THE
UPPER PENINSULA
ENVIRONMENTAL
HEALTH CODE

Adopted April 1, 2022

*Amended _____, 202_*

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THE UPPER PENINSULA ENVIRONMENTAL HEALTH CODE

Article I – Title, Purpose, Authority, Jurisdiction, and Administration

1-1 Title

These regulations shall be identified by the title "The Upper Peninsula Environmental Health Code."

1-2 Purpose

These regulations are hereby adopted for the purpose of protecting public health and safety and the quality of the environment as it affects human health and to prevent the occurrence of public health nuisances for all habitants of Luce, Mackinac, Alger and Schoolcraft Counties and persons entering therein.

1-3 Authority

The regulations imposed by this code are hereby adopted pursuant to authority conferred upon local health departments by Section 2435 (D) and Section 2441 (1) of the Michigan Public Health Code, Act 368, P.A. 1978 as amended. (Mich. Comp. Laws § 333.2435(d) and 333.441).

1-4 Jurisdiction

A. The LMAS District Health Department ("Department") and its duly appointed employees shall have jurisdiction throughout Luce, Mackinac, Alger and Schoolcraft Counties in all areas incorporated and unincorporated, which includes cities, villages, and townships for the administration and enforcement of these regulations.

B. Nothing herein contained shall be construed to restrict or abrogate the authority of any municipality in Luce, Mackinac, Alger, and Schoolcraft County to adopt more restrictive regulations or to enforce existing regulations relating to these regulations, control the issuance of licenses or the renewal or revocation thereof, or to charge and collect a fee, provided that whenever inspection relating to health and sanitation is required, no such municipality shall issue or renew such license without first having obtained a written statement from the LMAS District Health Department indicating compliance with the requirements of these regulations.

1-5 Right of Entry and Inspection

A. To assure compliance with the provisions of this regulation, the Department may conduct investigations which may include collecting samples, conducting tests, inspecting any matter, thing, premises, place, person, record, vehicle, incident, or event as provided for by Section 2446 of the Michigan Public Health Code, Act 368, P.A. 1978 as amended. (Mich. Comp. Laws § 333.2446).

B. It shall be unlawful for any person to molest, willfully oppose, verbally abuse, or otherwise obstruct the Department, or any other person charged with enforcement of these regulations, during, or as a result of performing, his or her professional duties.

C. The Department may request the assistance of law enforcement agencies when necessary to execute the Department's duty in a manner prescribed by law.

1-6 Interference with Notice

No person shall remove, mutilate, or conceal any notice or placard posted by the Department, except by permission of the Department.

1-7 Severability

If any section, subsection, clause or phrase of these regulations is for any reason declared unconstitutional or invalid, it is hereby provided that the remaining portions of these regulations shall not be affected.

1-8 Other Laws and Regulations

These regulations are supplemental to the Michigan Public Health Code, Act 368, P.A. 1978 as amended (Mich. Comp. Laws Ch. 333) and to other statutes duly enacted by the State of Michigan relating to public health and safety. These regulations shall be liberally construed for the protection of the health, safety, and welfare of the people of LMAS District Health Department and shall control and prevail over a less stringent or inconsistent provision enacted by a local governmental entity for the protection of public health.

For alternative methods of residential sewage treatment, including commercial systems discharging less than 1,000 gallons per day, a Minimum Requirements for Alternative On-Site Sewage Treatment Systems Manual ("Alternative Manual") has been developed for district wide application. The Alternative Manual is attached and incorporated herein as **Appendix A**. The

Alternative Manual is a working document, and modifications may be made as deemed necessary by the Department (defined below) as new or better technology and techniques in this industry emerge.

1-9 Fees

The Department reserves the right to set fee schedules, through approval by their governing board, to cover reasonable costs associated with the enforcement and administration of these regulations. All fee schedules existing prior to the adoption of these regulations shall remain in effect until revised.

