

*Recommended Standards and Guidance for Performance,
Application, Design, and Operation & Maintenance*

Alternating Drainfields

July 2012



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Preface

The recommended standards contained in this document have been developed for statewide application. Regional differences may, however, result in application of this technology in a manner different than it is presented here. In some localities, greater allowances than those described here may reasonably be granted. In other localities, allowances that are provided for in this document may be restricted. In either setting, the local health officer has full authority in the application of this technology, consistent with Chapter 246-272A WAC and local jurisdictional rules. If any provision of these recommended standards is inconsistent with local jurisdictional rules, regulations, ordinances, policies, procedures, or practices, the local standards take precedence. Application of the recommended standards presented here is at the full discretion of the local health officer.

Local jurisdictional application of these recommended standards may be:

- 1) **Adopted as part of local rules, regulations or ordinances** - When the recommended standards, either as they are written or modified to more accurately reflect local conditions, are adopted as part of the local rules, their application is governed by local rule authority.
- 2) **Referred to as technical guidance in the application of the technology** - The recommended standards, either as they are written or modified to more accurately reflect local conditions, may be used locally as technical guidance.

Application of these recommended standards may occur in a manner that combines these two approaches. How these recommended standards are applied at the local jurisdictional level remains at the discretion of the local health officer and the local board of health.

The recommended standards presented here are provided in typical rule language to assist those local jurisdictions where adoption in local rules is the preferred option. Other information and guidance is presented in text boxes with a modified font style to easily distinguish it from the recommended standards.

Glossary of Terms: A glossary of common terms for all RS&Gs can be found on the DOH Web site at <http://www.doh.wa.gov/Portals/1/Documents/Pubs/337-028.pdf>.

The recommended standards contained in this document have been primarily written to support the design of on-site sewage systems with design flows less than 3500 gpd, but may also be applied to large on-site sewage systems (LOSS).

With the adoption of the revised LOSS rule, chapter 246-272B WAC, in 2011, some provisions of the RS&Gs may not be appropriate or allowed for LOSS. Many applicable requirements from the RS&Gs have already been included in the LOSS rule. Design engineers and others interested in LOSS are directed to consult the rule and LOSS program staff before or instead of the RS&Gs.

Typical RS&G Organization:

Standards Section	Explanation
Performance	How this technology is expected to perform (treatment level and function).
Application	How this technology is to be applied. This section includes conditions that must be met prior to proceeding with design. Topics in this section describe the “approved” status of the technology, component listing requirements, permitting, installation, testing and inspection requirements, etc.
Design	How this technology is to be designed and constructed (includes minimum standards that must be met to obtain a permit).
Operation and Maintenance	How this technology is to be operated and maintained (includes responsibilities of various parties, recommended maintenance tasks and frequency, assurance measures, etc).
Appendices	Design examples, figures and tables, specific applications, and design and installation issues.

Introduction

Typical on-site sewage systems consist of a septic tank and a gravity flow, gravel-filled drainfield, with a designated drainfield replacement area set aside and protected for future use. Effluent from the septic tank is distributed to the drainfield, where it is dispersed to, and is treated in, the soil. Wastewater treatment in the soil is enhanced when flow through the soil occurs in unsaturated conditions. Bacteriological treatment occurs mostly on the surface of soil particles. When wastewater flow occurs in saturated conditions, the space between soil particles is occupied by wastewater, some of the wastewater travels faster, farther, and deeper. These conditions reduce the treatment capacity of this soil-based on-site sewage treatment system.

The rate of wastewater infiltration into the soil depends upon the volume and character of the wastewater, as well as the texture and structure of the soil. Depending on the interplay of these factors a biomat begins to form at the soil interface. This is a normal condition that occurs over time in nearly all drainfields, with both positive and negative impacts.

