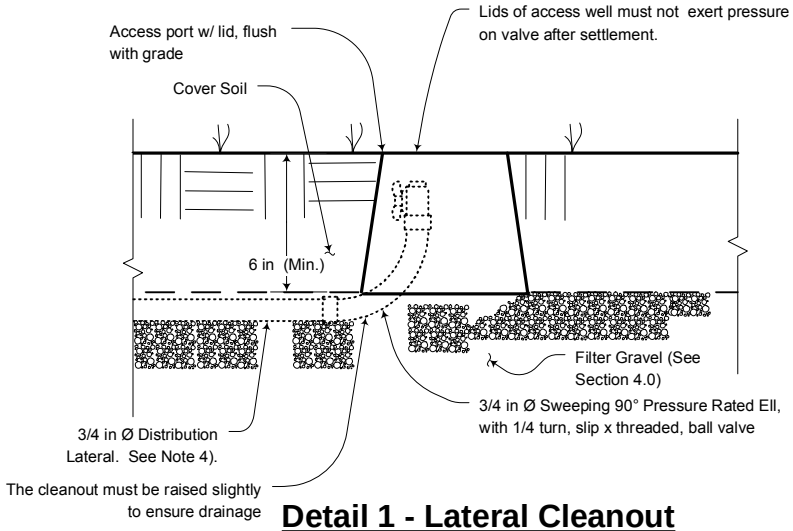


(For Section A-A, See Drawing Flat Site Modified At-Grade Structure - Cross Section A-A)

NOTE: Lateral Layout Shown Could be for up to 128 Feet. See Site Specific Approved Pressure Distribution Drawings for Further Information.

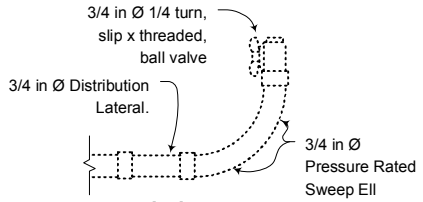
Flat Site Modified At-Grade Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)



Lateral Cleanout Setup

(No Scale)

Ø = Pipe Diameter

Notes:

1) Observation ports to be located per Section 10.11.
2) See Approved Plan for dimensions of various mound components.
3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.
4) Orifices are set at the 6 O'Clock position (down). See the Approved Plan for the pressure distribution layout detail.
5) Interceptor Drain and Gradient Drain Do Not share a common discharge line without a sample well on each.
6) Drains do not share a trench with pressure mains. Isolation distance is 3' minimum. If they must cross as part of an approved plan, then the drain is hard piped to 5' on either side of the pressure main and backfilled with tamped dirt. Interceptor drain maintains 5' from any distribution lateral. Curtain Drain maintains 8' from any distribution lateral. Both drain types maintain at least 12" from any basal area sand fill.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Flat Site Modified At-Grade Structure General Detail.

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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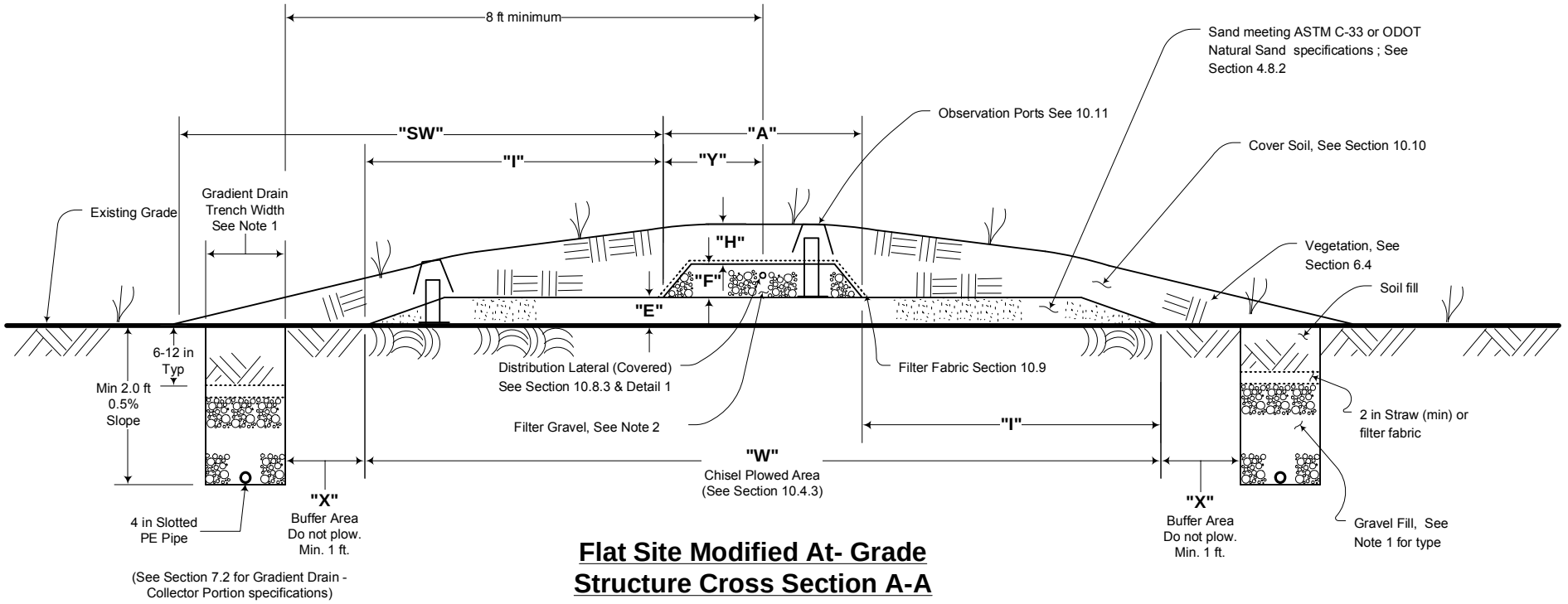
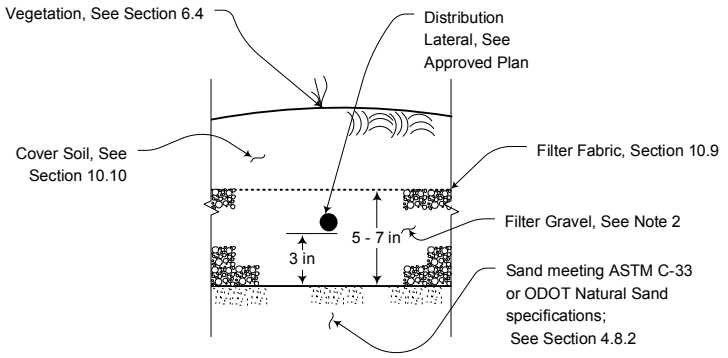


Flat Site Modified At- Grade Structure Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.

2) The specified aggregate(s) in this component are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the mains is maintained. The minimum slope for this drainback is 1% (1/8 in per ft). The mains must not penetrate the basal area.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Flat Site Modified At-Grade Structure Cross Section A-A

Drawn By:	Date:	Revision #:
CMG	1/31/05	2.0

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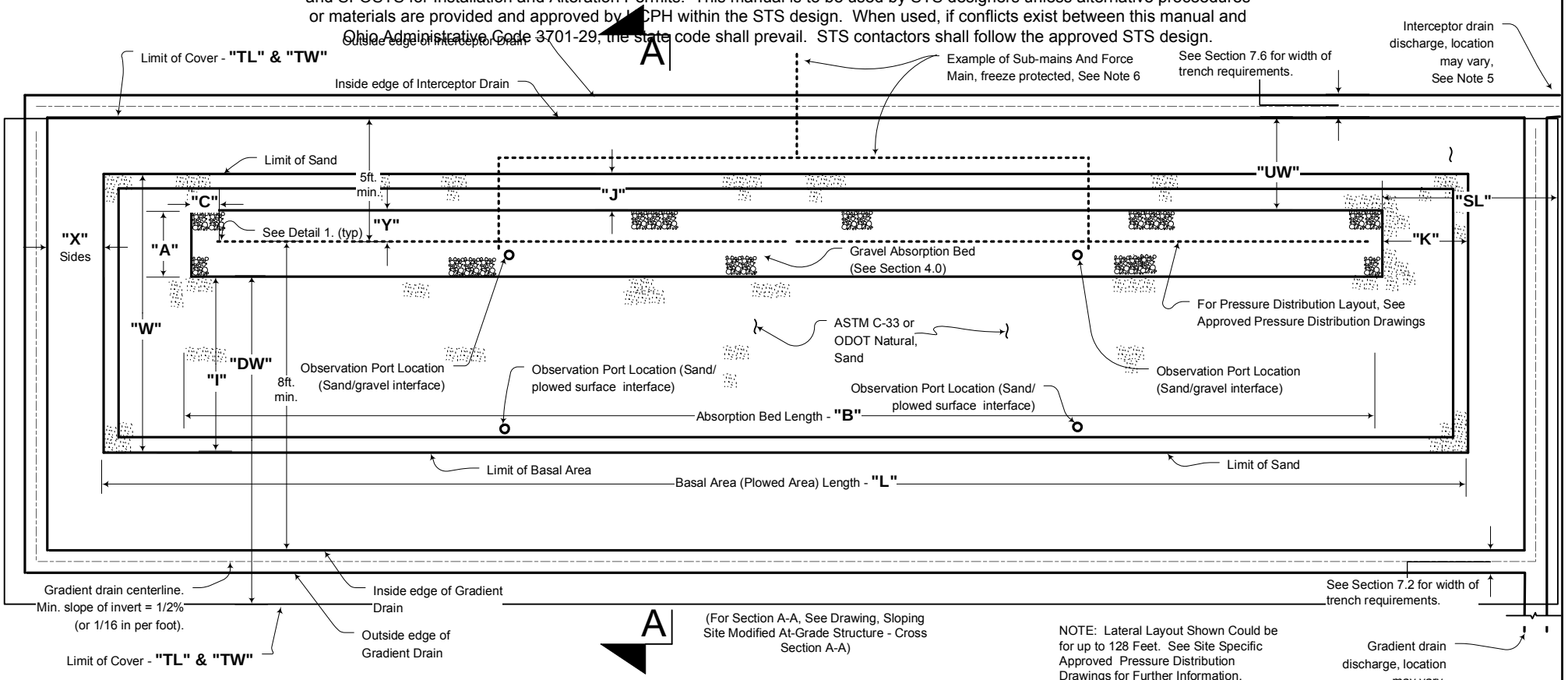
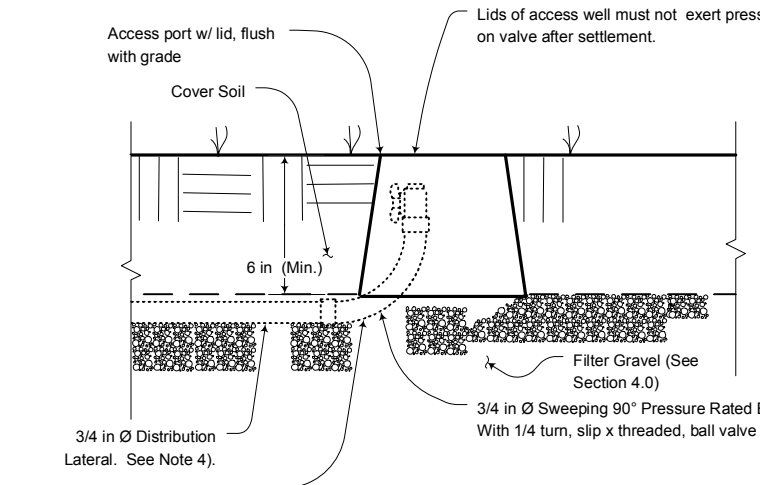


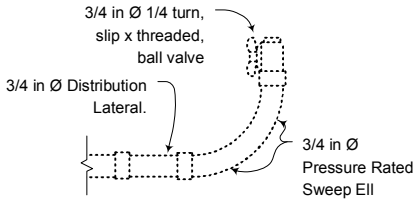
Sloping Site Modified At-Grade Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)



Lateral Cleanout Setup

(No Scale)

Ø = Pipe Diameter

Notes:

1) Observation ports to be located per Section 10.11.
2) See Approved Plan for dimensions of various mound components.
3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.
4) Orifices are set at the 6 O'Clock position (down). See the Approved Plan for the pressure distribution layout detail.
5) Interceptor Drain and Gradient Drain **Do Not** share a common discharge line without a sample well on each.
6) Drains do not share a trench with pressure mains. Isolation distance is 3' minimum. If they must cross as part of an approved plan, then the drain is hard piped to 5' on either side of the pressure main and backfilled with tamped dirt. Interceptor drain maintains 5' from any distribution lateral. Curtain Drain maintains 8' from any distribution lateral. Both drain types maintain at least 12" from any basal area sand fill.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Sloping Site Modified At-Grade Structure General Detail.

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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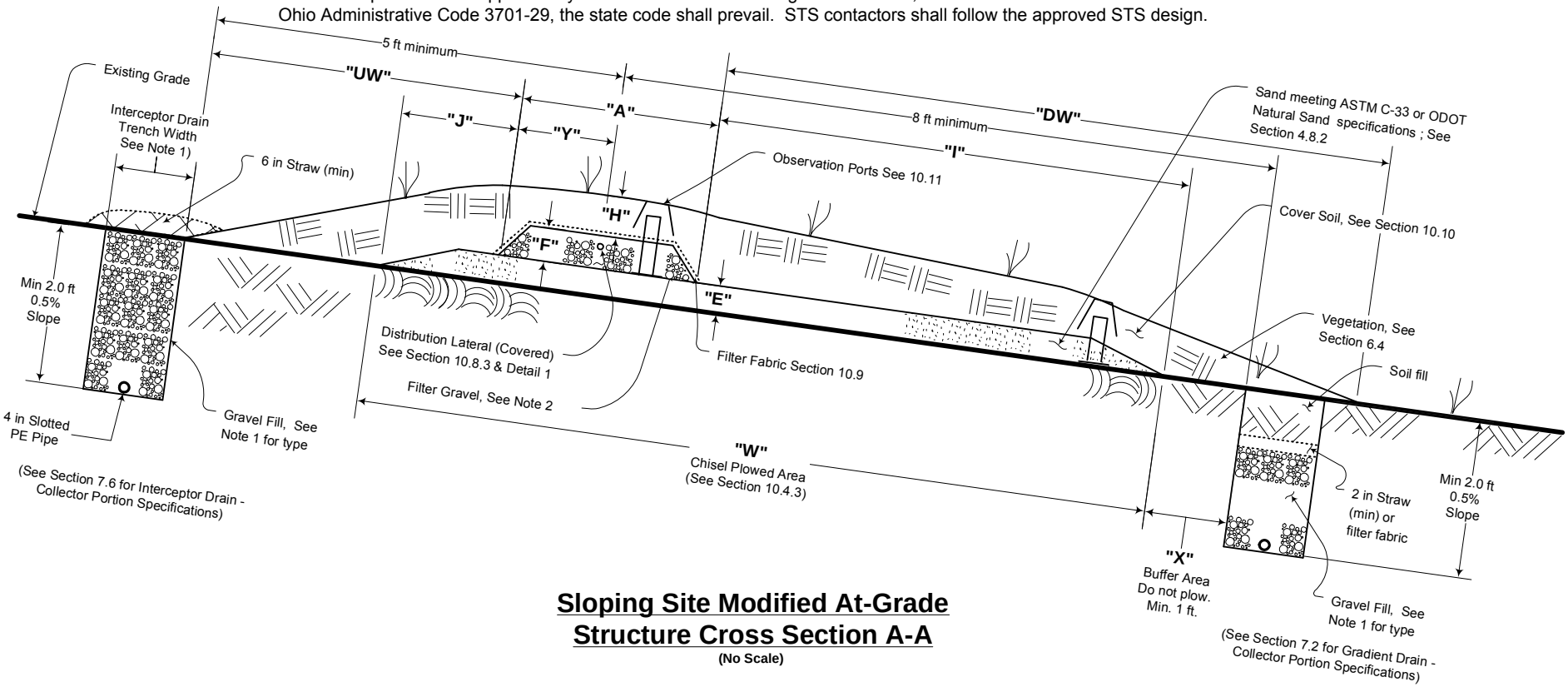
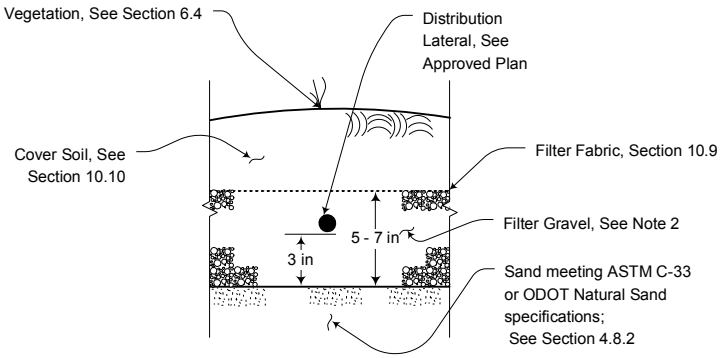


Sloping Site Modified At-Grade Structure Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 & 7.6 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.

2) The specified aggregate(s) in this component are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the mains is maintained. The minimum slope for this drainback is 1% (1/8 in per ft). The mains must not penetrate the basal area.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Sloping Site Modified At-Grade Structure Cross Section A-A

Drawn By:	Date:	Revision #:
CMG	1/31/05	2.0

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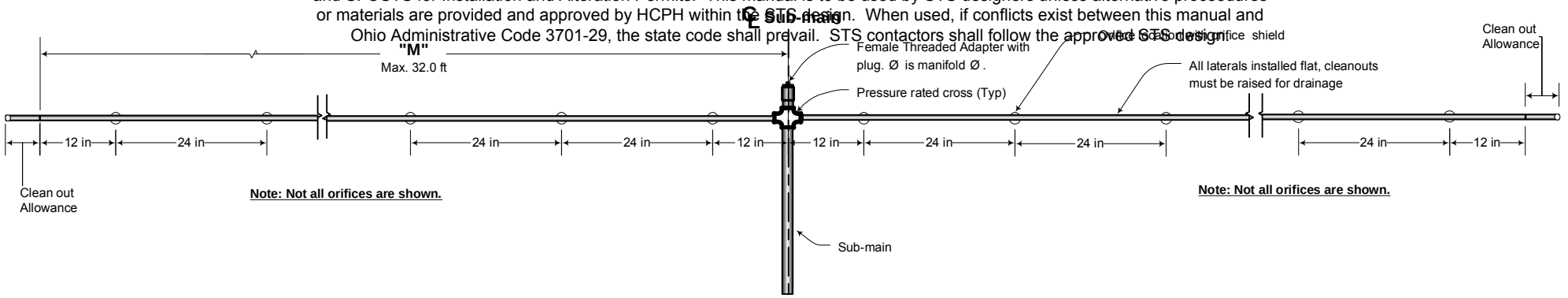
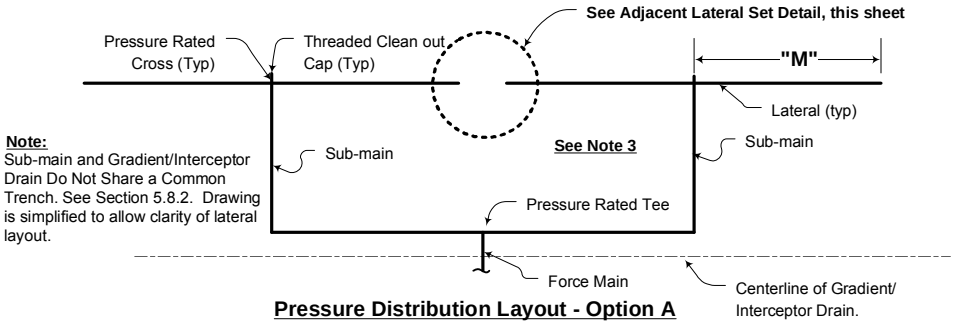


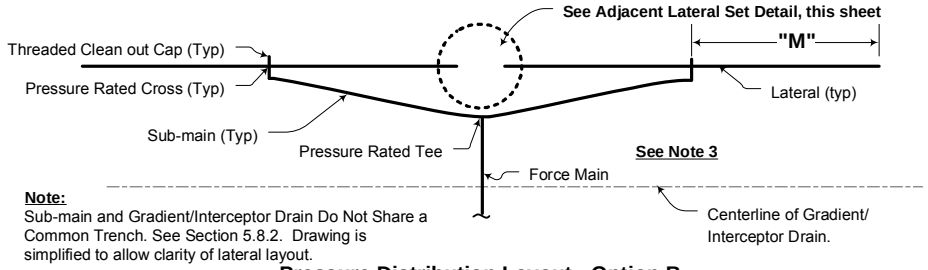
Typical Lateral Set Layout

(No Scale)

Note: Only (1) Pressure Distribution Lateral Set is shown for clarity.