1-10 Approval and Effective Date

These regulations were approved by action of the LMAS District Board of Health on October 4, 2021 and approved by action of the Luce County Board of Commissioners on November 16, 2021; the Mackinac County Board of Commissioners on November 23, 2021; the Alger County Board of Commissioners on November 8, 2021; and the Schoolcraft County Board of Commissioners on December 9, 2021 to become effective 45 days from this date.

1-11 Repeal of Previous Regulations

A. Previous regulations entitled "Superior Environmental Health Code for Luce, Mackinac, Alger and Schoolcraft Counties, Michigan" adopted by the LMAS District Board of Health on December 1, 1997 and approved by action of the Luce County Board of Commissioners on February 20, 1998; the Mackinac County Board of Commissioners on February 1, 1998; the Alger County Commissioners on February 27, 1998; and the Schoolcraft County Board of Commissioners on April 11, 1998 to become effective are hereby repealed.

B. Any other LMAS District Health Department regulations existing prior to the adoption of these regulations and in conflict with these regulations are hereby repealed.

C. No violation of any repealed regulation or portion thereof shall be made legal by virtue of the adoption of these regulations. Any act, situation, or condition which when created or first allowed to exist that was previously a violation shall continue to be a violation under these regulations. Any action or issuance of a permit that was previously mandatory shall continue under these regulations to be mandatory if a similar requirement is provided herein.

1-12 Power to Establish Policy and Guidelines

A. The Department is hereby granted the authority to adopt guidelines, not in conflict with the purpose and intent of these regulations, for the purpose of carrying out the responsibilities herein delegated to the Department by law and as necessary to conduct associated duties as required by contract with the State of Michigan.

B. All such guidelines shall be in writing and shall be kept in a policy file available for public inspection upon request.

1-13 Amendments

The Department, through approval by the LMAS District Board of Health and the Luce, Mackinac, Alger and Schoolcraft County Board of Commissioners, may amend, supplement, or change these regulations or portions thereof.

Article II – General Definitions

2-1 Interpretation

When not inconsistent with the context, words used in the present tense include the future, words in the singular number include the plural number, and words in the plural number include the singular. The word "shall" is always mandatory, and not merely directory. Words, terms, or expressions not defined herein shall be interpreted in the manner of their commonly accepted meanings, in accordance with Standard English usage.

2-2 Definitions

Approved	Acceptable for intended use as determined by the Department.
Board of Appeals	A board appointed by the Board of Health whose purpose is to hear, pass judgment, and make recommendations upon enforcement actions under these regulations that have been appealed above the Health Officer.
Board of Health	The Board approved by the Luce, Mackinac, Alger, and Schoolcraft County Board of Commissioners to sit as the LMAS District Board of Health.

Department	LMAS District Health Department having jurisdiction.
Dwelling	Any house, building, structure, tent, watercraft, shelter, mobile home, camper, vehicle, or portion thereof which is occupied or adopted in whole or in part as a home, residence, or living or sleeping place for one or more occupants.
Environmental Health	Per Mich. Comp. Laws § 333.12101, the area of activity that deals with the protection of human health through the management, control, and prevention of environmental factors, which may adversely affect the health of individuals. This activity is concerned with the existence of substances, conditions, or facilities in quantities, of characteristics, and under conditions, circumstances, or duration which are or can be injurious to human health.
Governing Board	The Board of Health and/or the Board of Commissioners to which the Department reports.
Habitable Building	Any building, or other place where occupants reside, are employed, or congregate, or any building adopted for such purposes.
Hazard	A condition or practice which could reasonably be expected to cause death, disease, or serious physical harm immediately or before the danger can be eliminated through normal enforcement procedures established in this code.
Health Officer	The administrative officer appointed by the local governing board who is responsible for the operations of the Department and the administration and enforcement of Michigan's Public Health Code, Act 368, P.A. 1978 as amended (Mich. Comp. Laws Ch. 333) and associated statutes within the legal jurisdiction of the Department. Health Officer also includes any employee or designee of the Department acting under the direction of the Health Officer during their normal course of duties.
His/He	Shall be construed as non-gender specific.
License	Includes the whole or part of a department permit, certificate, approval, registration, charter, or similar form of permission required by law.
Occupant	Those persons who occupy, live, habitually use, or otherwise are in possession of any property or premise.