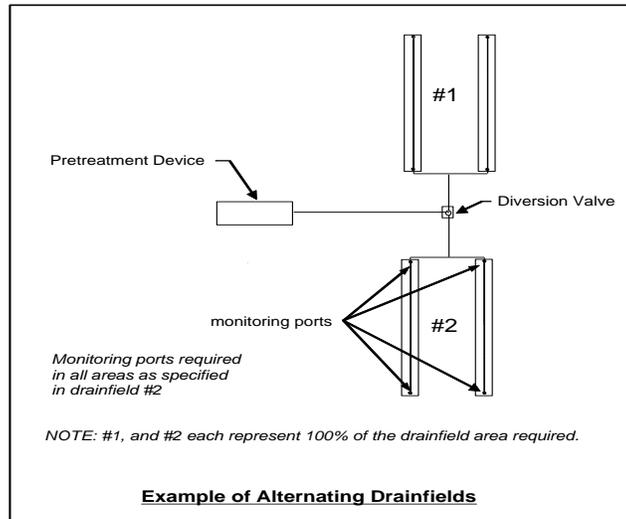
The general pattern of biomat development begins when the combination of wastewater flow and the load of suspended solids overwhelm the infiltrative capacity of the soil at the bottom of the trench. Wastewater accumulates or ponds above the infiltrative surface, inducing a zone of anaerobic conditions, leading to biomat development. This is a progressive event, leading in time to the development of a flow-restricting biomat over the entire trench-bottom infiltrative surface. As ponding continues to increase, the trench sidewall infiltrative surfaces become involved with the biomat development and the resulting regulation of wastewater flow into the surrounding soil. The anaerobic conditions induced by the ponding wastewater contribute to a thicker, denser biomat, which in turn further retards wastewater flow. In most drainfields a point of equilibrium is achieved, with a well-developed biomat that is in balance with the wastewater flow into the system and the soil which surrounds the drainfield. Over time, however, this condition of equilibrium may be upset, resulting in drainfield failure.

On the positive side, the developing biomat retards the flow of wastewater, contributing to unsaturated soil conditions below the drainfield, which are conducive to improving wastewater treatment. Without an established biomat to regulate wastewater flow into the surrounding soil, saturated flow conditions exist at and below the drainfield trench bottom infiltrative surface. These saturated flow conditions, as explained above, reduce the treatment efficiency of the soil below and around the drainfield. On the negative side, particularly in finer textured soils, the biomat can become so restrictive the drainfield exhibits continual and increasing ponding conditions that may result in drainfield failure.

Integrating the design elements of alternating drainfields into an on-site sewage system provides at least two normally sized drainfields, separated by a switching valve so that each drainfield can alternately be used and rested. These two drainfields constitute the initial and replacement drainfields, eliminating the need to designate an additional reserve area. Periodically the valve is switched and the second drainfield is placed into use while the first one is allowed to rest. This resting period allows the drainfield to completely drain and the biomat at the soil interface to dry.

Aerobic conditions then exist aiding the oxidation of the biomat, allowing the soil to renew its absorptive capacity. (See Figure 1)

Figure 1. Alternating Gravity-flow Drainfield



The goal of all on-site sewage systems is to provide wastewater treatment for the life of the facility served. Managing the development and existence of the biomat in the drainfield can contribute greatly to both the treatment performance and the lifespan of the drainfield system. The value of the alternating drainfield design is more easily realized in fine textured soils, Soil Types 3 through 6, as opposed to the coarser textured soils, Soil Types 1, and 2. The use of alternating drainfields in coarse soils may be counter-productive, particularly in terms of wastewater treatment. The development of a biomat in the drainfield is a positive condition even though too much of good thing can lead to problems. In coarse-textured soils the biomat is much slower to develop than in fine textured soils. During the time it takes to develop a biomat in coarse soils, wastewater flow in the soil below the drainfield is often under saturated flow conditions, which reduce the wastewater treatment capacity of the system. If alternating drainfields are used in this setting, an annual succession of slowly developing biomats can ensue in each of the drainfields. The two drainfields perform well hydraulically (disposing of the wastewater) but poorly in terms of treating the wastewater.

One approach to addressing the slow or poor development of a flow-restricting biomat in medium-to-coarse soils is the use of pressure distribution. The design nature of pressurized drainfield systems, that of frequent dosing of small volumes of wastewater uniformly throughout the drainfield, simulates the flow-restrictive nature of a well-developed biomat. This is why in coarse soils the on-site rules require the use of pressure distribution: the mechanical system of pressurizing and dosing replaces the biomat as a flow regulator in these soils where the natural development of a biomat is slow and unsure. For long-term management of wastewater treatment and disposal, alternating drainfields link very well with pressure distribution.