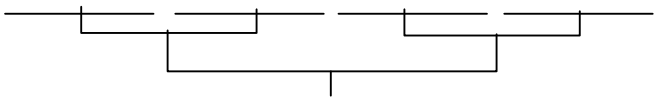
Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option B

Lateral Layout Options

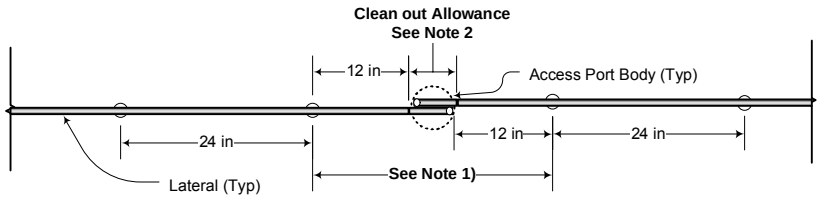
(No Scale)



Layout Used For Systems Up To 256 Ft Long

Notes:

1) This dimension may vary, but can be no less than 24 in. (Same as orifice center to center spacing)
2) Laterals may overlap or abut in these location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply.
3) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. The minimum slope for drainback is 1% (1/8 in per ft).
4) Refer to the approved plan set to determine exact lateral layout. Information given here is for reference only.
5) Laterals are 3/4" SCH 40 PVC and laid level within gravel with lateral clean outs slightly elevated and well supported.
6) Orifices are 1/8" and drilled on a press with a "Dreamer" bit. Burred or improperly sized orifices will result in disapproval.
7) Orifice orientation is in the 6 o'clock position.
8) Sub-mains must be installed at the same elevation as other sub-mains within the system. Additionally, equal amount of drainback should result. See Section 5.0, Piping.



Adjacent Lateral Set Layout

(No Scale)

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Modified At-Grade Structure Pressure Distribution Network Detail

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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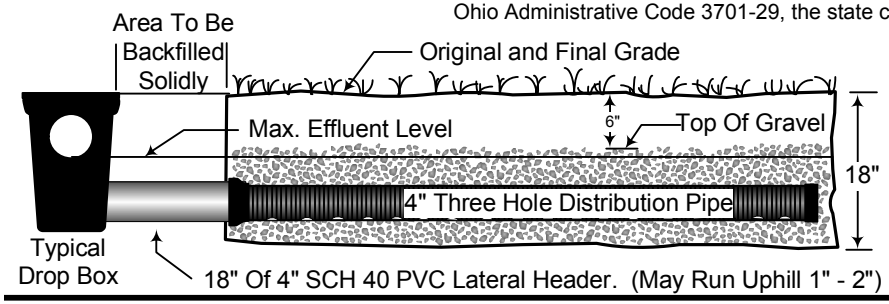
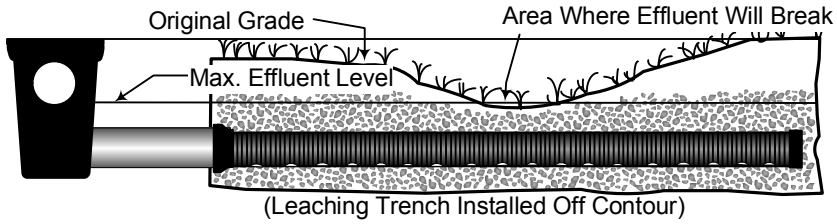
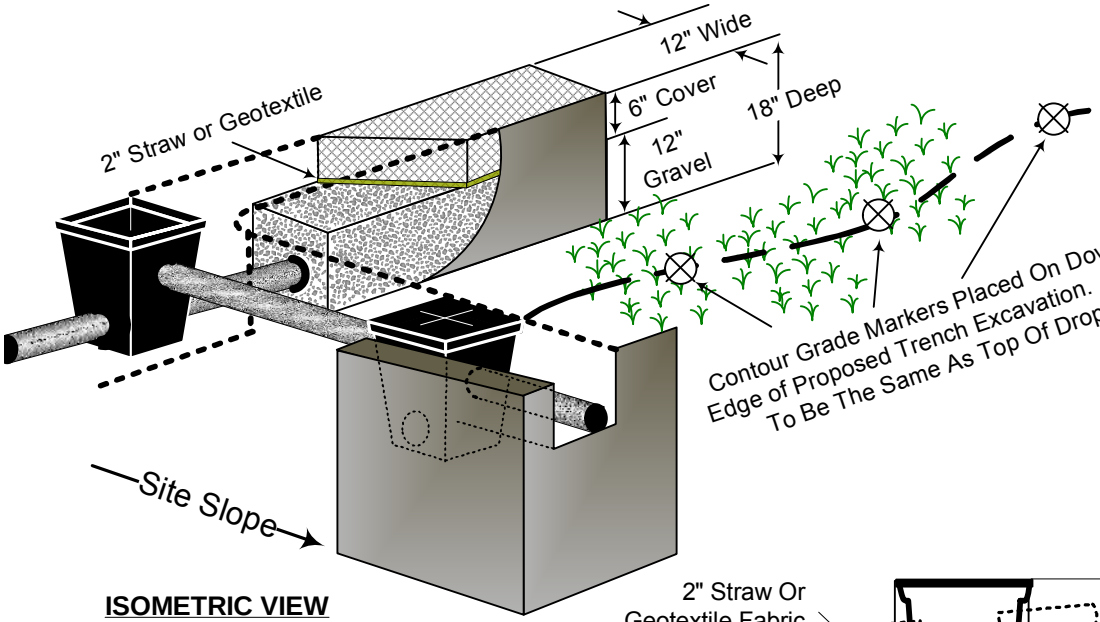


DO THIS

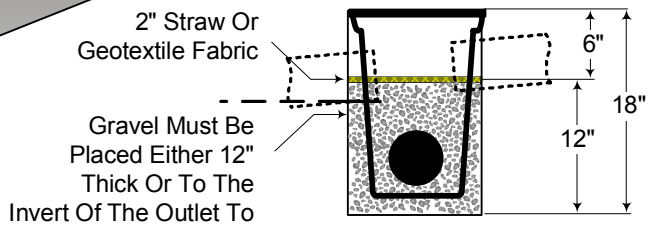


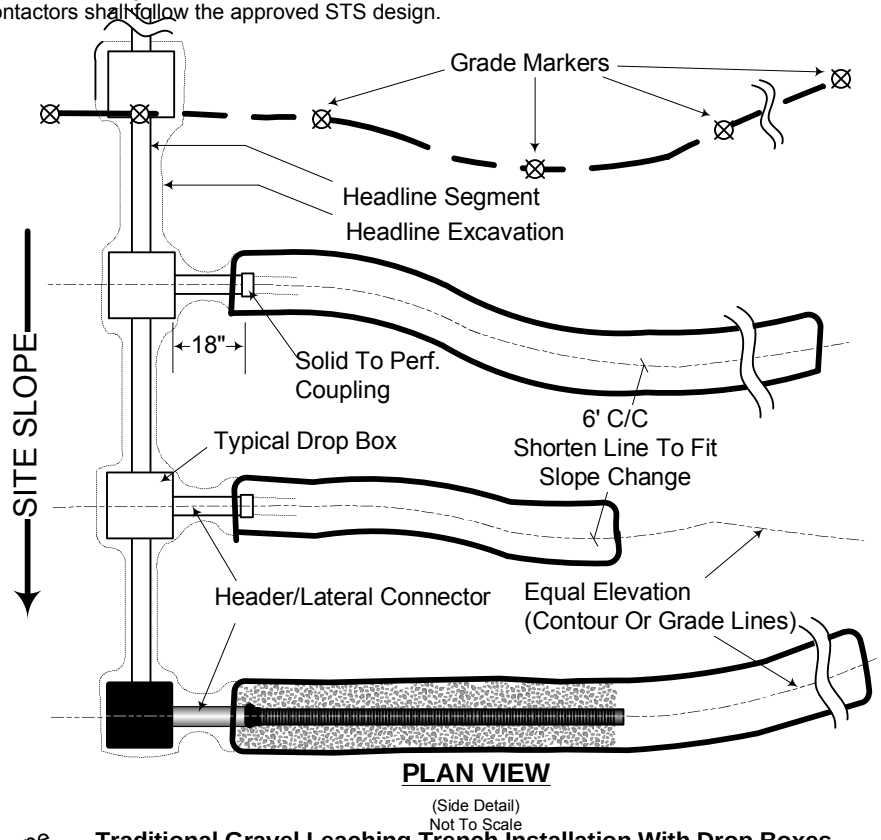
DON'T DO THIS

PROFILE VIEW
(Side Detail)
Not To Scale



ISOMETRIC VIEW
Not To Scale





PLAN VIEW
(Side Detail)
Not To Scale

Traditional Gravel Leaching Trench Installation With Drop Boxes

- See All Requirements in Section 11.0.
- Layout lines to contour with paint or flags.
- Shallowly excavate headline trench. Do Not Overdig.
- Set drop boxes with lids at contour elevations; connect with headline segments; firmly backfill headline trench by hand after inspection.
- Excavate trenches 18" deep following contour. Trench bottom level.
- Install 18" long 4" Solid SCH 40 header / lateral connectors with end squarely cut.
- Inside the drop box, leave enough space between the ends of the pipes to insert 4" plugs (plugs may be needed later to rest selected leach lines)
- Install flow control devices on outlet pipes inside drop boxes with holes dialed down.
- Place gravel fill to 6" thickness.
- Connect 4" three hole distribution lateral pipe and fix in place roughly level.
- Place gravel fill to final 12" total thickness or to the invert of the outlet to the next trench, whichever is greater.
- Cover gravel with 2" straw layer or geotextile fabric.
- Call for inspection.
- Backfill to natural grade after approved inspection; crown fill to allow for settlement over trenches.

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Leaching Trenches			
	Title: Traditional Gravel Leaching Trench		
	Drawn By: CMG	Date: 1/31/05	Revision #: 4.0

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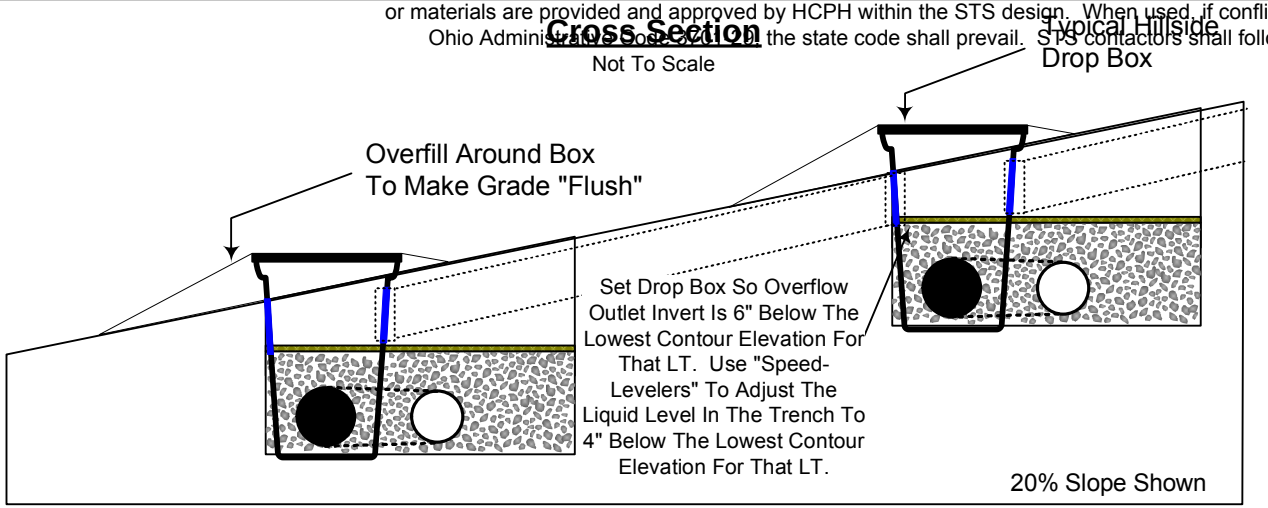
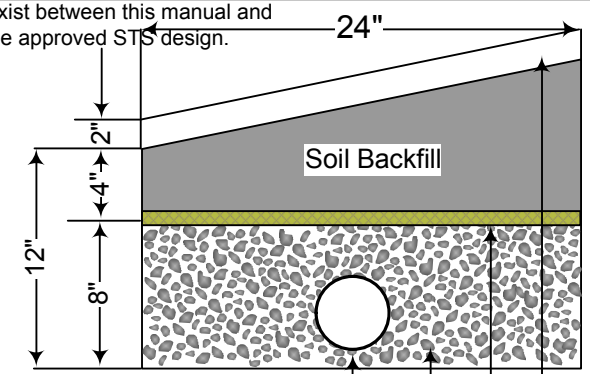
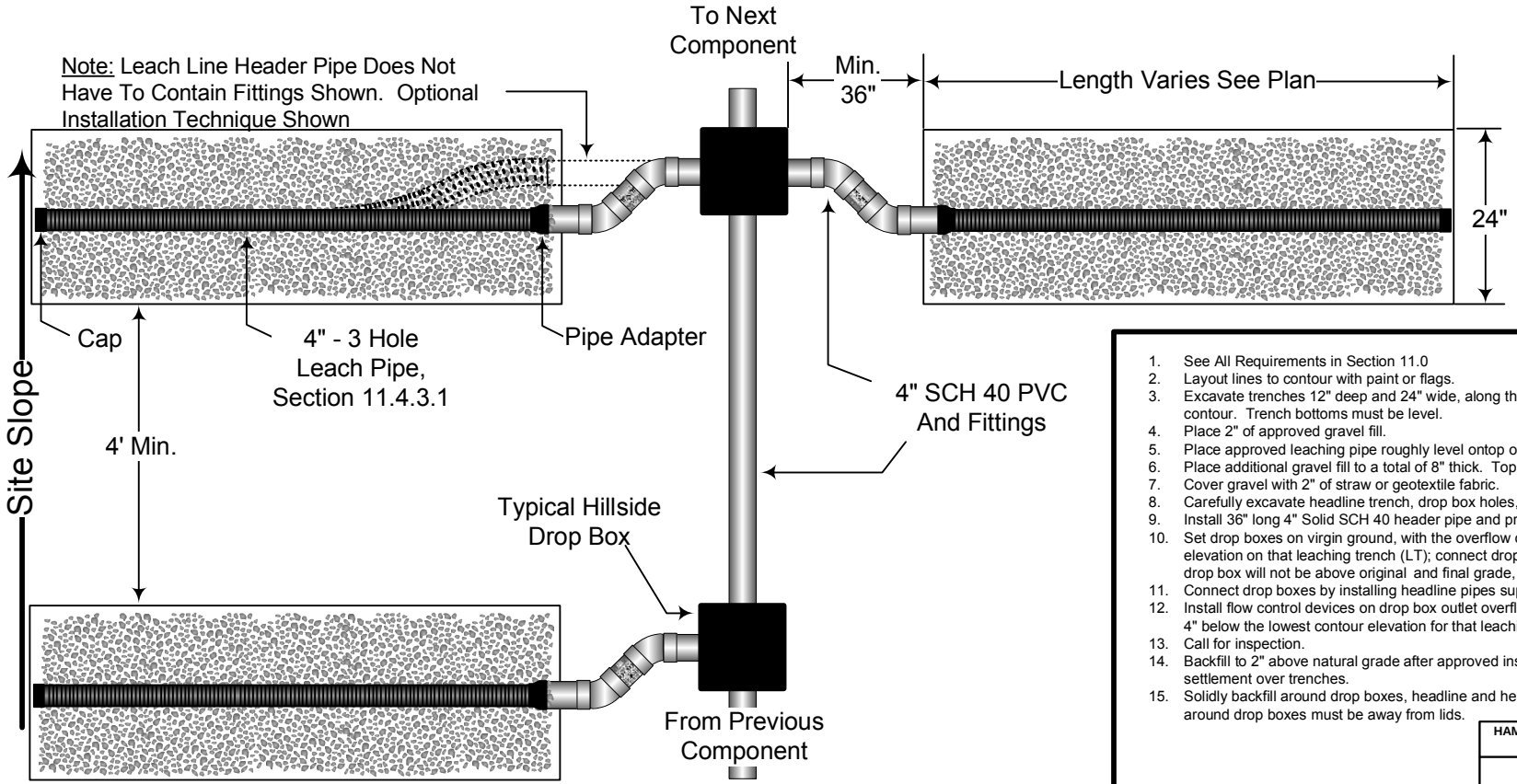
Cross Section
Not To Scale



Note: Drop Box Location Will Vary With Slope Of The Site. In Some Cases Drop Box Extensions May Be Needed



Cross Section
Not To Scale



Plan View
Not To Scale

1. See All Requirements in Section 11.0
2. Layout lines to contour with paint or flags.
3. Excavate trenches 12" deep and 24" wide, along the downslope edge of trench, following contour. Trench bottoms must be level.
4. Place 2" of approved gravel fill.
5. Place approved leaching pipe roughly level ontop of gravel.
6. Place additional gravel fill to a total of 8" thick. Top of gravel must be level throughout trench.
7. Cover gravel with 2" of straw or geotextile fabric.
8. Carefully excavate headline trench, drop box holes, and header trench. **DO NOT OVERDIG**.
9. Install 36" long 4" Solid SCH 40 header pipe and properly connect it with the leaching pipe.
10. Set drop boxes on virgin ground, with the overflow outlet invert 6" below the lowest contour elevation on that leaching trench (LT); connect drop boxes with header pipe segments. If lid of drop box will not be above original and final grade, add 6" drop box extensions.
11. Connect drop boxes by installing headline pipes supported on virgin ground.
12. Install flow control devices on drop box outlet overflow pipes, with holes dialed to hold effluent 4" below the lowest contour elevation for that leaching trench (LT).
13. Call for inspection.
14. Backfill to 2" above natural grade after approved inspection; crown fill to allow for settlement over trenches.
15. Solidly backfill around drop boxes, headline and header pipes by hand. Final grade around drop boxes must be away from lids.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Leaching Trenches