Owner	Both the owner of title record, and those persons occupying or in possession of any property or premises, or their designated representative.
Person	Any individual, firm, partnership, party, corporation, company, society, association, local governmental entity, or other legal entity responsible for the ownership or operation of a premise, or an employee or officer thereof.
Permit	A written document issued and signed by the Health Officer which authorizes a person to construct, repair, or install an OSTDS or well.
Premises	A tract or parcel of land on which a habitable building or dwelling is, or would be, located and shall include the building or dwelling.

Article III – On-site Sewage Treatment and Disposal

3-1 Applicability

This article shall apply to single and two-family On-Site Sewage Treatment and Disposal Systems (OSTDS) and OSTDS other than private single or two-family residences, which utilize septic tanks and absorption systems for peak daily flows less than 1,000 gallons per day. Appeals on all sites which serve buildings other than single and two-family residences, including those with peak daily flows of less than 1,000 gallons per day evaluated under these regulations, shall be made to the Michigan Department of Environment Great Lakes and Energy or current State agency responsible under the Michigan Criteria for Subsurface Sewage Disposal, as written by the Division of Environmental Health, Bureau of Environmental and Occupational Health, Michigan Department of Public Health, April 1994, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State requirement.

3-2 Licensure

A. All OSTDS installers shall be licensed by the Department. No person shall install, alter, or repair an OSTDS unless they are a licensed sewage system installer.

B. Nothing in this code shall preclude a property owner, who is not a licensed OSTDS installer, from installing an OSTDS for his own use under a valid permit.

C. The Department shall have authority to promulgate standards for licenses, registrations, renewals, and examinations.

D. In developing minimum standards for licensing or registration, the Department shall consider equivalency and proficiency testing and where appropriate, grant credit for past training, education, or experience in related fields.

E. An individual shall not make a false representation or impersonation or act as a proxy for another individual in connection with an examination or application for licensure or registration or a request to be examined, licensed, or registered.

F. The Department shall issue a certificate of licensure or registration to an applicant who has satisfied all of the requirements set forth in this code.

G. To satisfy all of the requirements set forth in this code, an applicant shall complete a written exam proctored by an environmental health representative of the local health department. The exam may be taken at any of the local health department jurisdictions using the code.

H. Upon satisfactory completion of the exam, the results will be reviewed and incorrect answers discussed with the applicant. A passing score is 70%. A retest can be scheduled at the contractor's discretion.

I. Licenses will be valid for three years, starting with the calendar year in which the license is first issued. Licenses shall expire on December 31.

J. A licensee or registrant shall have available for inspection a certificate issued by the Department.

K. A separate license will be required for each local health department. A license is not transferable.

L. No person shall permit anyone to operate under his license without supervision by the licensee.

M. The Department may deny, suspend, revoke, or refuse to renew any license for fraud or deceit in obtaining the license or for violating, or aiding or abetting in a violation of this code.

N. An applicant or licensee may request an informal hearing in connection with the suspension, revocation, or denial of a license or registration in accordance with Article XVI.

3-3 Technical Definitions - On-site Sewage Treatment and Disposal

Absorption System	The part of an OSTDS in which septic tank effluent is distributed by arrangement of trenches or beds that allows

	the effluent to be absorbed and treated by the surrounding soil.
Absorption Bed	An absorption system with a minimum of two lateral lines in a distribution system wider than three feet installed below natural grade, at natural grade, or above natural grade on fill
Absorption Trench	An absorption system 12-36" inches in width with one distribution line and installed below grade. Native soils shall remain in place between trenches in multiple trench systems.
Alter	To change the design or location of an existing OSTDS or any part of a system.
Alternative On-Site Sewage Treatment System	Any OSTDS that is not a conventional sewage system and meets the requirements of the Alternative Manual attached and incorporated hereto as **Appendix A**.
Available Sewer	A public sewer that is physically and politically available, of acceptable design and capacity, within 200 feet of the proposed origin of sewage.
Cesspool	A pit which receives raw sanitary sewage, allows separation of solids and liquids, retains the solids, and allows liquids to seep into the surrounding soil through perforations in the lining.
Commercial Facility	Any structure or building, or any portion thereof, other than a single or two-family dwelling.
Conventional Sewage System	An OSTDS containing a septic tank used in conjunction with an absorption system.
Deep Cut	An excavation beginning at a depth of 6' feet below ground surface and extending to a depth not to exceed 12' feet below ground surface.
Distribution Pipe	Approved pipe used in the dispersion of septic tank effluent.