In all soil conditions the frequency of valve switching depends upon the rate of biomat development, which in turn is dependent upon biological load and hydraulic flow of the wastewater being treated and disposed at the site. As mentioned earlier a well-developed, flow-regulating biomat is an important element in the treatment capacity of the on-site sewage system drainfield. This is particularly true in systems using gravity flow distribution, less true in systems using pressure distribution. Generally, a biomat will form more slowly in coarse soils and when the hydraulic or biologic load on the system is low. When the soils are of a finer texture or when the hydraulic or biologic load on the system is high, the biomat will form more quickly. In any case, proper management of the biomat -development, existence, and resting/drying- is based upon observations of the drainfield ponding levels. These routine observations will lead the operator to select a valve switching schedule or frequency that matches the particular system site, soil, and wastewater characteristics. Such an approach, depending upon conditions, could result in a relatively frequent valve switching cycle (every six months) to a relatively infrequent valve switching cycle (every 3 or 4 years).

The alternating drainfield system incorporates two elements of equal importance: 1) the physical capacity to switch from one drainfield to another, and 2) operation and maintenance of the system, regularly observing the condition of the biomat and ponding levels. Together these elements allow for complete long-term management of wastewater treatment and disposal. Contrast this with the steps of the more common approach to long-term management of septic tank and drainfield systems:

1. The on-site sewage system, with the initial drainfield and replacement drainfield area designed, is installed and put into use.
2. The system is used, hopefully properly operated and maintained, and over time (hopefully greater than 15 years), the capacity of the drainfield to infiltrate wastewater into the soil is exceeded, due largely to biomat development that restricts wastewater flow to a degree that upsets the system equilibrium.
3. The reserve area is used for the installation of a repair/replacement drainfield. The initial drainfield is abandoned. (Commonly involving great expense and the destruction of long-established landscaping and plants, shrubs and trees.)
4. Step 2 is repeated.

When alternating drainfields are properly managed the long-term treatment performance and disposal capacity of the system is enhanced. An additional advantage of alternating drainfields is that by initially installing both drainfields and alternating their use (synonymous with the initial and the replacement drainfields in the scenario described above), future expensive system repair/replacement and the negative impact to landscape, turf, shrubs and trees is avoided.

A word of caution may be in order here, in that if alternating drainfields are managed in the same way as the four steps above describe for the typical approach to long-term management of septic

tank and drainfield systems, the results will be the same. That is if the first drainfield is used until it fails at which time the second is put into service, rather than applying prudent on-going monitoring and maintenance and management of wastewater flow to the drainfields, the system owner is robbed of the system's inherent design benefits. There is a functional (and probably a significant lifespan) difference between installing and properly operating alternating drainfields and simply "pre-installing" the repair/replacement drainfield. For this reason in those settings where the initial and replacement drainfields are installed together, operating the two-drainfield system as alternating drainfields is preferred. This approach may also decrease the potential for detrimental uses of the reserve drainfield area over time if the second drainfield is not placed into regular/sequential service.

1. Performance Standards

Alternating drainfields provide an on-site sewage treatment and disposal system with the capacity to alternately use one of two drainfields installed as the initial system. Each of the two component drainfield parts are designed, sized and installed to treat and dispose of the anticipated daily sewage flow and incorporate a means of diverting flow to either one (not both) of the drainfields. Operation and maintenance of the system includes the evaluation of when to switch from one field to the other as a means to manage the biomat at or near equilibrium (of wastewater into and out of the drainfield).

2. Application Standards

2.1 Soil Type Conditions

Alternating drainfields may be used:

- 2.1.1 In Soil Types 3 through 6, with either gravity or pressure distribution.
- 2.1.2 In Soil Types 1 & 2, only with pressure distribution. (Pretreatment to Treatment Levels A or B may be required. WAC 246-272A-0230 and -0234.)

2.2 Influent Characteristics

- 2.2.1 Residential Wastewater: Alternating drainfields are designed for treating residential strength wastewater. The wastewater applied to drainfields must not be higher in strength than 125 mg/l CBOD₅, 80 mg/l TSS, and 20 mg/l O&G. Lowering wastewater strengths, without increasing flow rates is preferable for assuring long term operation of a drainfield system.
- 2.2.2 Non-Residential Wastewater: High-strength wastewater and wastewater from non-domestic sources (such as restaurants, hotels, bed and breakfast establishments, and other commercial wastewater sources, etc.) must be individually evaluated for treatability and degree of pretreatment required prior to distribution to the alternating drainfields for final treatment and disposal.