Title: **Shallow Gravel Leaching Trench 24 Inches Wide**

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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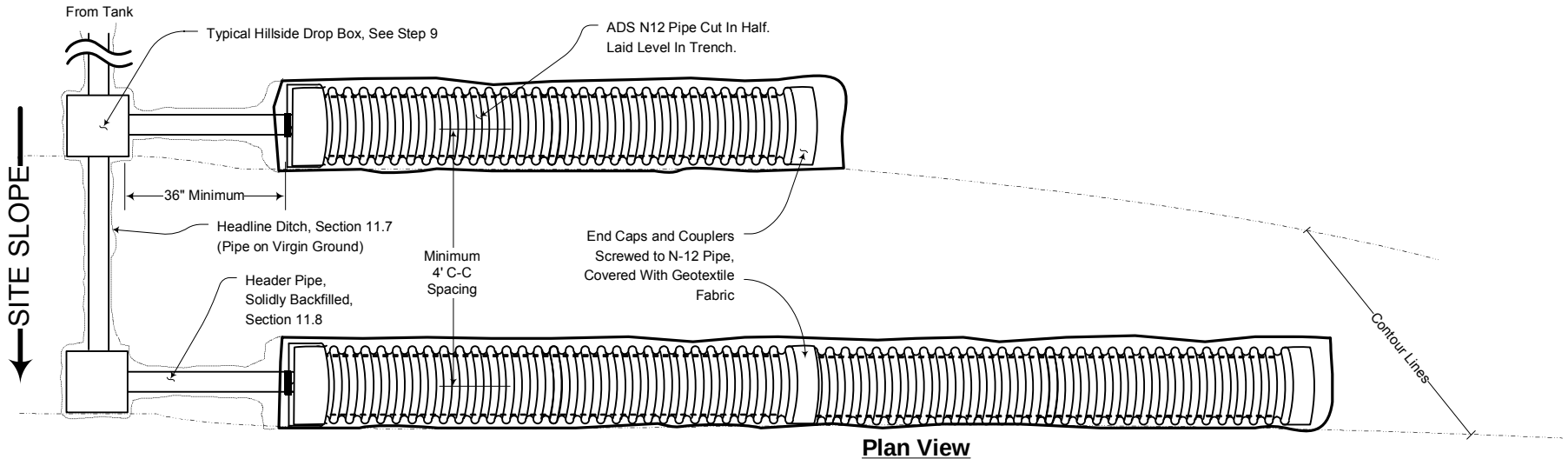
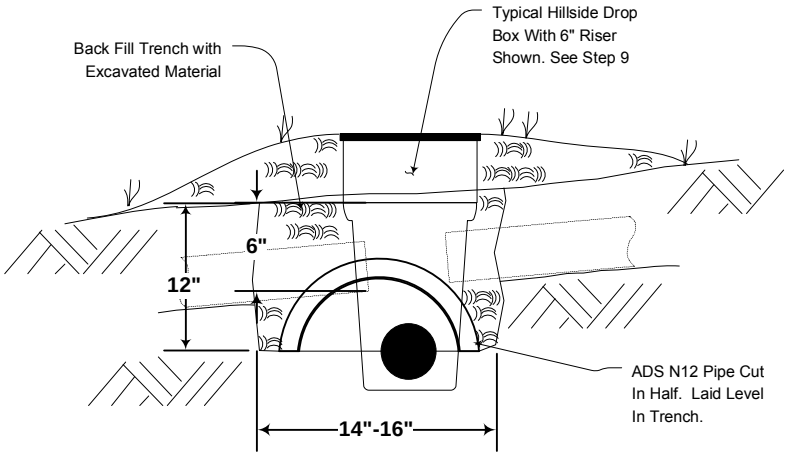
Shallow Half-Pipe Leaching Trenches

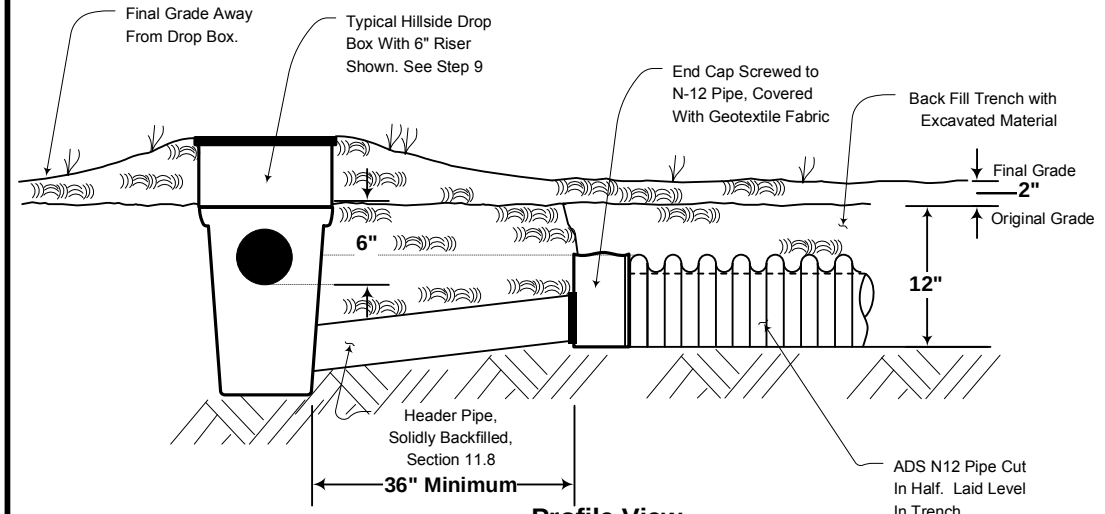
Section 11.4.3.2



Plan View
Not To Scale



Profile View
(End Detail)
Not To Scale



Profile View
(Side Detail)
Not To Scale

1. See All Requirements in Section 11.0
2. Layout lines to contour with paint or flags.
3. Excavate trenches 12" deep, along the downslope edge of trench, following contour. Trench bottoms must be level.
4. Place N12 "half-pipe" in trench with tops level.
5. Screw N12 pipe segments together at couplers and at end caps.
6. Cover couples and end caps with geotextile fabric.
7. Carefully excavate headline trench, drop box holes, and header trench. **DO NOT OVERDIG**.
8. Install 36" long 4" Solid SCH 40 header pipe into N12 pipe cap with properly drilled hole.
9. Set drop boxes on virgin ground, with the outlet invert 6" below the lowest contour elevation for that leach line; connect with header segments. If lid of drop box will not be above original and final grade, add 6" drop box extensions.
10. Connect drop boxes by installing headline pipes supported on virgin ground.
11. Install flow control devices on overflow outlet pipes, with holes dialed to hold effluent in leaching trench 4" below lowest contour elevation for that leaching trench.
12. Call for inspection.
13. Backfill to 2" above natural grade after approved inspection; crown fill to allow for settlement over trenches.
14. Solidly backfill around drop boxes, headline and header pipes by hand. Final grade around drop boxes must be flush with and graded away from lids.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Leaching Trenches

Title: **Shallow Half-Pipe Leaching Trenches**

Drawn By:	Date:	Revision #:
CMG	1/31/05	3.0

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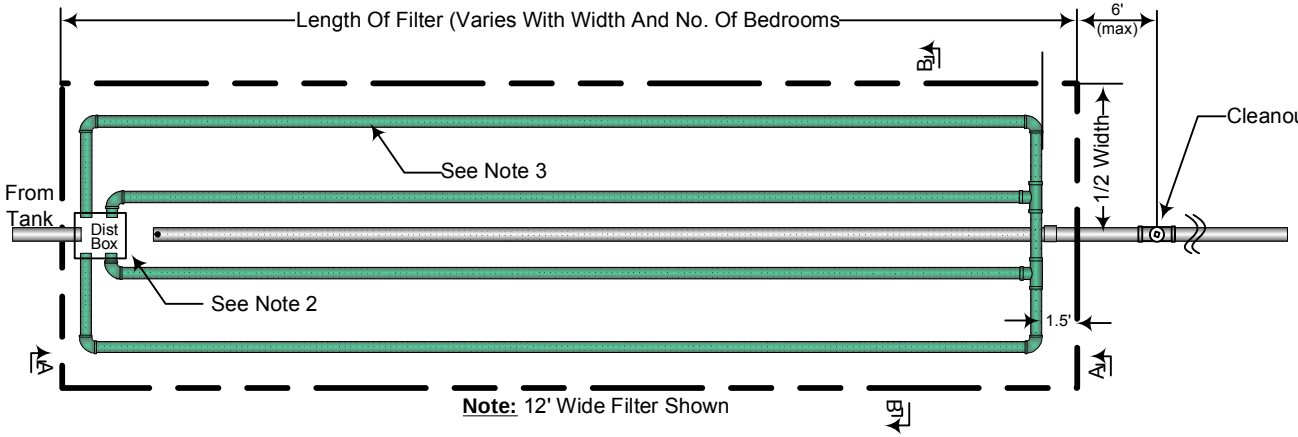


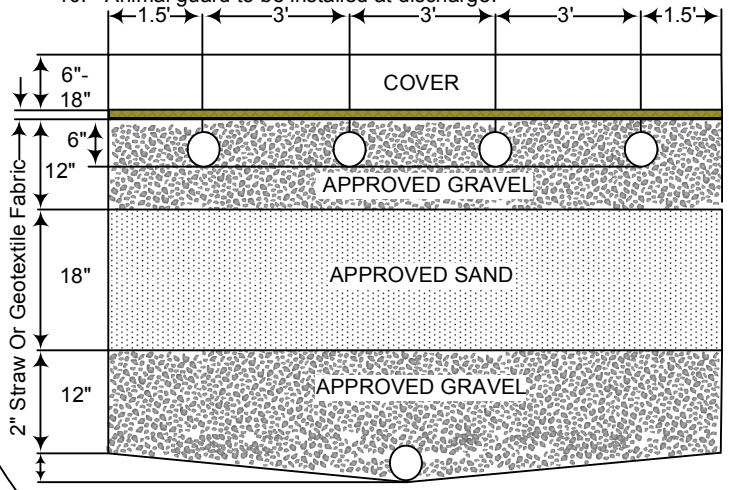
Note: 12' Wide Filter Shown

PLAN VIEW

Not To Scale

NOTES:

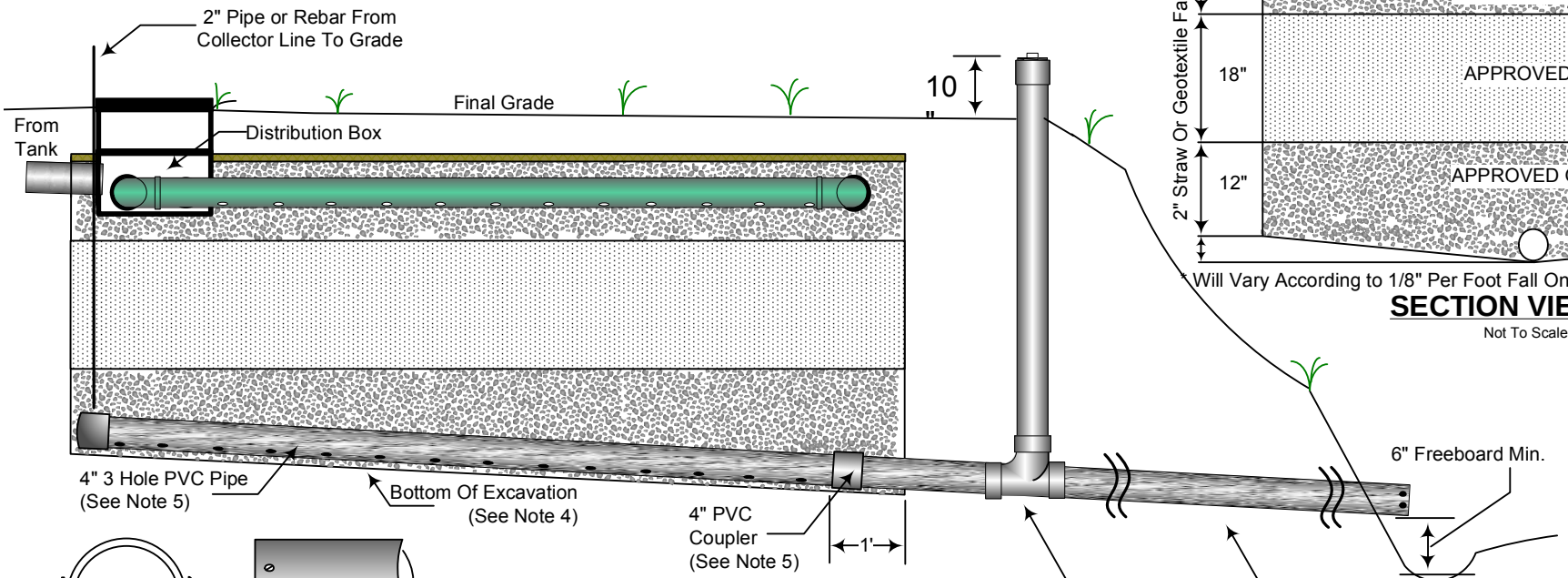
1. Filter area to be 240 sq. ft. per bedroom.
2. Distribution box to be set level with all entries sealed and to grade.
3. Lines from D-box into SF to be level with ≤ 2" of fall from distributio box to far end of filter.
4. Collection line to slope ≥1/8" per ft. Bottom of filter bed to be graded to drain to collection line.
5. Collection line to be 4" PVC pipe with 1/2" holes. This is to run the length of the sand filter one foot before this pipe leaves the filter area a 4" PVC coupler and solid 4" SCH 40 PVC is required from this point on to the discharge.
6. 4" SCH 40 PVC cleanout within 6ft. of end of sand filter and extent 10" above grade and fitted with female threaded adapter and plug.
7. Gravel and sand to be as specified in Section 4.0 of this manual.
8. Disinfection device and sample well per Section 9.0, both must be accessible to grade, and installed no closer that 10ft. from discharg point.
9. Discharge line must have 6" of freeboard under pipe.
10. Animal guard to be installed at discharge.



* Will Vary According to 1/8" Per Foot Fall On Collector And Length Of Bed.

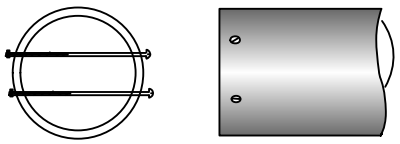
SECTION VIEW B-B

Not To Scale



SECTION VIEW A-A

Not To Scale



4" SCH 40 PVC With 1/4" Nuts And Bolts (Corrosion Resistant)

ANIMAL GUARD DETAIL

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Subsurface Sand Filter			
Title: Gravity Subsurface Sand Filter			
Drawn By: CMG	Date: 1/31/05	Revision #: 3.0	

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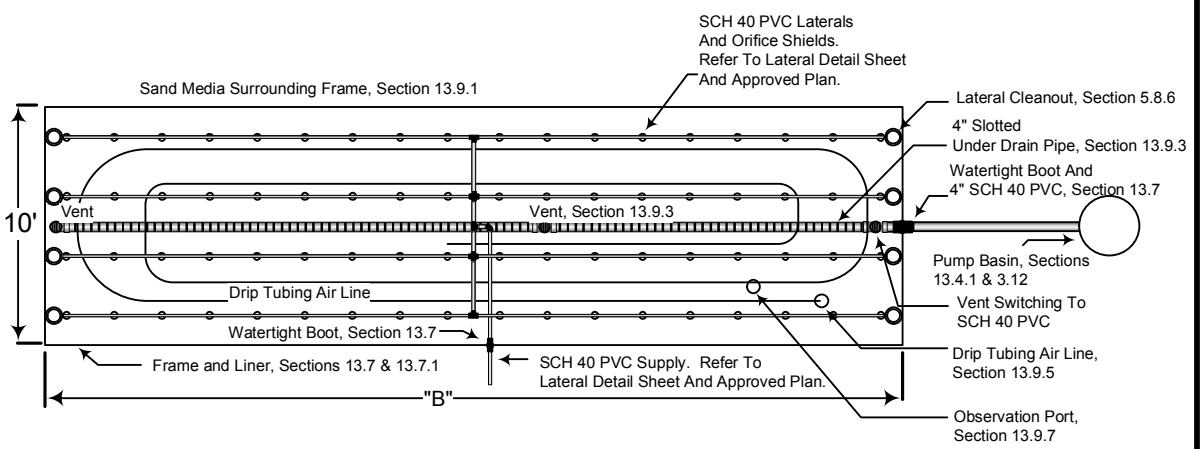
Intermittent Sand Filter (Shown With Pumped Discharge)

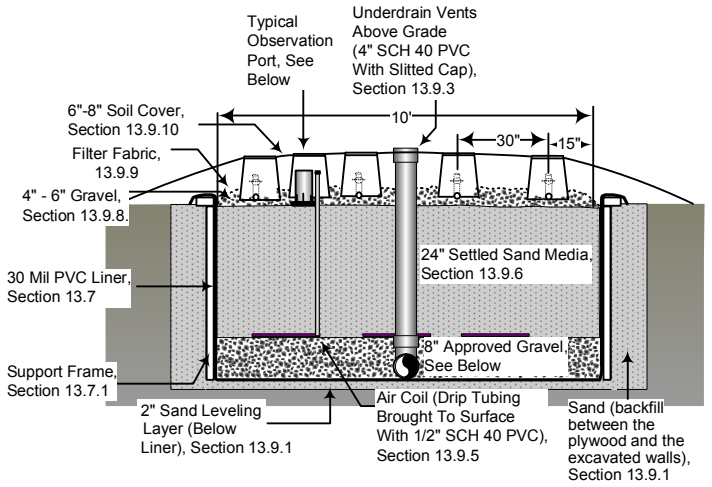


Plan View

Not to Scale

"B" =

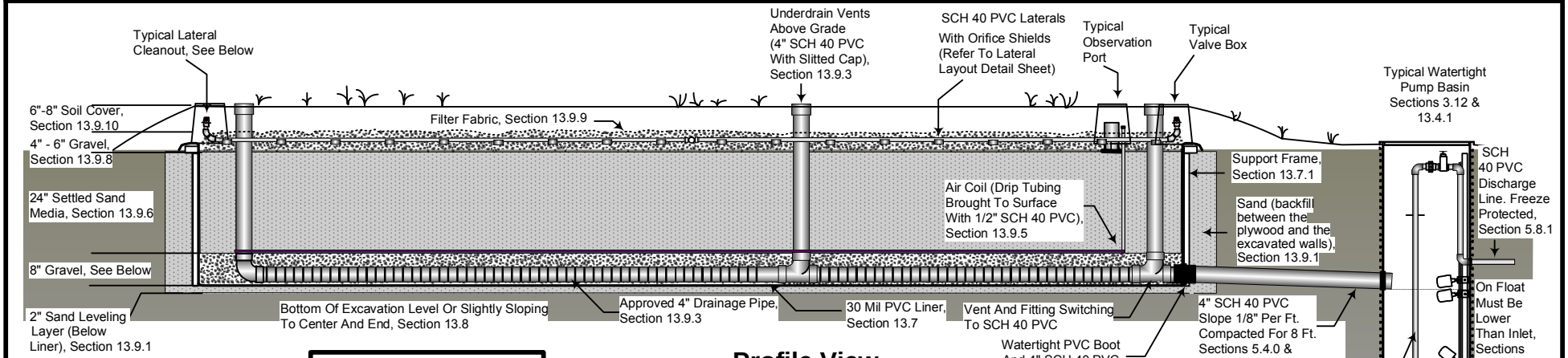
2 Bedroom - 36ft.
3 Bedroom - 36ft
4 Bedroom - 48ft
5 Bedroom - 60ft



Profile View

(End Detail)

Not to Scale

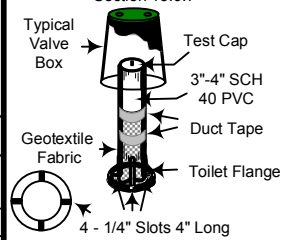


Profile View

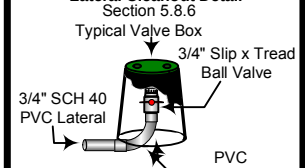
(Side Detail)

Not to Scale

OBSERVATION PORT DETAIL
Section 13.9.7



Lateral Cleanout Detail
Section 5.8.6



Underdrain Detail
Sections 13.9.3 - 13.9.4

**** An Addtional 2" of #57 Gravel Must Be Placed Under The Drain Pipe When Filter Is Unlined**

Note:
If using a Lined Filter with a gravity discharge to a secondary treatment system (ex. LL's, wetlands), then the filter must have a liner drain installed outside the filter box which outlets away from the secondary treatment system.