Drain A pipe or manmade conduit used to carry surface water or other liquid material via pressure or gravity.

Earth Pit Privy A structure used for the disposal of human waste which is discharged directly into the natural soils.

Effective Soil Depth The depth of soil material between the natural grade and the limiting zone suitable for the installation of an absorption system.

Effluent Partially treated sanitary sewage which is discharged from a septic tank or other sanitary sewage treatment system device.

Effluent Filter A commercially produced filter designed to be installed in the outlet of a septic tank, or other approved location, for the purpose of preventing the discharge of solid material from the septic tank to the absorption system.

Experimental System A developed method of on-site sewage treatment that has not been fully proven in field tests.

Failing System An OSTDS is considered to be failing if any one of the following conditions exists:

(1) The OSTDS fails to accept effluent at the rate of application.

(2) Sanitary sewage effluent seeps from, ponds on or around the OSTDS, or backs up into the structure.

(3) The Department has determined that the OSTDS has contaminated the groundwater, surface water, or a water supply.

(4) Any part of the OSTDS is bypassed; the system is the source of an illicit discharge; there is an absence of an absorption system and/or a septic tank, or there is a structural failure of a septic tank or other associated appurtenances.

(5) The OSTDS is creating or contributing to a threat to public health or the environment.

Fill and Fill Material	Soil that is placed beneath the absorption system of an OSTDS for the purpose of improving the infiltrative capacity of the native soil or to elevate the absorption system above a limiting layer to improve system performance. Fill shall consist of clean medium sand uncontaminated by other soil texture classes or debris of any kind, unless otherwise specified as part of a permit condition and approved by the Department.
Filter Fabric	A permeable geotextile fabric made with polymer used to impede or prevent the movement of sand, silt, and clay into aggregate/filter media.
Floodplain	A nearly level alluvial plain that borders a river, lake, or stream and is subject to flooding unless protected artificially.
Footer	That portion of the soil absorption system which interconnects the rear portion of the distribution line laterals.
Footing drains	A conduit installed around foundation footings to transport groundwater away from the foundation.
Fragipan	A loamy subsurface horizon with high bulk density relative to the horizon above, seemingly cemented when dry, and weakly to moderately brittle when moist. Fragipans are mottled and low in organic matter. They impede movement of water and air, and growth of plant roots.
Groundwater Table	The saturated zone which exists below the ground surface throughout the year.
Hardpan	A hardened layer in soil caused by cementation of soil particles with either silica, calcium carbonate, magnesium carbonate, or iron and/or organic matter. The hardness does not change appreciably with changes in moisture content. Hardpan impedes movement of water and air, and growth of plant roots.
Header	That portion of a soil absorption system which receives effluent from the septic tank and interconnects the front portion of the distribution line laterals.