2.3 Pretreatment

- 2.3.1 If the wastewater is residential sewage, settleable and floatable solid separation by a properly sized two-compartment septic tank with effluent baffle screening will suffice. All septic tanks must be designed in compliance with Washington State On-Site Sewage System Regulations (WAC 246-272A and WAC 246-272B) and the Recommended Standards and Guidance for On-site Sewage System Tanks. Pretreatment with some other approved sedimentation/initial treatment unit (such as an ATU—Aerobic Treatment Unit) may be used instead of a septic tank.
- 2.3.2 If the wastewater is from a non-domestic source, influent to the alternating drainfield must be equivalent to residential strength septic tank effluent. Aerobic treatment or some other treatment process may be needed to modify the influent to the drainfields to within the range of residential septic tank effluent quality.

2.4 Listing

Because an alternating drainfield is a public domain distribution technology [See WAC 246-272A-0100(2)], not one used to meet any of the treatment levels specified in WAC 246-272A, it is not listed in the department's List of Registered On-site Treatment and Distribution Products. However, alternating drainfields may still be permitted by local health officers because of this Recommended Standard and Guidance document.

2.5 Permitting

An installation permit and an operational permit (if required by the local health jurisdiction) must be obtained from the appropriate local health officer prior to installation and use. These permits or other system-related documents (such as inspection reports or as-built / record drawings & specifications) must include information about the need for routine operation and maintenance including annual inspection to properly manage the switching from one drainfield to another.

3. Design Standards

3.1. Drainfield Sizing

Each segment of an alternating drainfield (drainfield #1 and drainfield #2) must be sized at 100% of the drainfield required to match the estimated daily design flow with the Soil Type at the site.

3.2. Reserve Area

With the installation of two drainfields (#1 & #2), additional reserve area is not required.

3.3. Drainfield Type / Technologies

Either gravel-filled or gravelless drainfield technologies may be used in alternating drainfield systems.

3.4. Distribution Methods

Distribution requirements noted in WAC 246-272A-0230 (Table 6) and -0280 (Table 11) must be satisfied. Table 6 in WAC 246-272A-0230 shows that pressure distribution is required on most sites containing Soil Types 1 & 2 and in Soil Types 3 through 6 when vertical separation is less than three (3) feet. On site with conditions requiring a treatment technology that meets either Treatment Level A or B, pressure distribution with time dosing is required. For all repairs that must utilize Table 11 in WAC 246-272A-0280, pressure distribution with time-dosing is required. When pressure distribution is used, design information may be obtained in the DOH Recommended Standards and Guidance for Pressure Distribution Systems.

3.5. Effluent Screens

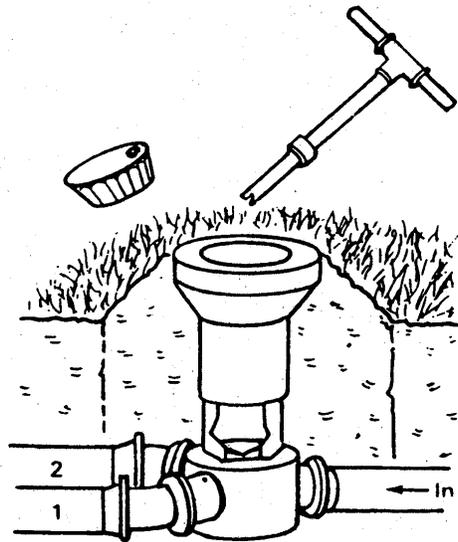
The septic tank must be fitted with an effluent screen to prevent the passage of suspended solids large enough to foul the diversion valve.

3.6. Diversion Valves

All diversion valves (see Figure 2) regardless of the type of distribution used (gravity or pressure) must:

- 3.6.1.** Provide for independent flow to drainfield #1 or #2, but not both.
- 3.6.2.** Be fitted with risers and watertight lids or covers, extending to grade, which will permit unobstructed access for maintenance, inspection, and operation.
- 3.6.3.** Have a valve box and either suitable length valve stems or long-handled keys or tools so that they may be easily operated from the ground surface.