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

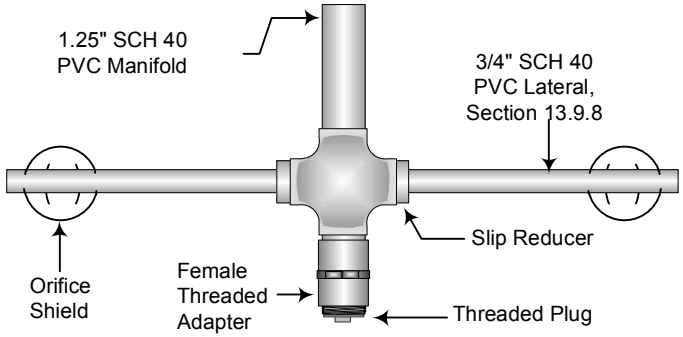
Intermittent Sand Filter

Title: Intermittent Sand Filter (Shown With Pumped Discharge)
Drawn By: CMG | Date: 1/31/05 | Revision #: 4.0

Lateral Distribution Network For 1-3 Bedroom Intermittent Sand Filter

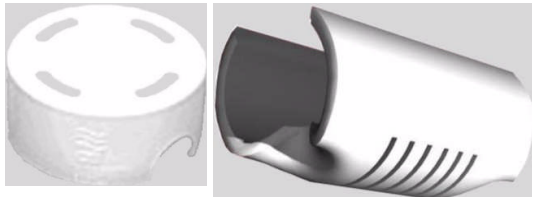
Manifold Line Cleanout Detail

Section 5.8.1 - 5.8.3



Orifice Shield Detail

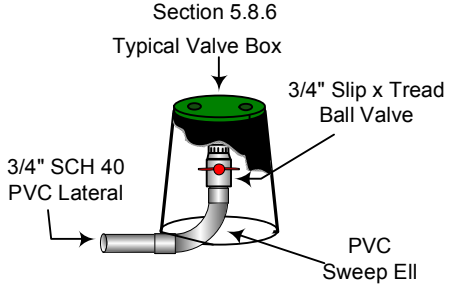
Orifice Size - 1/8" Total Orifices - 72



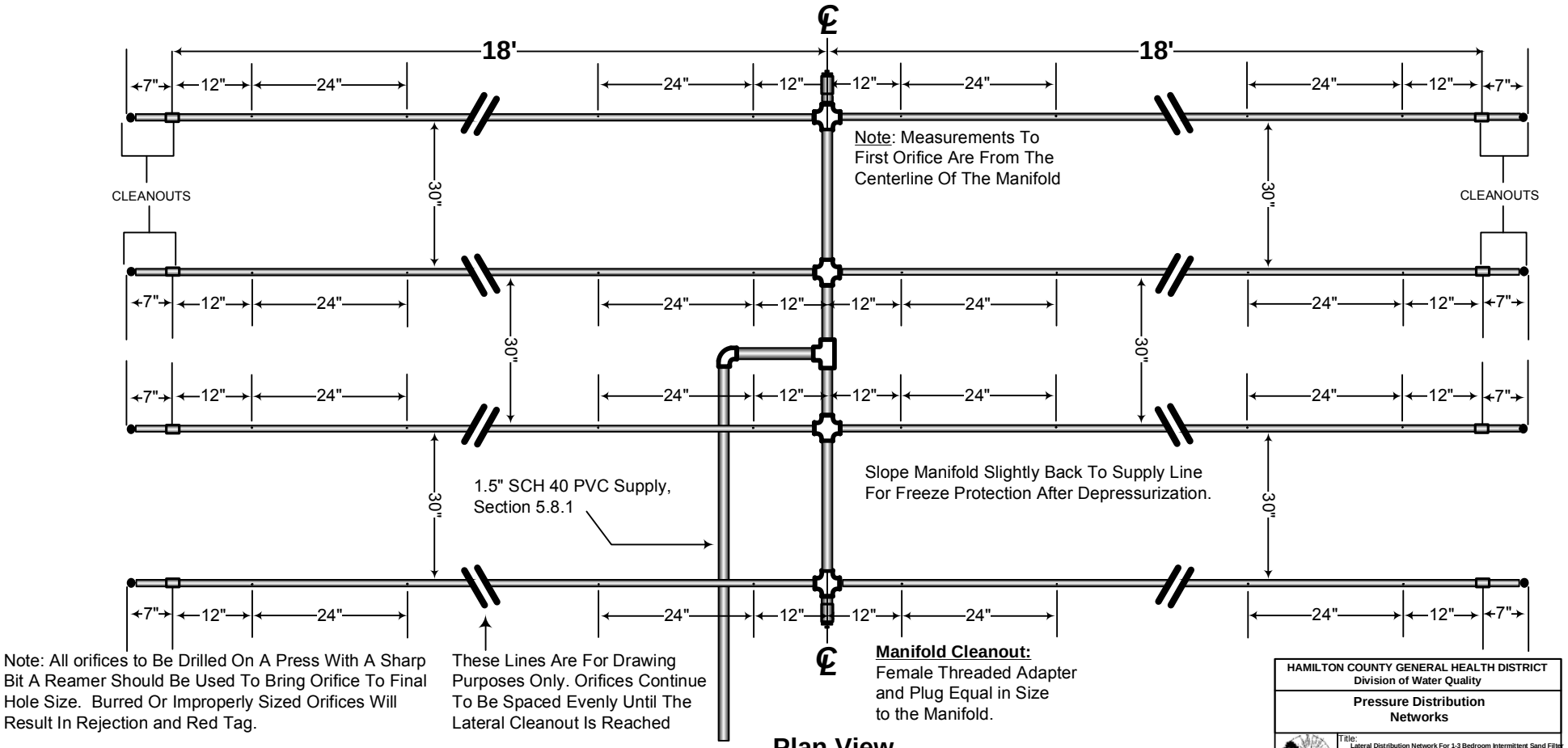
Commercially Manufactured For The Use Intended Or Fabricated By The Installer Following Health District Specs. Section 5.10.0

Lateral Cleanout Detail

Section 5.8.6



Cleanouts Elevated 1/2" Above Lateral To Drain Effluent Back To Orifices After Depressurization. Section 5.8.6



Note: All orifices to Be Drilled On A Press With A Sharp Bit A Reamer Should Be Used To Bring Orifice To Final Hole Size. Burred Or Improperly Sized Orifices Will Result In Rejection and Red Tag.

These Lines Are For Drawing Purposes Only. Orifices Continue To Be Spaced Evenly Until The Lateral Cleanout Is Reached

Plan View

Not to Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

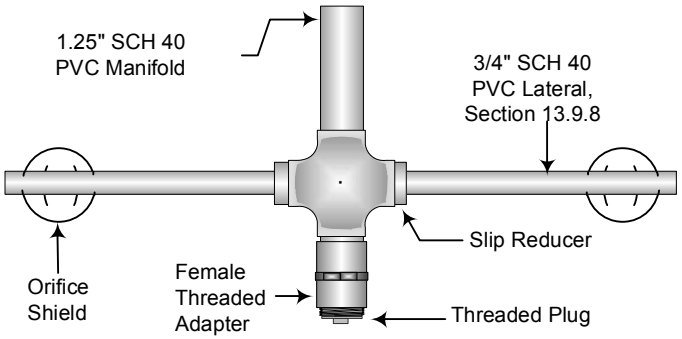
Pressure Distribution Networks

Title: Lateral Distribution Network For 1-3 Bedroom Intermittent Sand Filter		
Drawn By: CMG	Date: 1/31/05	Revision #: 4.0

Lateral Distribution Network For 4 Bedroom Intermittent Sand Filter

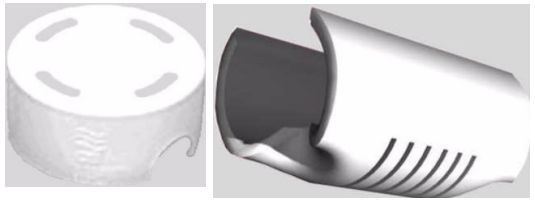
Manifold Line Cleanout Detail

Section 5.8.1 - 5.8.3



Orifice Shield Detail

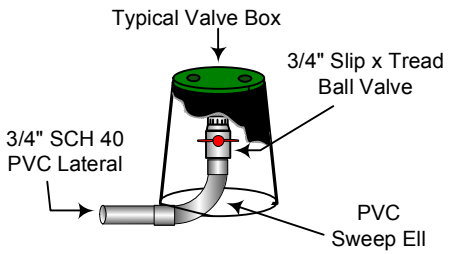
Orifice Size - 1/8" Total Orifices - 96



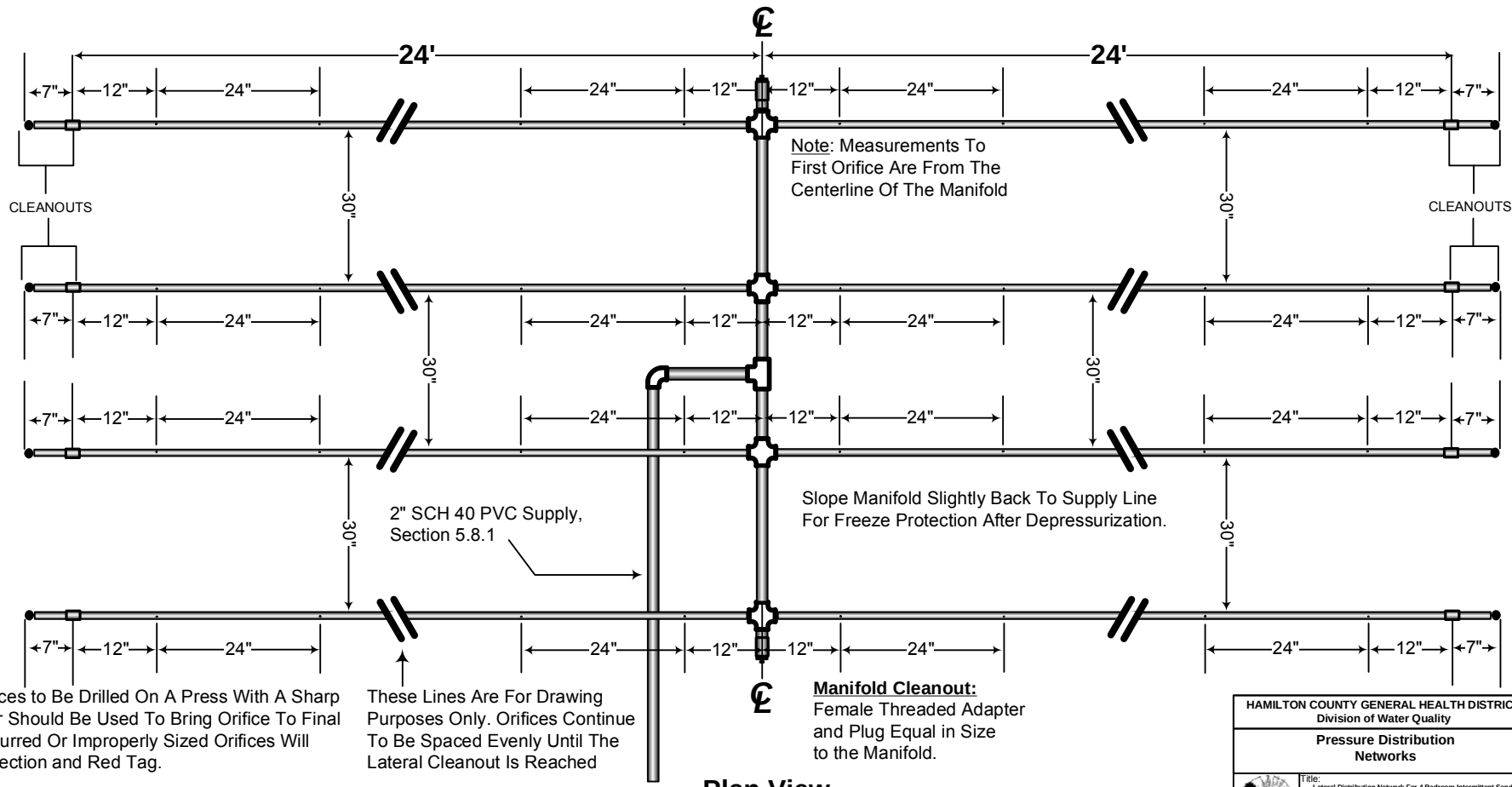
Commercially Manufactured For The Use Intended Or Fabricated By The Installer Following Health District Specs. Section 5.10.0

Lateral Cleanout Detail

Section 5.8.6



Cleanouts Elevated 1/2" Above Lateral To Drain Effluent Back To Orifices After Depressurization. Section 5.8.6



Note: All orifices to Be Drilled On A Press With A Sharp Bit A Reamer Should Be Used To Bring Orifice To Final Hole Size. Burred Or Improperly Sized Orifices Will Result In Rejection and Red Tag.

These Lines Are For Drawing Purposes Only. Orifices Continue To Be Spaced Evenly Until The Lateral Cleanout Is Reached

Plan View

Not to Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Pressure Distribution Networks

Title: Lateral Distribution Network For 4 Bedroom Intermittent Sand Filter

Drawn By:	Date:	Revision #:
CMG	1/31/05	4.0

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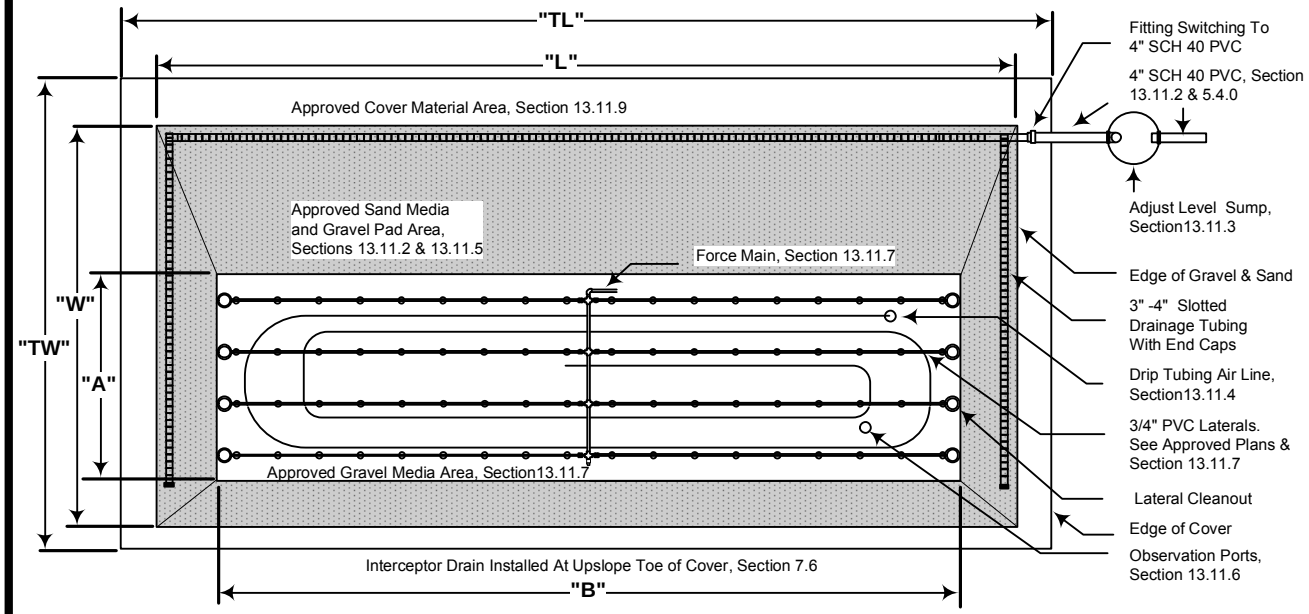
Above Grade Intermittent Sand Filter General Plan

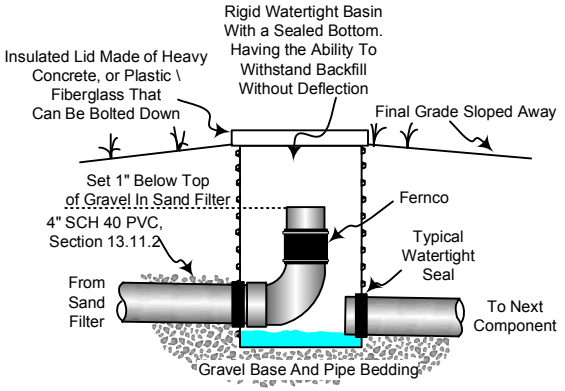


Plan View

Not to Scale

Adjust Level Sump

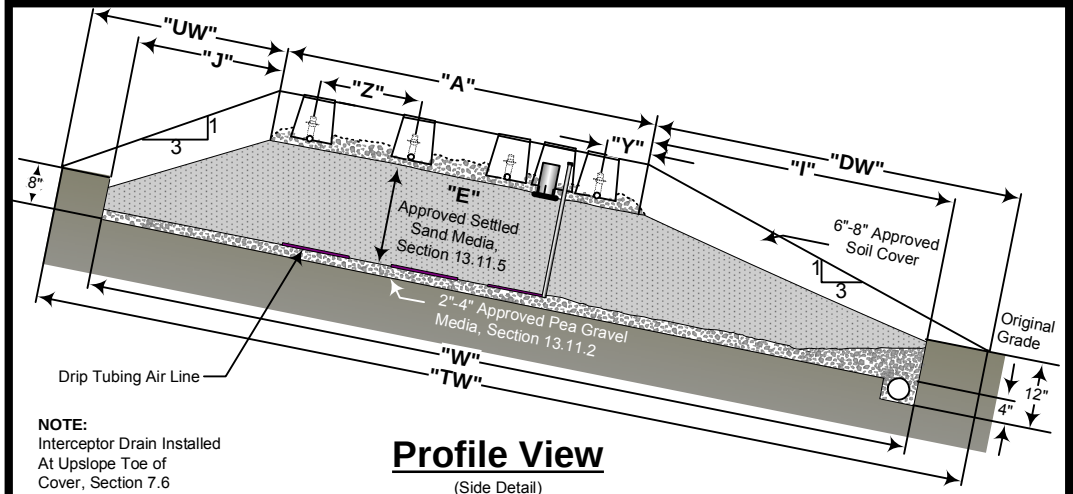
Section 13.11.3



Note: Do Not Allow Gravel Bedding To Connect With Gravel Under Sand Filter. Compact Dirt Between; 8ft. Min. Separation.

Profile View

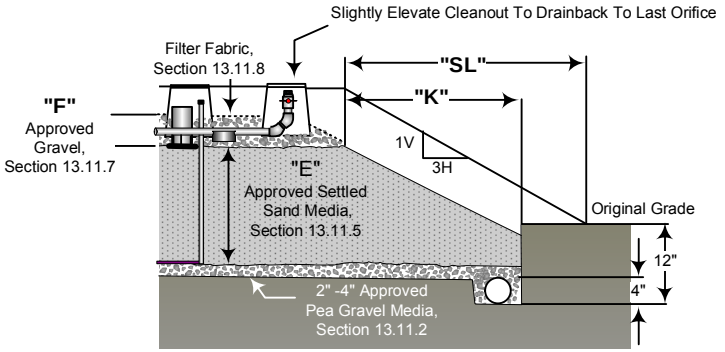
Not to Scale



NOTE:
Interceptor Drain Installed At Upslope Toe of Cover, Section 7.6

Profile View

(Side Detail)
Not to Scale



Profile View

(End Detail)
Not To Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Above Grade Intermittent Sand Filter

Title: Above Grade Intermittent Sand Filter General Plan		
Drawn By: CMG	Date: 1/31/05	Revision #: 3.0

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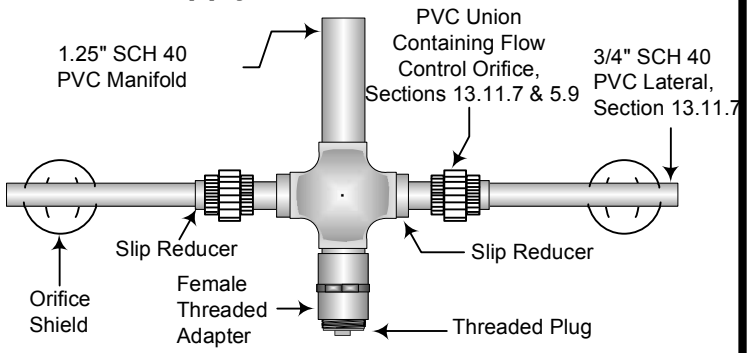
Lateral Distribution Network For A 1-3 Bedroom Above Grade Sand Filter

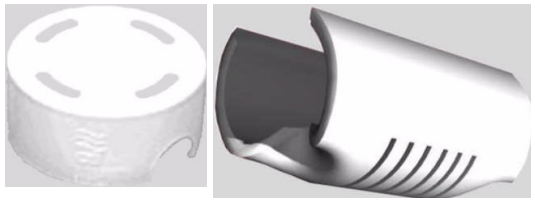
Supply Line Cleanout Detail



Section 5.8.1 - 5.8.3

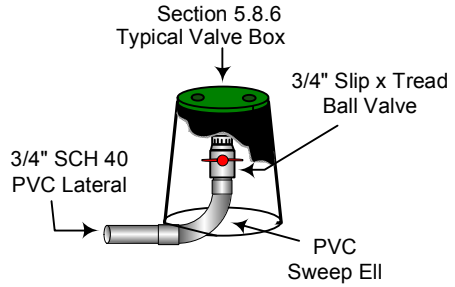
Orifice Shield Detail

Orifice Size - 1/8" Total Orifices - 72

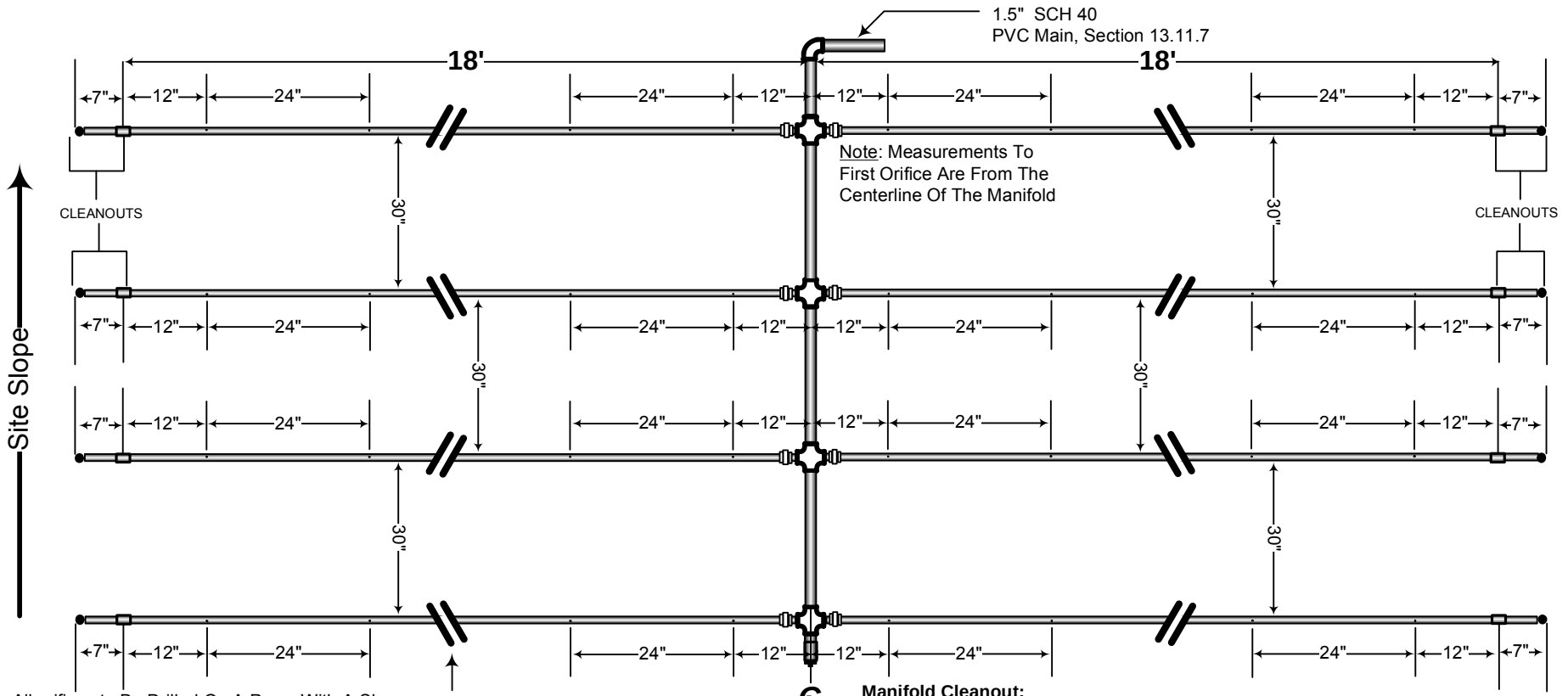


Commercially Manufactured For The Use Intended Or Fabricated By The Installer Following Health District Specs. Section 5.10.0

Lateral Cleanout Detail



Cleanouts Elevated 1/2" Above Lateral To Drain Effluent Back To Orifices After Depressurization. Section 5.8.6



Note: All orifices to Be Drilled On A Press With A Sharp Bit A Reamer Should Be Used To Bring Orifice To Final Hole Size. Burred Or Improperly Sized Orifices Will Result In Rejection and Red Tag.

These Lines Are For Drawing Purposes Only. Orifices Continue To Be Spaced Evenly Until The Lateral Cleanout Is Reached

Manifold Cleanout:
Female Threaded Adapter and Plug Equal in Size to the Manifold.

Plan View

Not to Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

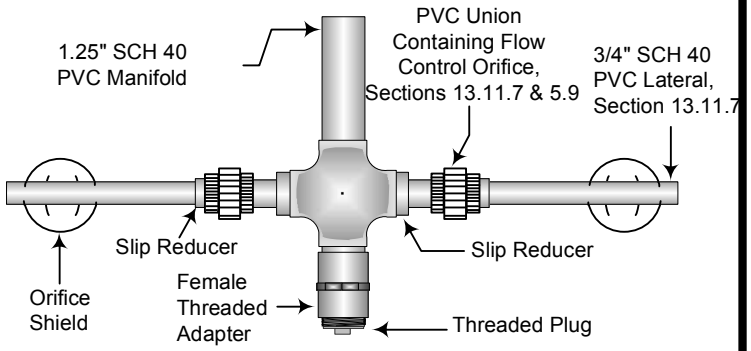
Pressure Distribution Networks

Title: Lateral Distribution Network For A 1-3 Bedroom Above Grade Sand Filter

Drawn By:	Date:	Revision #:
CMG	1/31/05	4.0

Lateral Distribution Network For A 4 Bedroom Above Grade Sand Filter

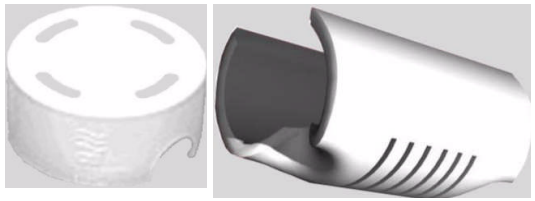
Supply Line Cleanout Detail



Section 5.8.1 - 5.8.3

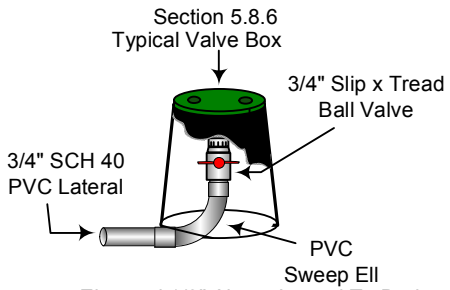
Orifice Shield Detail

Orifice Size - 1/8" Total Orifices - 96

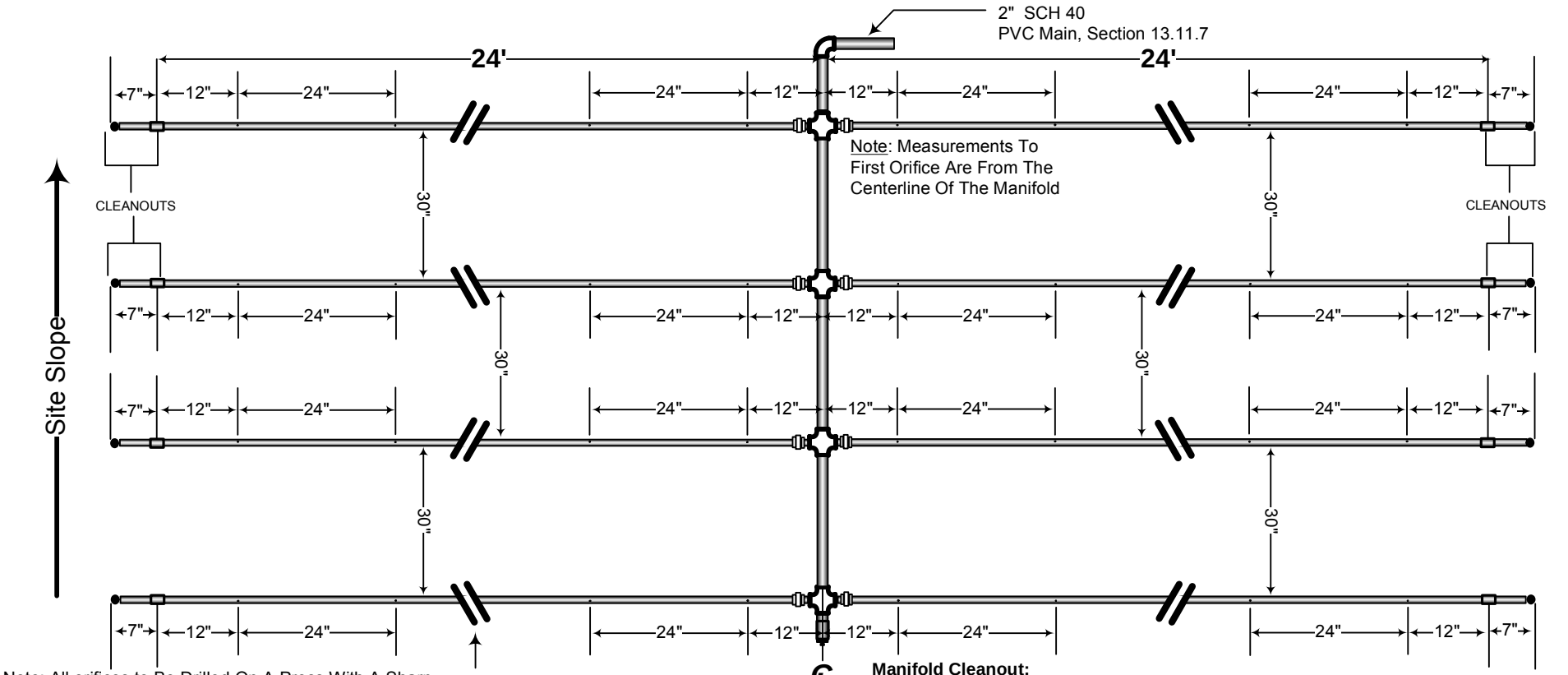


Commercially Manufactured For The Use Intended Or Fabricated By The Installer Following Health District Specs. Section 5.10.0

Lateral Cleanout Detail



Cleanouts Elevated 1/2" Above Lateral To Drain Effluent Back To Orifices After Depressurization. Section 5.8.6



Note: All orifices to Be Drilled On A Press With A Sharp Bit A Reamer Should Be Used To Bring Orifice To Final Hole Size. Burred Or Improperly Sized Orifices Will Result In Rejection and Red Tag.

These Lines Are For Drawing Purposes Only. Orifices Continue To Be Spaced Evenly Until The Lateral Cleanout Is Reached

Manifold Cleanout:
Female Threaded Adapter and Plug Equal in Size to the Manifold.

Plan View

Not to Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Pressure Distribution Networks			
Title: Lateral Distribution Network For A 4 Bedroom Above Grade Sand Filter			
Drawn By: CMG	Date: 1/31/05	Revision #: 4.0	

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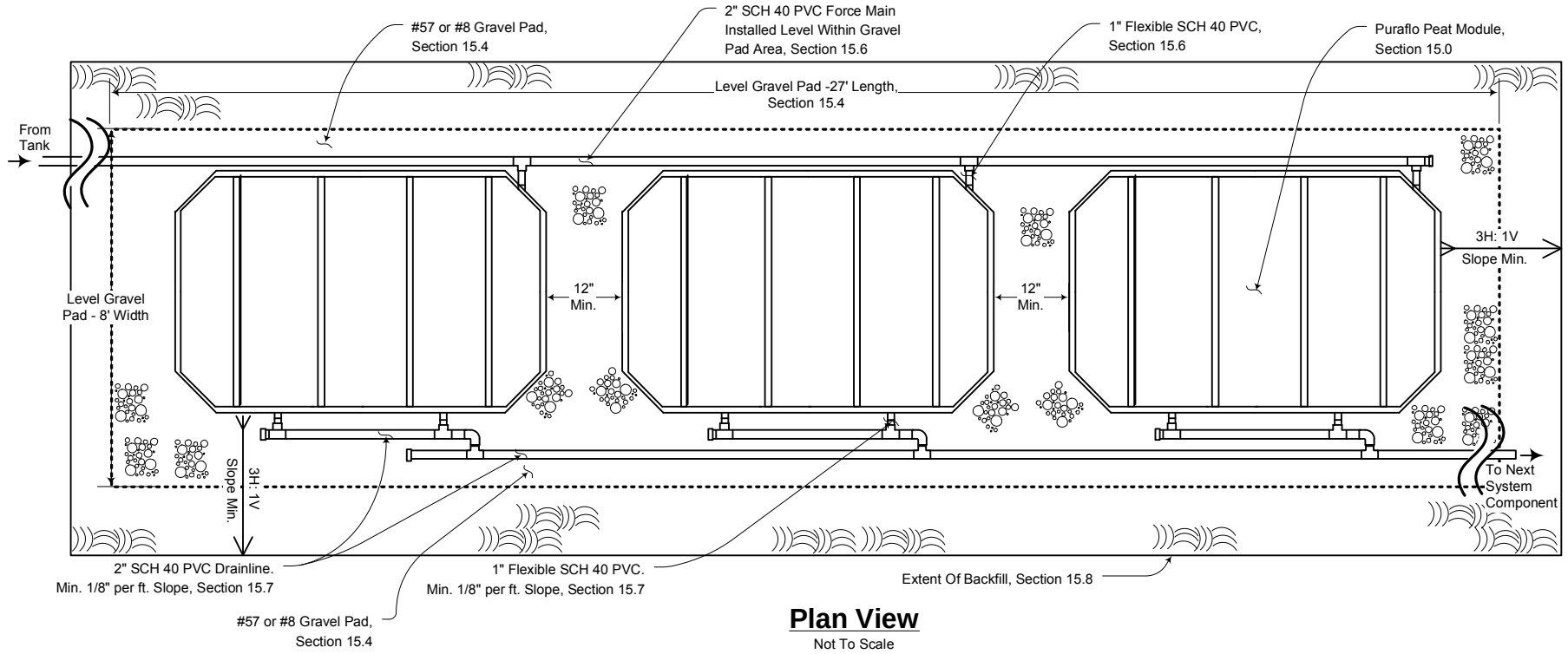
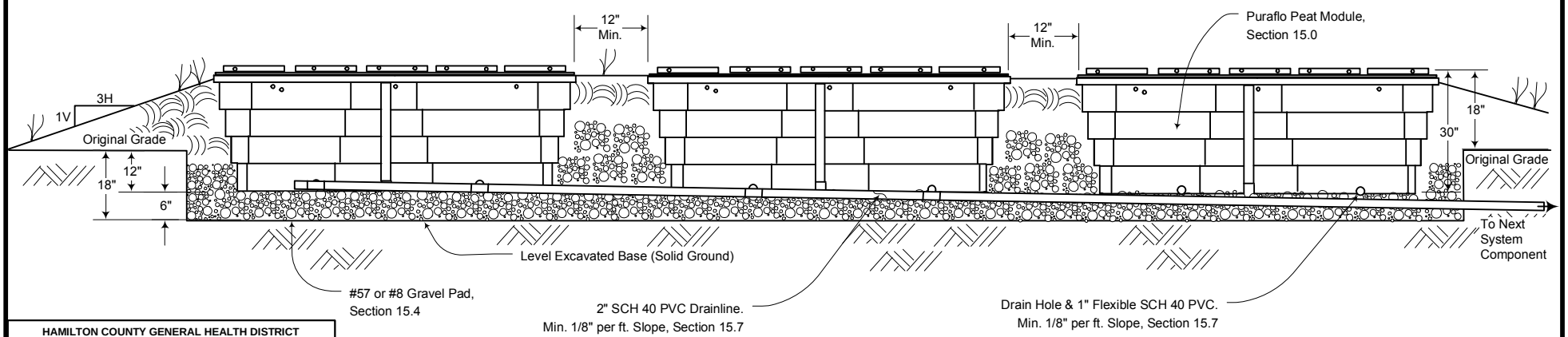
Puraflo Peat Biofilters

Section 15.0



Plan View

Not To Scale



Profile View

(Discharge Side)
Not To Scale

HAMILTON COUNTY GENERAL HEALTH DISTRICT Division of Water Quality			
Puraflo Peat Biofilters			
	Title: Puraflo Peat Biofilters		
	Drawn By: CMG	Date: 1/31/05	Revision #: 4.0