Figure 2. Typical Diversion Valve



3.7. Observation Ports

Observation ports must be installed to the level of the trench-bottom infiltrative surface in each drainfield line so that the levels of ponding can be observed.

4. Operation and Maintenance Standards

4.1. General

- 4.1.1. The owner of the residence or facility served by the alternating drainfield system is responsible for assuring proper operation and providing timely maintenance for all components of the on-site wastewater treatment and disposal system.
- 4.1.2. The on-site wastewater system designer must instruct, or assure that instruction is provided to, the owner of the residence or facility regarding proper operation of the entire on-site wastewater system. This instruction should emphasize regular observation of the conditions of the drainfield (including observations of ponding levels within the drainfield lines).
- 4.1.3. Alternating drainfields must be monitored and maintained at a frequency commensurate with the site, soil, system complexity and use patterns.

4.2. O&M Activities

4.2.1. Septic and Pump Chamber Inspection Items

- 4.2.1.1. Observe sludge and scum accumulations; pump as necessary.
- 4.2.1.2. Check condition of effluent screen for clogging, damage, and proper placement. Clean each time it is inspected or as needed.
- 4.2.1.3. Look for signs of leaking in tanks and risers. Repair or replace if necessary.
- 4.2.1.4. Check that risers and lids are in good condition and that the lids are securely fastened.
- 4.2.1.5. If pressure distribution is used:
 - 4.2.1.5.1. Measure pump run time per cycle and drawdown. Compare with time recorded in as-built or record drawing.
 - 4.2.1.5.2. Test alarms for proper functioning (high and low liquid level).
 - 4.2.1.5.3. Check for properly function of floats. Movement should not be restricted. Floats should be positioned correctly and provide positive instrumentation signals. Adjust and repair as necessary.

4.2.2. Distribution Device Inspection Items - If a distribution box is used to distribute wastewater to individual lines in the drainfield, and if it is accessible, inspection must include the following items:

- 4.2.2.1. Uneven settling of d-box
- 4.2.2.2. Levelness of inverts of outlets of d-box
- 4.2.2.3. Uniformity of outlet flow of d-box

4.2.3. Diversion Valve Inspection Items - Check the diversion valve for proper placement to assure that wastewater is being diverted to the correct drainfield in proper sequential order.

4.2.4. Drainfield Protection Efforts

- 4.2.4.1. Assure that no surface water collects on the drainfield site.
- 4.2.4.2. Prohibit any type of vehicular or livestock traffic over the drainfield area.

4.2.4.3. Prohibit the construction of decks or buildings, or the placement of impervious materials or surfaces over the drainfield site.

4.2.4.4. Maintain a suitable, non-invasive shallow-rooted vegetative cover over the drainfield site.

4.2.5. Drainfield Inspection Items - Inspecting/observing the entire on-site sewage system must be done at least once a year. This may be done by the homeowner or other persons, depending upon the provisions of the local health jurisdiction permit. Items to look for include:

4.2.5.1. Indication of surfacing effluent.

4.2.5.2. Abnormal settling or erosion.

4.2.5.3. Ponding of wastewater in the drainfield (check via the Observation Ports).

4.3. Observed Conditions/Actions

The general system management approach to alternating drainfields is to switch from one drainfield to the other on a calendar basis, usually at the same time each year. However, if observations reveal continuous and increasing ponding levels that if left unresolved will probably result in drainfield failure, appropriate action must be taken. Appropriate action may include:

4.3.1. Switching from one drainfield to the other.

4.3.2. Modifications or changes within the structure relative to wastewater strength or hydraulic flows.

4.4. Routine Servicing

Servicing all system components as needed, including product manufacturer's requirements/recommendations for service.

Proper operation of an alternating drainfield system requires that the flow be diverted from one segment to the other. Each segment should be allowed to rest for periods of six to 12 months before being put back into use, depending upon the degree of biomat development, which is dependent on wastewater conditions of flow volume and strength, and the soil type present in the drainfield area. Records of inspections, dates of flow diversions, and system design should be kept in a location where they are easily retrievable.