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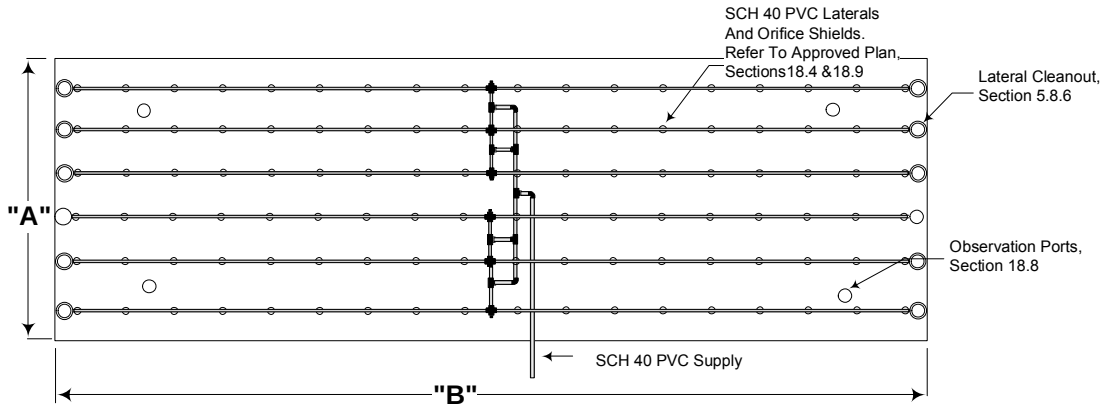
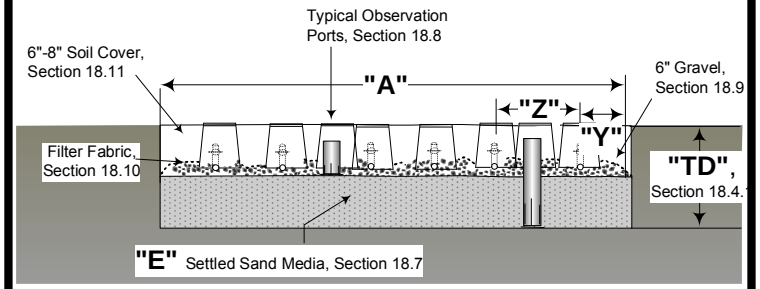
Generic Pressurized Leach Bed

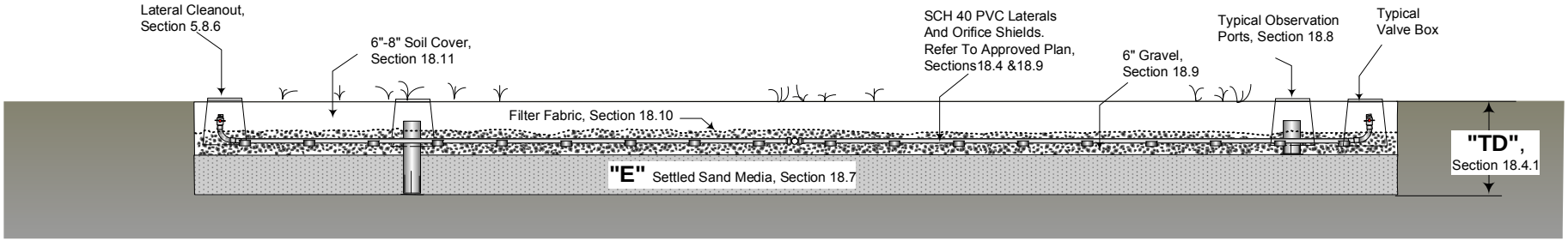
Section 18.0



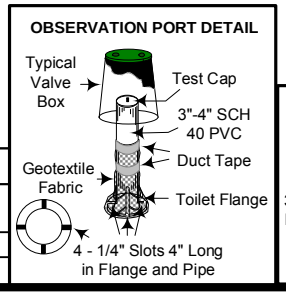
Plan View
Not to Scale

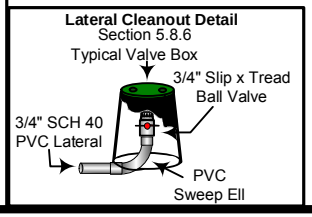


Profile View
(End Detail)
Not to Scale



Profile View
(Side Detail)
Not to Scale





1. See all requirements of Section 18.0.
2. Layout the length of the filter bed as parallel as possible to the site contour +/- 8".
3. The highest point of the ground surface around the perimeter of the filter is used to set the excavation depth.
4. Pit excavated so that the bottom is level and roughened.
5. Pit walls must be vertical before material is added.
6. Health District inspection of "open pit" is required before material placement.

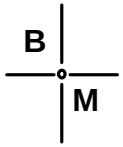
HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Pressurized Leach Bed

Title: Generic Pressurized Leach Bed			
Drawn By: CMG	Date: 1/31/05	Revision #: 4.0	

23 Appendix 23.0 As-Builts & Layout Surveys

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCPH within the STS design. When used, if conflicts exist between this manual and Ohio Administrative Code 3701-29, the state code shall prevail. STS contactors shall follow the approved STS design.



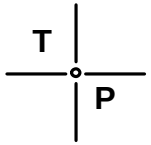
Benchmark

B.S. Backsight

F.S. Foresight

H.I. Height of Instrument

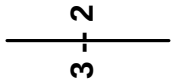
Instrument Set-up Location



Turning Point

(3 - 2) Existing (Natural) Elevation

Pressure/Gravity Pipe



Top of Pipe

Spot Grade Rod Reading*

*Spot grades are to be used with the following prefixes and suffixes to indicate item being surveyed.

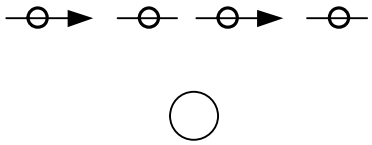
Prefixes:
- EX - Existing
- PL - Planned
- AB - As-Built

Suffixes:
- D.B. - Ditch Bottom (Ditch Invert)
- T.G. - Top of Gravel
- T.S. - Top of Sand
- F.L. - Flow Line(Pipe Invert)
- T.T. - Top of Tank
- T.R. - Top of Riser
- T.P. - Top of Pipe

Example:

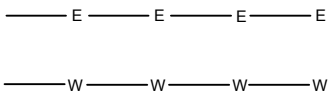
AB 3 - 2 TT

Interpretation: As-Built Spot Elevation Shot for Top of Tank ; Grade Rod Reading of 3 ft - 2 in.



Gradient Drain

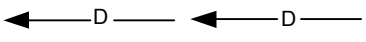
Gradient Drain Sump Basin or Pump Basin



Buried Electric Service

Buried Water Service

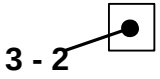
Structure (Building)



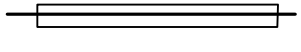
Diversion Ditch

Control Panel

Electrical Disconnect

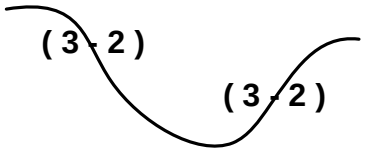


Top of Drop Box



Cased Pipe

Tank



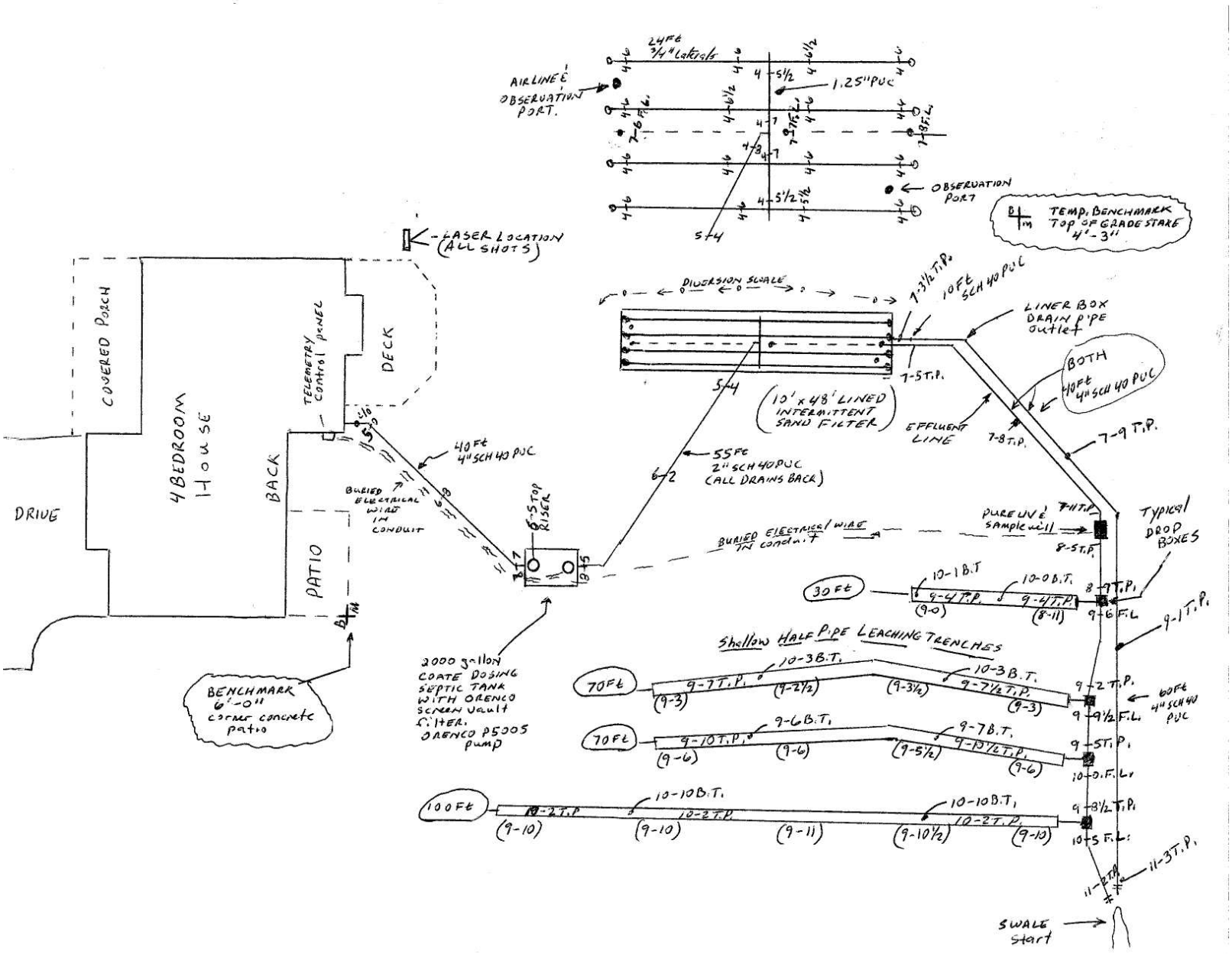
Contour

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Symbols for "Layout Surveys" and "As-Builts"

Title: Symbols for "Layout Surveys" and "As-Builts"		
Drawn By: CMG	Date: 2/2/05	Revision #: 3.0

As-Built Drawing Example



24 Appendix 24.0 Forms

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCGHD within the STS design. When there is a conflict between this manual and Ohio Administrative Code 3701-29-10, the state code shall prevail. STS contractors shall follow the approved STS design.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 30' ISF Using A Concrete Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on <u>all</u> of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The volume of the tank/basin in gallons per inch will be needed. Consult the tank vendor for specific tank volumes. For best accuracy, draw down tests should be performed by running the pump for 2 – 4 minutes.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____

   (End measurement_____ - Start measurement_____) **x** Volume of tank_____ $^{gal}/_{inch}$ ÷ Run Time_____min. **=**
   [Q_{set}] _____ $^{gal}/_{min}$

5. Divide Q_{set} by Q_{design} (Q_{design} is 25.95 $^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If Q_{set}/Q_{design} is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If Q_{set}/Q_{design} is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____	Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

17 $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ **=** **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x 60 $^{sec}/_{min}$ = 40 sec)
   On Setting = _____min _____sec
   Override On Setting is the same as the On Setting
   Off Setting 2.84 $^{hours}/_{dose}$ or **Off Setting** = 2 hrs 51 min per dose.
   Override Off Setting 1.7 $^{hours}/_{dose}$ or **Override Off Setting** = 1 hr 42 min per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 30' ISF Using A Poly or Fiberglass Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on <u>all</u> of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The septic tank volume chart will be needed. To properly perform a draw down test, a measurement must be made to determine the water level location within the tank in relation to the tank top. The tank volume chart must then be consulted after the draw down has been completed to determine specific volumes. For best accuracy, draw down tests should be performed by running the pump for 2-4 minutes. Start by measuring from a fixed point to the inside top of the tank. Record this distance in the space provided. Next measure from the fixed point to the surface of the water level. Record this distance in the space provided. Finally run the pump for an exact length of time and immediately measure from the fixed point to the "stop" liquid level. Record this measurement in the space provided. **Note:** The stop measurement should not include piping drainback. All Measurements must be to the nearest 1/8 inch.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   Fixed Point to Inside Top of Tank_____
   Fixed Point to Start Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Start Measurement
   Fixed Point to Stop Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Stop Measurement
   Volume In Tank at the Start Measurement _____gallons
   \- Volume In Tank at the Stop Measurement _____gallons
   ==========
   = _____gallons ÷ _____ minutes run = **[Q_{set}]** _____ $^{gal}/_{min}$

5. Divide Q_{set} by Q_{design} (Q_{design} is 25.95 $^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If Q_{set}/Q_{design} is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If Q_{set}/Q_{design} is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

   \+ ==========
   [$V_{Total\ Drain\ back}$] = _____ gallons.

   17 $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x 60 $^{sec}/_{min}$ = 40 sec)

   On Setting = _____min _____sec
   Override On Setting is the same as the On Setting
   Off Setting 2.84 $^{hours}/_{dose}$ or **Off Setting** = 2 hrs 51 min per dose.
   Override Off Setting 1.7 $^{hours}/_{dose}$ or **Override Off Setting** = 1 hr 42 min per dose.

Effective January 1, 2015 - This manual contains the Terms and Conditions authorized under OAC 3701-29-09(B)(5) for HSTS and SFOSTS for Installation and Alteration Permits. This manual is to be used by STS designers unless alternative proceedures or materials are provided and approved by HCGHD within the STS design. When there is a conflict between this manual and Ohio Administrative Code 3701-29-10, the state code shall prevail. STS contractors shall follow the approved STS design.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 36" ISF Using A Concrete Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on all of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The volume of the tank/basin in gallons per inch will be needed. Consult the tank vendor for specific tank volumes. For best accuracy, draw down tests should be performed by running the pump for 2 - 4 minutes.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____

   (End measurement_____ - Start measurement_____) **x** Volume of tank_____ $^{gal}/_{inch}$ ÷ Run Time_____min. **=**
   [Q_{set}] _____ $^{gal}/_{min}$

5. Divide **Q_{set}** by **Q_{design}** (**Q_{design}** is 31.14 $^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If **Q_{set}/Q_{design}** is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If **Q_{set}/Q_{design}** is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

20 $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ **=** **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x 60 $^{sec}/_{min}$ = 40 sec)
   On Setting = _____min _____sec
   Override On Setting is the same as the On Setting
   Off Setting 2.23 $^{hours}/_{dose}$ or **Off Setting** = 2 hrs 14 min per dose.
   Override Off Setting 1.34 $^{hours}/_{dose}$ or **Override Off Setting** = 1 hr 21 min per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 36" ISF Using A Poly or Fiberglass Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on all of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The septic tank volume chart will be needed. To properly perform a draw down test, a measurement must be made to determine the water level location within the tank in relation to the tank top. The tank volume chart must then be consulted after the draw down has been completed to determine specific volumes. For best accuracy, draw down tests should be performed by running the pump for 2-4 minutes. Start by measuring from a fixed point to the inside top of the tank. Record this distance in the space provided. Next measure from the fixed point to the surface of the water level. Record this distance in the space provided. Finally run the pump for an exact length of time and immediately measure from the fixed point to the "stop" liquid level. Record this measurement in the space provided. **Note:** The stop measurement should not include piping drainback. All Measurements must be to the nearest 1/8 inch.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   Fixed Point to Inside Top of Tank_____
   Fixed Point to Start Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Start Measurement
   Fixed Point to Stop Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Stop Measurement
   Volume In Tank at the Start Measurement _____gallons
   \- Volume In Tank at the Stop Measurement _____gallons
   ==========
   = _____gallons ÷ _____ minutes run = **[Q_{set}]** _____ $^{gal}/_{min}$

5. Divide Q_{set} by Q_{design} (Q_{design} is 31.14 $^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If Q_{set}/Q_{design} is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If Q_{set}/Q_{design} is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

   \+ ==========
   [$V_{Total\ Drain\ back}$] = _____ gallons.

   20 $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x 60 $^{sec}/_{min}$ = 40 sec)

   On Setting = _____min _____sec
   Override On Setting is the same as the On Setting

Off Setting 2.23 $^{hours}/_{dose}$	or	**Off Setting** = 2 hrs 14 min per dose.
Override Off Setting 1.34 $^{hours}/_{dose}$	or	**Override Off Setting** = 1 hr 21 min per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 48" ISF Using A Concrete Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on <u>all</u> of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The volume of the tank/basin in gallons per inch will be needed. Consult the tank vendor for specific tank volumes. For best accuracy, draw down tests should be performed by running the pump for 2 - 4 minutes.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____

   (End measurement_____ - Start measurement_____) **x** Volume of tank_____ $^{gal}/_{inch}$ ÷ Run Time_____min. =
   [Q_{set}] _____ $^{gal}/_{min}$

5. Divide **Q_{set}** by **Q_{design}** (**Q_{design}** is 41.52 $^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If **Q_{set}/Q_{design}** is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If **Q_{set}/Q_{design}** is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

27 $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x 60 $^{sec}/_{min}$ = 40 sec)
   On Setting = _____min _____sec
   Override On Setting is the same as the On Setting
   Off Setting 2.25 $^{hours}/_{dose}$ or **Off Setting** = 2 hrs 15 min per dose.
   Override Off Setting 1.35 $^{hours}/_{dose}$ or **Override Off Setting** = 1 hr 21 min per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For 10' x 48" ISF Using A Poly or Fiberglass Septic Tank

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on <u>all</u> of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The septic tank volume chart will be needed. To properly perform a draw down test, a measurement must be made to determine the water level location within the tank in relation to the tank top. The tank volume chart must then be consulted after the draw down has been completed to determine specific volumes. For best accuracy, draw down tests should be performed by running the pump for 2-4 minutes. Start by measuring from a fixed point to the inside top of the tank. Record this distance in the space provided. Next measure from the fixed point to the surface of the water level. Record this distance in the space provided. Finally run the pump for an exact length of time and immediately measure from the fixed point to the "stop" liquid level. Record this measurement in the space provided. **Note:** The stop measurement should not include piping drainback. All Measurements must be to the nearest 1/8 inch.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   Fixed Point to Inside Top of Tank_____
   Fixed Point to Start Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Start Measurement
   Fixed Point to Stop Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Stop Measurement
   Volume In Tank at the Start Measurement _____gallons
   \- Volume In Tank at the Stop Measurement _____gallons
   ==========
   = _____gallons ÷ _____ minutes run = **[Q_{set}]** _____ $^{gal}/_{min}$

5. Divide Q_{set} by Q_{design} (Q_{design} is $41.52^{gal}/_{min.}$)
   Q_{set}/Q_{design} = _____
   (a) If Q_{set}/Q_{design} is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If Q_{set}/Q_{design} is less that .85 or greater than 1.15; then repairs must be made. Return to step 1.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, and manifolds)

_____Feet of 1" PVC Drain back	x	$.045^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	$.078^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	$.106^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	$.174^{gal}/_{ft}$ =	_____gallons

\+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

$27^{gal}/_{dose}$ + $V_{Total\ Drain\ back}$ _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

7. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x $60^{sec}/_{min}$ = 40 sec)

On Setting = _____min _____sec		
Override On Setting is the same as the On Setting		
Off Setting 2.25 $^{hours}/_{dose}$	or	**Off Setting** = 2 hrs 15 min per dose.
Override Off Setting 1.35 $^{hours}/_{dose}$	or	**Override Off Setting** = 1 hr 21 min per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For Intermittent Sand Filters and Mounds (Concrete Tank)

Address:_____ Permit Number:_____

1. Number of bedrooms _____ x 120 $^{gal}/_{day}$ = **[Q_{peak}]** _____ $^{gal}/_{day}$ x .60 = **[$Q_{average}$]** _____ $^{gal}/_{day}$

2. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.

3. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

4. Set the operating head to 5ft. on each lateral using clear tubes on <u>all</u> of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 2.

5. Perform a timed draw down test, Section 3.8.1. The volume of the tank/basin in gallons per inch will be needed. Consult the tank vendor for specific tank volumes. For best accuracy, draw down tests should be performed by running the pump for 2 - 4 minutes.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   (End measurement_____ **-** Start measurement_____) **x** Volume of tank_____ $^{gal}/_{inch}$ ÷ Run Time_____min. **=**
   [Q_{set}] _____ $^{gal}/_{min}$

6. Divide **Q_{set}** by **Q_{design}** (**Q_{design}** is given in the design or is calculated by the # of orifices in each zone multiplied by .4325)
   Number of orifices per zone in the system_____ x .4325 = **[Q_{design}]** _____ $^{gal}/_{min}$
   Q_{set}/Q_{design} = _____
   (a) If **Q_{set}/Q_{design}** is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If **Q_{set}/Q_{design}** is less that .85 or greater than 1.15; then repairs must be made. Return to step 2.

7. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, sub mains, and manifolds)
   Note: Laterals would only be calculated if orifices are in the up position

_____Feet of ¾" PVC Drain back	x	.028 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

8. Calculate the total dose volume required for the design.
   .028 $^{gal}/_{ft}$ x _____feet of lateral per zone x 5 = **[$V_{Net\ Dose}$]** _____ $^{gal}/_{dose}$
   $V_{Net\ Dose}$_____ $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ **=** **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

9. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose.}$
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x $60^{sec}/_{min}$ = 40 sec)
   On Setting = _____min _____sec ((Note: **Overide On Setting** set the same as **On Setting**))
   Off Setting = $Q_{average}$ ($^{gal}/_{day}$) **÷ $V_{Net\ Dose}$** ($^{gal}/_{dose}$) **=>>** _____ $^{gal}/_{day}$ ÷_____ $^{gal}/_{dose}$ = **[$D_{average}$]**_____ $^{doses}/_{day}$
   24 $^{hours}/_{day}$ **÷ [$D_{average}$]**_____ $^{doses}/_{day}$ = **Off Setting** _____ $^{hours}/_{dose}$
   Convert any fractional hours to minutes. (.10 hour = 6 minutes Ex. .20 hours x $60^{min}/_{hour}$ = 12minutes.)
   Off Setting = _____hrs _____min -- per dose.
   Override Off Setting = Q_{peak} ($^{gal}/_{day}$) **÷ $V_{Net\ Dose}$** ($^{gal}/_{dose}$) **=>>** _____ $^{gal}/_{day}$ ÷_____ $^{gal}/_{dose}$ = **[D_{peak}]**_____ $^{doses}/_{day}$
   24 $^{hours}/_{day}$ **÷[D_{peak}]**_____ $^{doses}/_{day}$ = **Override Off Setting**_____ $^{hours}/_{dose}$
   Convert any fractional hours to minutes. (.10 hour = 6 minutes Ex. .45 hours x $60^{min}/_{hour}$ = 27minutes.)
   Override Off Setting = _____hrs _____min -- per dose.

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Hamilton County General Health District

Flow Rate Calculations/Drainback/Timer Settings Worksheet For Intermittent Sand Filters and Mounds (Fiber or Poly Tank)

Address:_____ Permit Number:_____

1. Number of bedrooms _____ x 120 $^{gal}/_{day}$ = **[Q_{peak}]** _____ $^{gal}/_{day}$ x .60 = **[$Q_{average}$]** _____ $^{gal}/_{day}$
2. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.
3. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

4. Set the operating head to 5ft. on each lateral using clear tubes on all of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 2.
5. Perform a timed draw down test, Section 3.8.1. The septic tank volume chart will be needed. To properly perform a draw down test, a measurement must be made to determine the water level location within the tank in relation to the tank top. The tank volume chart must then be consulted after the draw down has been completed to determine specific volumes. For best accuracy, draw down tests should be performed by running the pump for 2-4 minutes. Start by measuring from a fixed point to the inside top of the tank. Record this distance in the space provided. Next measure from the fixed point to the surface of the water level. Record this distance in the space provided. Finally run the pump for an exact length of time and immediately measure from the fixed point to the "stop" liquid level. Record this measurement in the space provided. **Note:** The stop measurement should not include piping drainback. All Measurements must be to the nearest 1/8 inch.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   Fixed Point to Inside Top of Tank_____
   Fixed Point to Start Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Start Measurement
   Fixed Point to Stop Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Stop Measurement
   Volume In Tank at the Start Measurement _____gallons
   \- Volume In Tank at the Stop Measurement _____gallons
   ==========
   = _____gallons ÷ _____ minutes run = **[Q_{set}]** _____ $^{gal}/_{min}$
6. Divide **Q_{set}** by **Q_{design}** (**Q_{design}** is given in the design or is calculated by the # of orifices in each zone multiplied by .4325)
   Number of orifices per zone in the system_____ x .4325 = **[Q_{design}]** _____ $^{gal}/_{min}$
   Q_{set}/Q_{design} = _____
   (a) If **Q_{set}/Q_{design}** is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If **Q_{set}/Q_{design}** is less that .85 or greater than 1.15; then repairs must be made. Return to step 2.
7. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, sub mains, and manifolds)
   Note: Laterals would only be calculated if orifices are in the up position

_____Feet of ¾" PVC Drain back	x	.028 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

   + ==========
   [$V_{Total\ Drain\ back}$] = _____ gallons.
8. Calculate the total dose volume required for the design.
   .028 $^{gal}/_{ft}$ x _____feet of lateral per zone x 5 = **[$V_{Net\ Dose}$]** _____ $^{gal}/_{dose}$
   $V_{Net\ Dose}$_____ $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$
9. Calculate the timer settings required for the design
   On Setting = $V_{Total\ Dose}$ ($^{gal}/_{dose}$) ÷ Q_{set} ($^{gal}/_{min}$) **=>>** _____ $^{gal}/_{dose}$ ÷ _____ $^{gal}/_{min}$ = **On Setting** _____ $^{min}/_{dose}$.
   Convert any fractional minutes to seconds. ($^{1}/_{10}$ minute = 6 seconds Ex. .67min x $60^{sec}/_{min}$ = 40 sec)
   On Setting = _____min _____sec ((Note: **Overide On Setting** set the same as **On Setting**))
   Off Setting = $Q_{average}$ ($^{gal}/_{day}$) **÷ $V_{Net\ Dose}$** ($^{gal}/_{dose}$) **=>>** _____ $^{gal}/_{day}$ ÷_____ $^{gal}/_{dose}$ = **[$D_{average}$]**_____ $^{doses}/_{day}$
   24 $^{hours}/_{day}$ **÷ [$D_{average}$]**_____ $^{doses}/_{day}$ = **Off Setting** _____ $^{hours}/_{dose}$
   Convert any fractional hours to minutes. (.10 hour = 6 minutes Ex. .20 hours x $60^{min}/_{hour}$ = 12minutes.)
   Off Setting = _____hrs _____min -- per dose.
   Override Off Setting = Q_{peak} ($^{gal}/_{day}$) **÷ $V_{Net\ Dose}$** ($^{gal}/_{dose}$) =>> _____ $^{gal}/_{day}$ ÷_____ $^{gal}/_{dose}$ = **[D_{peak}]**_____ $^{doses}/_{day}$
   24 $^{hours}/_{day}$ **÷[D_{peak}]**_____ $^{doses}/_{day}$ = **Override Off Setting** _____ $^{hours}/_{dose}$
   Convert any fractional hours to minutes. (.10 hour = 6 minutes Ex. .45 hours x $60^{min}/_{hour}$ = 27minutes.)
   Override Off Setting = _____hrs _____min -- per dose.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Float Settings Worksheet For Pumped Secondary Systems (ex. Modified At-grades)

Using A Dosing Basin/Tank With A Uniform Volume Throughout The Tank's Depth

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.
2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on all of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.

4. Perform a timed draw down test, Section 3.8.1. The volume of the tank/basin in gallons per inch will be needed. Consult the tank vendor for specific tank volumes. For best accuracy, draw down tests should be performed by running the pump for 2 - 4 minutes.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   (End measurement_____ - Start measurement_____) **x** Volume of tank_____ $^{gal}/_{inch}$ ÷ Run Time_____min. **=**
   [Q_{set}] _____ $^{gal}/_{min}$

5. Divided Q_{set} by Q_{design} (Q_{design} is given in the design or is calculated by the # of orifices in each zone multiplied by .4325)
   Number of orifices per zone in the system_____ x .4325 = **[Q_{design}]** _____ $^{gal}/_{min}$
   Q_{set}/Q_{design} = _____
   (a) If **Q_{set}/Q_{design}** is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If **Q_{set}/Q_{design}** is less that .85 or greater than 1.15; then repairs must be made. Return to step 2.

6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, sub mains, and manifolds)
   Note: Laterals would only be calculated if orifices are in the up position

_____	Feet of ¾" PVC Drain back	x	.028 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

+ ==========

[$V_{Total\ Drain\ back}$] = _____ gallons.

Verify this calculated estimate by measuring the liquid levels directly in dosing tank after the pump turns off following a full dosing event and after drain back ceases. This will yield the drain back volume. The volume of the dose tank in gallons per inch will be needed to calculate using this method. Consult the tank vendor for specific tank volumes.

(Start measurement_____ - End measurement_____) x Volume of tank_____ $^{gal}/_{inch}$ = **[$V_{Total\ Drain\ back}$]** _____**gal**

***Note**: The greater of these two volumes will be used for future calculations*.

7. Calculate the total dose volume required for the design.
   .028 $^{gal}/_{ft}$ x _____feet of lateral per zone x 5 = **[$V_{Net\ Dose}$]** _____ $^{gal}/_{dose}$
   $V_{Net\ Dose}$_____ $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$

8. Use the space below to calculate the float settings required for the design. These float settings must take into account any delay which the control panel may have after the "OFF" float drops. In these situations the installer will have to adjust the float settings accordingly.

Hamilton County General Health District

Flow Rate Calculations/Drainback/Float Settings Worksheet For Pumped Secondary Systems (ex. Modified At-grades)

Using A Dosing Basin/Tank With A Variable Volume Throughout The Tank's Depth

Address:_____ Permit Number:_____

1. The following must be done BEFORE completing this work sheet.
   a. All pressure pipes are properly glued, weep hole has been properly drilled, and no external water is entering the tank.
   b. Supply mains and manifolds, then laterals were flushed. See Section 5.14. Observe water leaving clean-outs for:
      (i) Uniform Streams.
      (ii) Clear Flow With No Debris.
2. Make a drawing of laterals below and note the house location. Measure the full operating head of the system using clear tubes on the lateral clean outs. Measurements are taken from the top of the lateral, not the top of the clean out. Record the initial squirt heights on at least 25% (min. 2) of the laterals.

3. Set the operating head to 5ft. on each lateral using clear tubes on all of the lateral cleanouts (Check Every Lateral at the same time.) The "lowest" squirt height must be at 5ft. Record each individual lateral's set squirt height on your drawing above.
   (a) If the squirt heights vary on different laterals, then check for blocks/breaks or other problems and make appropriate repairs. See Section 5.8.5 for allowable squirt height variation.
   (b) After repairs are made start over at step 1.
4. Perform a timed draw down test, Section 3.8.1. The dosing tank volume chart will be needed. To properly perform a draw down test, a measurement must be made to determine the water level location within the tank in relation to the tank top. The tank volume chart must then be consulted after the draw down has been completed to determine specific volumes. For best accuracy, draw down tests should be performed by running the pump for 2-4 minutes. Start by measuring from a fixed point to the inside top of the tank. Record this distance in the space provided. Next measure from the same fixed point to the surface of the water level. Record this distance in the space provided. Finally run the pump for an exact length of time and immediately measure from the fixed point to the "stop" liquid level. Record this measurement in the space provided. **Note:** The stop measurement should not include piping drainback. All Measurements must be to the nearest 1/8 inch.

   Dosing Tank Dimensions_____ Manufacturer_____ Size_____
   Fixed Point to Inside Top of Tank_____
   Fixed Point to Start Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Start Measurement
   Fixed Point to Stop Liquid Level _____ - Fixed Point to Inside Top of Tank_____ = _____ Stop Measurement
   Volume In Tank at the Start Measurement _____gallons
   \- Volume In Tank at the Stop Measurement _____gallons
   ==========
   = _____gallons ÷ _____ minutes run = **[Q_{set}]** _____ $^{gal}/_{min}$
5. Divided Q_{set} by Q_{design} (Q_{design} is given in the design or is calculated by the # of orifices in each zone multiplied by .4325)
   Number of orifices per zone in the system_____ x .4325 = **[Q_{design}]** _____ $^{gal}/_{min}$
   Q_{set}/Q_{design} = _____
   (a) If Q_{set}/Q_{design} is .85 or greater, but less than 1.15; then it is OK to proceed.
   (b) If Q_{set}/Q_{design} is less that .85 or greater than 1.15; then repairs must be made. Return to step 2.
6. Calculate any drain back volume in the piping network. (Includes discharge assemblies, force mains, sub mains, and manifolds)
   Note: Laterals would only be calculated if orifices are in the up position

_____	Feet of ¾" PVC Drain back	x	.028 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1" PVC Drain back	x	.045 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1¼" PVC Drain back	x	.078 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 1½" PVC Drain back	x	.106 $^{gal}/_{ft}$ =	_____gallons.
_____	Feet of 2" PVC Drain back	x	.174 $^{gal}/_{ft}$ =	_____gallons

   \+ ==========
   [$V_{Total\ Drain\ back}$] = _____ gallons.

   Verify this calculated estimate by measuring the liquid levels directly in dosing tank after the pump turns off following a full dosing event and after drainback ceases. This will yield the drainback volume. The tank volume chart must be consulted to determine specific volumes. Use a method similar to Step 4 to derive volumes at specific tank depths.

   (Vol. In Tank at the Stop Measurement _____ - Vol. In Tank After Drainback Measurement _____) = **[$V_{Total\ Drain\ back}$] _____gal**

   ***Note**: The greater of these two volumes will be used for future calculations.*
7. Calculate the total dose volume required for the design.
   .028 $^{gal}/_{ft}$ x _____feet of lateral per zone x 5 = **[$V_{Net\ Dose}$]** _____ $^{gal}/_{dose}$
   $V_{Net\ Dose}$_____ $^{gal}/_{dose}$ + **$V_{Total\ Drain\ back}$** _____ $^{gal}/_{dose}$ = **[$V_{Total\ Dose}$]** _____ $^{gal}/_{dose}$
8. Use the space below to calculate the float settings required for the design. These float settings must take into account any delay which the control panel may have after the "OFF" float drops. In these situations the installer will have to adjust the float settings accordingly.

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Site Address		**Number of Bedrooms**		
Installer		**Daily Design Flow (DDF) [# Bedrooms x 120 gal/day]**		**gal**
HSTS Type		**Reserve Volume [0.80 x DDF]*** Time Dosed / [1.0 x DDF] Demand Dosed**	Minimum	Set At **gal**
Permit Number		**Minimum Operating Capacity [2.5 x DDF]**	Minimum	Set At **gal**

Date:

Completed By:

Pump#1 (First Pump in Treatment Train)

Dosing Application	**Timed**	**Demand**	
Tank Make/Model		**(**	**gal/in)**
Pump Make/Model			

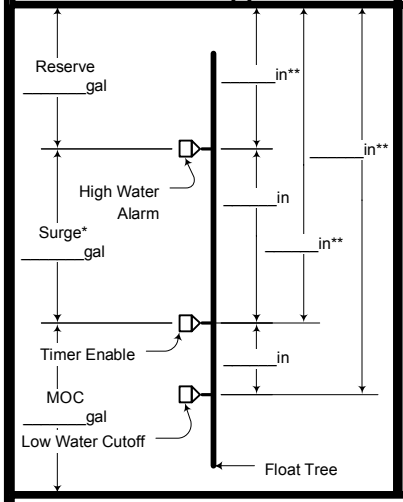
Timed Dosing

Surge Capacity [0.80 x DDF]* **	Minimum	Set At	**gal**
Timed Drawdown Flow Rate, (gal/min)	Q=		**gal/min**
Timer Setting Pump Run, (min)	T=		**min**
Dose Volume Delivered by Pump [Q x T]			**gal**
Drainback Volume			**gal**
Net Dose Volume			**gal**

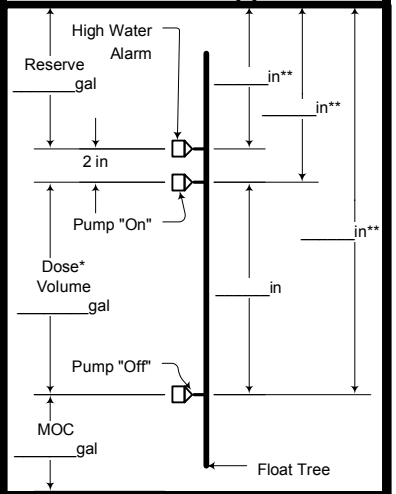
Demand Dosing

Dose Volume Delivered (Based on float settings)	**gal**
Drainback Volume	**gal**
Net Dose Volume	**gal**

Timed Dose Application



Demand Dose Application



***Water level MUST be within this capacity for 1) Pump drawdown test; 2) Gate valve adjustment; 3) Squirt height check**
****These dimensions measured from the "Top of the Tank Lid" or "Top of the Tank Lip"**
***** Volumes may be reduced according to Section 3.4.4**

Pump#2 (Second Pump in Treatment Train)

Dosing Application	**Timed**	**Demand**	
Tank Make/Model		**(**	**gal/in)**
Pump Make/Model			

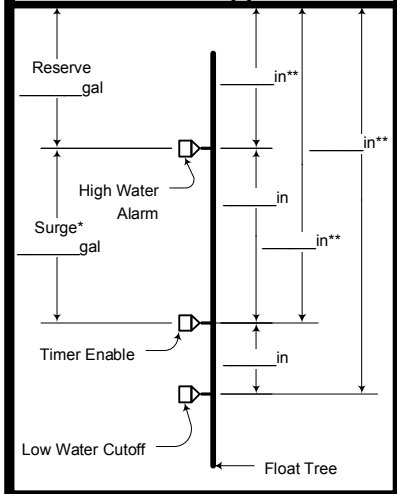
Timed Dosing

Surge Capacity [0.80 x DDF]* **	Minimum	Set At	**gal**
Timed Drawdown Flow Rate, (gal/min)	Q=		**gal/min**
Timer Setting Pump Run, (min)	T=		**min**
Dose Volume Delivered by Pump [Q x T]			**gal**
Drainback Volume			**gal**
Net Dose Volume			**gal**

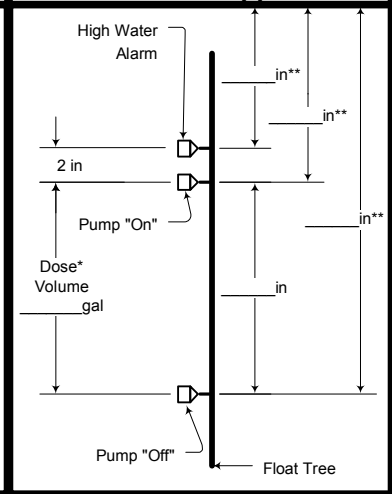
Demand Dosing

Dose Volume Delivered (Based on float settings)	**gal**
Drainback Volume	**gal**
Net Dose Volume	**gal**

Timed Dose Application



Demand Dose Application



***Water level MUST be within this capacity for 1) Pump drawdown test; 2) Gate valve adjustment; 3) Squirt height check**
****These dimensions measured from the "Top of the Tank Lid" or "Top of the Tank Lip"**
***** Volumes may be reduced according to Section 3.4.4**

HAMILTON COUNTY GENERAL HEALTH DISTRICT
Division of Water Quality

Installer Generated Documentation

Title: **Dose Worksheets**

Drawn By:	Date:	Revision #:
CMG	2/2/05	3.0

Owner/Installer Replacement System Interview and Sign Off Form

The following problems have come up on previous repairs or replacements of Household Sewage Treatment Systems (HSTS) throughout the County. These situations have created unnecessary call-backs, nuisance alarms, and very costly newly installed system replacements. As a result, the Health District requires that the installer must interview the homeowner before the replacement system is given final approval. The following list includes situations that must be identified and eliminated by the homeowner. Your installer, or other qualified professional, may help you in this process. Once all of the items on the list have been addressed, you and your installer must sign the bottom of this form, acknowledging that the appropriate corrective actions have been taken. This form must then be given back to the Health District. The intent of this exercise is to ensure that your new HSTS will not be unnecessarily overloaded, creating premature system failure or nuisance conditions.

- ☐ I/we have identified and fixed, if present, any leaking pipes in the building sewer, allowing groundwater infiltration into the house drain and ultimately the HSTS.
- ☐ I/we have verified and have taken corrective actions, if necessary, ensuring that all piping tied into the HSTS is from household wastewater sources.
- ☐ I/we have verified and have taken corrective actions, if necessary, to ensure that all sources of wastewater are routed to the HSTS. (applicable permits obtained, for example a plumbing permit)
- ☐ I/we have verified and have taken corrective actions, if necessary, to ensure no downspouts, foundation drains, clear water sumps, and/or other non-wastewater sources are routed to the HSTS.
- ☐ I/we have verified and have taken corrective actions, if necessary, to reroute downspouts, foundation drains, and/or other non-wastewater source outlets away from the new sewage system.
- ☐ I/we will have the building sewer line replaced, back to the exit of the house, or as close as practically possible.
- ☐ I/we have verified and have taken corrective actions, if necessary, to fix any leaking plumbing fixtures in the dwelling. (Faucets, toilets, etc.)
- ☐ I/we have verified that any watersoftners within the dwelling are set so that the backwash waters will not make the household's wastewater volume exceed the average design flow rate of the sewage system.

_____ _____

Installer's Signature Date Homeowner's Signature Date

_____ _____

Printed Name Printed Name

25 Appendix 25.0 References

AK Industries, Inc. 2001. *AK Industries: Plastic Sewage Tank Installation Procedures*. Plymouth, Indiana.

ASTM. 2003. *Standard Specifications for Concrete Aggregate. C-33.* American Society of Testing and Materials. ASTM C33-03. West Conshohocken, Pennsylvania

ASTM. 2003. *Standard Specification for Precast Concrete Septic Tanks*. American Society of Testing and Materials. ASTM C1227-03 West Conshohocken, Pennsylvania.

Advanced Drainage Systems, Inc. *SB_2 Installation Guidelines*. Columbus, Ohio.

Advanced Drainage Systems, Inc. *N-12 Sanitary Pipe Products*. Columbus, Ohio.

Advanced Drainage Systems, Inc. *Nonwoven Geotextile Products*. Columbus, Ohio.

American Manufacturing Company, Inc. 2002. *Perc-Rite Wastewater Drip Dispersal Systems: Designer's Guide*. Manassas, Virginia.

American Manufacturing Company, Inc. 2004. *American Septic Drip Distribution Installer's Guide - Draft*. Manassas, Virginia.

Amerson, R., Tyler, E.J., and Converse, J.C. 1991. *Infiltration as Affected by Compaction, Fines, and Contact Area of Gravel.* Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan

Auger, R., Chenier, R., and Roy, C. 1998. *Use of Non-Woven Fabric in Intermittent Filters.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Ball, H.L. 1991. *Sand Filters: State of the Art and Beyond*. Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Ball, H.L. 1994. *Sand Filters and Shallow Drainfields*. Orenco Systems, Inc., Sutherlin Oregon.

Ball, H.L. 1995. *Pressure Dosing: Attention To Detail*. Orenco Systems, Inc., Sutherlin Oregon.

Ball, H.L. 1995. *Nitrogen Reduction in an Onsite Trickling Filter/Upflow Filter System.* Orenco Systems, Inc. Sutherlin, Oregon.

Ball, H.L. 1996. *Design, Use and Installation of Dosing Siphons for Onsite Wastewater Treatment Systems*. Orenco Systems, Inc., Sutherlin Oregon.

Ball, H.L., Gaddy, B.S., and Weaver, C.P. 1998. *Effects of Media Variations on Intermittent Sand Filter Performance.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Ball, H.L. 1999. *Orenco Automatic Distributing Valve Assemblies For Wastewater Effluent Systems*. Orenco Systems, Inc., Sutherlin Oregon.

Benson, R.A., and Griffith, C.M. 2001. *Modified Mounds on Soils with Slow Permeability and Shallow Seasonal Water Tables.* Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Benson, R.A., and Griffith, C.M. 2002. *Alternative Technology Specification and Guidance Manual*. Clermont County General Health District. Batavia, Ohio.

Bohrer, R. M. and Converse, J. C. 2001. *Soil Treatment Performance And Cold Weather Operations Of Drip Distribution Systems.* Publication 10.24. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Bord Na Móna. 1998. *Puraflo Peat Biofilter for Wastewater Treatment: Design Reference Material For Single Family Systems*. Greensboro, North Carolina.

Bord Na Móna. 1998. *Puraflo Peat Biofilter for Wastewater Treatment: Installation Reference Material For Single Family Systems*. Greensboro, North Carolina.

Bounds, T.R. 1987. *Glide Audit 1986-1987: Summary of Sludge and Scum Accumulation Rates*. Orenco Systems, Inc. Sutherlin, Oregon.

Bounds, T.R. 1994. *Septic Tank Sizes For Large Flows*. Proceedings of the Seventh National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Bounds, T.R. 1994. *Septic Tank Septage Pumping Intervals*. Proceedings of the Seventh National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Bounds, T.R. 1995. *Pumps, Controls, and Regulations*. Orenco Systems, Inc. Sutherlin, Oregon.

Bounds, T.R. 1998. *Design Criteria for Recirculating Sand Filters*. Orenco Systems, Inc. Sutherlin, Oregon.

Bounds, T.R. 1998. *Performance of Textile-Based Packed Bed Filters*. Orenco Systems, Inc. Sutherlin, Oregon.

Bounds, T.R., and Ball, H.L. 1998. *Septic Tank Effluent Pump Systems*. Orenco Systems, Inc. Sutherlin, Oregon.

Bounds, T.R. 2002. *Design and Performance of Septic Tanks*. Site Characterization and Design of Onsite Septic Systems ASTM STP 901. ASTM, Philadelphia, Pennsylvania.

Brown, L.C. 1999. *Soil Properties Important for Irrigation*. Bulletin OAWMGWG No. 5-3/1999. The Ohio State University.

Clermont County General Health District. 1993-2000. *Construction Specifications and Inspection Checklists for Household Sewage Disposal Systems in Clermont County, Ohio*. Batavia, Ohio.

Coate Concrete Products, Inc. 2004. *Coate Standards For Installation of Sewage Tanks*. West Milton, Ohio.

Converse, J.C., and Tyler, E.J., 1989 *Inspecting and Troubleshooting Wisconsin Mounds*. Publication G3406. Agricultural Publications. Wisconsin, Madison.

Converse, J.C., Tyler, E.J., and Peterson, J.O. 1990. *The Wisconsin At-Grade Soil Absorption System Siting, Design, and Construction Manual*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C., Kean, M.E., Tyler, E.J., and Peterson, J.O. 1991. *Bacterial and Nutrient Removal in Wisconsin At-Grade Onsite Systems.* Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Converse, J.C., and Tyler, E.J. 1994. *Soil Acceptance on Onsite Wastewater as Affected by Soil Morphology and Wastewater Quality*. Proceedings of the Seventh National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Converse, J.C., Tyler, E.J., and Peterson, J.O. 1996. *Aerobic Systems for Onsite Treatment of Domestic Wastes. Publication 16.2*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C. 1996. *Changes to Modified Mounds*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C., 1996-2004. *Personal Communications*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C., and Tyler, E.J. 1998. *Soil Treatment of Aerobically Treated Domestic Wastewater with Emphasis on Modified Mounds.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Converse, J.C. 1999. *Mound Systems For Onsite Wastewater Treatment and Dispersal*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C. 2000. *Pressure Distribution Design Based on Comm 83*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C. 2000. *Pressure Distribution Design Based on Orifice Area (6 and 12ft^2 Per Orifice)*. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C. 2000. *Pressure Distribution Network Design*. Publication 9.14. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Converse, J.C., and Tyler, E.J. 2000. *Wisconsin Mound Soil Absorption System Siting, Design, and Construction Manual*. Publication 15.24. The University of Wisconsin-Madison. Small Scale Waste Management Project.

Crites, R. and G. Tchobanoglous. 1998. *Small and Decentralized Wastewater Management Systems*. The McGraw-Hill Companies. Boston, Massachusetts.

D'Amato, V.A. and Devkato, I.C. 1998. *Development of Prefabricated Septic and Pump Tank Construction and Installation Standards for North Carolina*. Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Darby, J.L., Asri Nor, M., Mociolek, D., and Tchobanoglous, G. 1996. *Shallow Intermittent Sand Filteration: Performance Evaluation*. The Small Flows Journal. 2(1):3-15.

Darby, J.L., Emerich, R.W., Manning, J., and Tchobanoglous, G. 1999. *Impact of Bacteria and Dosing Frequency on the Removal of Virus within Intermittently Dosed Biological Filters*. The Small Flows Journal. 1(1):36-41.

Dycom Corp. 2004. *Puraflo Peat Biofilter for Wastewater Treatment: Installation Reference Material For Single Family Systems (Local Procedures)*. Amelia, Ohio.

Emerick, R.W., Test, R.M., Tchobanoglous, G., and Darby, J. 1997*. Shallow Intermittent Sand Filtration: Microorganism Removal*. The Small Flows Journal. 3(1):12-22.

Frazier, A. 2003. *Correspondence Regarding the use of Hydraulic Cement as a Permanent Concrete Sealant*. Municipal and Concrete Sealing Products, Inc. Cincinnati, Ohio.

Goff, R.L., Gross, M.A., Paul, J.T., and Rutledge, E.M. 2001. *Using Drains Between Renovation Trenches to Lower a Seasonal Water Table*. Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Gross, M.A. and Vanlandingham, D.S. 1998. *Contaminant Distribution in Intermittent Sand Filters.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Gufstason, R., Mancl, K., and Kang, K.W. 2004. *Draft Mound System: Pressure Distribution of Wastewater. Design and Construction In Ohio*. Ohio State University. Columbus, Ohio.

Hamilton County General Health District. 2002. *Sanitary Regulation 529*. Cincinnati, Ohio.

Hamilton County General Health District. 1994. *The Household Sewage Disposal Manual: An Interpretive and Technical Guide for Hamilton County, Ohio*. Cincinnati, Ohio.

Infiltrator System, Inc. 2000. *Septic Installation Instructions For Equalizer Chambers*. Old Saybrook, Connecticut.

Infiltrator System, Inc. 2000. *Performance Research on Infiltrator Aggregate Free Chamber Systems*. Old Saybrook, Connecticut.

International Code Counsel (ICC). 2000. *International Private Sewage and Disposal Code.* Falls Church, Virginia.

International Code Counsel (ICC). 2000. *International Plumbing Code.* Falls Church, Virginia.

J.K. Precast. 2004. *Installation Standards For Concrete Tanks*. Washington Court House, Ohio.

Loudon, T.L., and Bernie, G.L. 1991. *Performance of Trenches Receiving Sand Filter Effluent in Slowly Permeable Soils.* Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Loudon, T.L., Miller, P., and Mokma, D.L. 2001. *Rationale for Shallow Trenches in Soil Treatment Systems*. Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Mancl, K. and Slater, B. *Why Do Septic Systems Malfunction?* Bulletin AEX-741-00. Ohio State University Extension. Columbus, Ohio.

Mancl, K., and Gustafson, R. 1992. *Mound Systems: Pressure Distribution of Wastewater.* Bulletin 829. Ohio State University Extension. Columbus, Ohio.

Mancl. K. 2000. Managing Septic Tank-Mound Systems. Bulletin AEX-753. Ohio State University. Columbus, Ohio.

Mancl, K., and Chen, C.L. 2004. *Mound Systems For Onsite Wastewater Treatment Siting, Design and Construction in Ohio.* Bulletin 813. Ohio State University Extension. Columbus, Ohio.

Metcalf and Eddy, Inc. 1991. *Wastewater Engineering: Treatment, Disposal, and Reuse. 3rd Ed*. The McGraw-Hill Companies. New York, New York.

National Electric Code. 2002. National Fire Protection Association, Quincy, Massachusetts.

National Precast Concrete Association. *Septic Tank Manufacturing: Best Practices Manual*. Indianapolis, Indiana.

National Weather Service, National Oceanic and Atmospheric Administration. 2000. *Geographic Areas Frost Penetration Diagram*. Washington, DC.

Netafim USA. 2001. *Bioline Design Guide: Drip Disposal of Highly Treated Effluent*. Fresno, California.

Nolte, B.H. and Fausey, N.R. *Soil Compaction And Drainage*. Bulletin AEX-301. Ohio State University Extension. Columbus, Ohio.

NOWRA. 1995. *Mound Troubleshooting*. Onsite Insight. Edgewater, Maryland.

Ohio Administrative Code. 1977. *Household Sewage Disposal Rules, Chapter 3701-29-01 to 3701-29-21*. Ohio Department of Health. Columbus, Ohio.

Ohio Administrative Code. 2002. *Water Standards, Chapter 3745*. Ohio Environmental Protection Agency. Columbus, Ohio.

Ohio EPA. 1993. *Sewage: Collection, Treatment and Disposal: Where Public Sewers are not Available*. Columbus, Ohio

Ohio State Department of Health. *An Interpretive Guide To Home Sewage Disposal Rules 3701-29-01 to 3701-29-21 Inclusive of the Ohio Administrative Code*. Columbus, Ohio.

Ohio State Department of Health. *2001. Technical Guidelines for the Use of Advanced Technologies in Ohio*. Columbus, Ohio.

Orenco Systems, Inc. *Unpublished Research on Orifice Wetting Patterns Through Two Feet of Sand*. Sutherlin, Oregon.

Orenco Systems, Inc. 1992. *Method For Determining Total Headloss in a Pressure Laterals*. Sutherlin, Oregon.

Orenco Systems, Inc. 1995. *Determining the Programmable Timer Settings for a Sand Filter Control Panel*. Sutherlin, Oregon.

Orenco Systems, Inc. 1996-2004. *Personal Communications*. Sutherlin, Oregon.

Orenco Systems, Inc. 1998. *Pea Gravel Gradation Range for Supporting Sand Filter Media*. Sutherlin, Oregon.

Orenco Systems, Inc. 1999. *Biotube Effluent Filter Sizing*. Sutherlin, Oregon.

Orenco Systems, Inc. 1999. *Sand Gradation Range for Intermittent Sand Filter Systems Loaded up to 1.25gal/ft^2*. Sutherlin, Oregon.

Orenco Systems, Inc. 2002. *Installation Guide: Intermittent Sand Filters Systems*. Sutherlin, Oregon.

Orenco Systems, Inc. 2003. *Installation Guide: AdvanTex –AX Treatment Systems.* Sutherlin, Oregon.

Orenco Systems, Inc. 2003. *Fiberglass Tanks: Approvals Package*. Sutherlin, Oregon.

Orenco Systems, Inc. 2004. *Product Fact Sheet: Filter Facts…Hard Facts.* Sutherlin, Oregon.

Otis, R.J. 1998. *Decentralized Wastewater Treatment: A Misnomer.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Rains, M. 2001. *Effect of Orifice Plugging on Pump Run Time and Residual Pressure in Pressure Distribution Systems – Draft*. Orenco Systems, Inc. Sutherland, Oregon.

Siegrist, R.L. 1987. *Hydraulic Loading Rates for Soil Absorption Systems Based on Wastewater Quality.* Proceedings of the Fifth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Siegrist, R.L. 1987. *Soil Clogging During Subsurface Wastewater Infiltration as Affected by Effluent Composition and Loading Rate*. Journal of Environmental Quality. 16(2). 181-187.

Sievers, D.M. 1998. *Pressurized Intermittent Sand Filter with Shallow Disposal Field for a Single Residence in Boone County, Missouri.* Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Tuf-Tite, Inc. *Drop Box Distribution Systems: Installation and Use*. Wauconda, Illinois.

Tyler, E.J. 2001. *Hydraulic Wastewater Loading Rates to Soil*. Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

Tyler, E.J. 2001. *A Model for Soil Oxygen Delivery to Wastewater Infiltration Surfaces*. Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. ASAE, St. Joseph, Michigan.

US EPA. 1980. *Design Manual-Onsite Wastewater Treatment and Disposal Systems.* EPA 625/1-80-012. Municipal Environmental Research Laboratory, Cincinnati, Ohio.

US EPA. 1997. *Response to Congress on Use of Decentralized Wastewater Treatment Systems.* U.S. Environmental Protection Agency, Office of Water, Washington, DC.

US EPA. 2002. *Onsite Wastewater Treatment Systems Manual.* EPA 625 EPA/625/R-00/008. National Risk Management Research Laboratory, Cincinnati, Ohio.

USDA, Soil Conservation Service, 1975. *Soil Survey of Clermont County, Ohio*. Washington DC.

USDA, Soil Conservation Service, 1992. *Soil Survey of Hamilton County, Ohio*. Washington DC.

USDA, Soil Conservation Service, 1993. *National Soil Survey Handbook*. Title 430-VI. Washington DC.

Washington State Department of Health, Office of Environmental Health and Safety. 2000. *Intermittent Sand Filter Systems: Recommended Standards and Guidance For Performance, Application, Design, Operation, and Maintenance*. Olympia, Washington.

Wisconsin Department of Commerce. 1998. *Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems*. Division of Safety and Buildings. Publication SBD-10573-P (R.12/98). Wisconsin, Madison.

Wisconsin Administrative Code. 2000. *Private Onsite Sewage Systems.* Comm 83. State of Wisconsin Department of Commerce, Bureau of Plumbing, Safety, and Building Division. Madison, Wisconsin.

Xerxes Corp. 2002. *Xerxes RST –II Installation Instructions: 1500 Gallon and 1000 Gallon Residential Septic Tanks. Minneapolis, Minnesota.*

Xerxes Corp. 2002. *Xerxes Tank Backfill Guidelines. Minneapolis, Minnesota.*

Zabel Environmental Technology. Zabel Zone. 1999 Zabel Filter Test Reports. Zabel Zone. Fall Edition. p.63. Crestwood, Kentucky.

Zabel Environmental Technology. 2003. *Tech Data – Effluent Filters (A300^{TM} – 12 Series). Crestwood, Kentucky.*

Zoeller Company. Onsite Products. *Zoeller Recirculating Media Filter Packages*. Louisville, Kentucky.

Zoeller Company. Onsite Products. *Various Product Installation Guidelines*. Louisville, Kentucky.

Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W