Holding Tank	A watertight receptacle designed to receive and store sanitary sewage effluent to be pumped, hauled, and disposed of in an approved manner by a licensed septage hauler.
Install	To alter, construct, place, or repair an OSTDS or any component thereof, or to provide labor or oversight under formal contract or informal agreement including excavation work, installation of fill material, placement of a tank, or installation of associated piping.
Limiting Zone	Any horizon or condition in the soil profile or underlying strata which will interfere in any way with the treatment and/or infiltration of sewage effluent before entering the groundwater table. Such horizons include hardpans, fragipans, clay layers, compacted soils, bedrock, clayey soils, permanent and perched groundwater tables, and seasonal high-water table.
Native Soil	Naturally occurring soil deposited through geologic processes and undisturbed by human activity. Native soil does not include soil deposited as fill.
Natural Grade	The ground elevation as it exists in the natural state prior to the placement of any fill.
New or Increased Use	The connection of a new structure to an existing OSTDS or the addition to a structure of at least one bedroom, or a change to a structure resulting in an increase in one bedroom or increased sewage flow rate of 150 gallons per day or more.
OSTDS	An On-Site Sewage Treatment and Disposal System having the primary design that incorporates a septic tank and an absorption system, or a privy.
OSTDS Installer	A person licensed to alter, install, or repair an OSTDS.
Perched Water Table	The upper surface of a saturation zone resulting from a limiting zone.
Permeability	The quality of the soil which enables it to transmit water or air. Permeability values in these regulations are based upon

	standard estimates derived from the United States Department of Agriculture (USDA) established soil texture classes.
Privy	An enclosed non-portable toilet into which non-water-carried human wastes are disposed. Privies may be of earth pit or vaulted design.
Public Sewer	A sanitary sewer or combined sanitary and storm sewer used or intended for use by the public for the collection and transportation of sanitary sewage. It is commonly known as a municipal sewage system.
Riser	A watertight attachment to the top of a septic tank or dose chamber that allows at grade access to the tank for inspection and maintenance.
Sanitary Sewage	Human wastes discharging from any plumbing fixture within a residence, building, commercial establishment, or other place, including toilets, sinks, showers, dishwashing, laundry wastes, and/or other associated fixtures.
Saturated Zone	A three-dimensional layer, lens, or other section of the subsurface in which all open spaces including joints, fractures, interstitial voids, or pores are filled with ground-water. The thickness and extent of a saturated zone may vary seasonally or periodically in response to changes in the rate or amount of groundwater recharge or discharge.
Seasonal High-Water Table	The elevation of the groundwater at the upper surface of the saturation zone, as may occur during the wettest periods of the year, as indicated by mottling or a water surface in an unlined hole, whichever of the two levels is higher.
Septage Hauler	A person who holds a Septage Waste Servicing License issued by the State of Michigan.
Septic Tank	A watertight receptacle which receives sewage designed to separate solids from liquids, digest organic matter during a period of retention, and to allow the liquids to discharge into a second treatment unit or to a soil absorption system.

Sewer line	That part of the system of drainage piping which conveys sanitary sewage from a building or dwelling into an OSTDS or public sewer.
Site and Soils Evaluation	An on-site investigation to evaluate the suitability of a site (i.e., a specific location on each parcel) to support a functional, legally compliant, and environmentally sound OSTDS.
Slope	The rate of fall or drop in feet per 100' feet of the ground surface. It is expressed as a percent of grade.
Soil Texture	The relative proportions of sand, silt, and clay particles in a mass of soil. The United States Department of Agriculture (USDA) Soil texture classes used in this regulation are as follows:
Sand	Individual grains which can be seen and felt readily. Squeezed in the hand when dry, this soil will fall apart when the pressure is released.
Loamy Sand	Consists mainly of sand, but has a small amount of clay, and/or silt to give it some stability. It breaks very easily when handled and will not withstand much handling.
Sandy Loam	Consists largely of sand, but has enough silt and clay present to give it a small amount of stability. Individual sand grains can be readily seen and felt. Squeezed in the hand when dry, this soil will readily fall apart when the pressure is released. Squeezed when moist, it forms a cast which will not only hold its shape when the pressure is released, but will withstand careful handling without breaking. The stability of the moist cast differentiates this soil from loamy sand.
Loam	Consists of an even mixture of the different sizes of sand silt and clay. It is easily crumbled when dry and has a slightly gritty, yet fairly smooth feel. It is slightly plastic. Squeezed in the hand when dry, it will form a cast that will withstand careful handling. The cast formed of moist soil can be handled freely without breaking.

Silt Loam	Consists of a moderate amount of fine grades of sand, a small amount of clay, and a large quantity of silt particles. Lumps in a dry, undisturbed state appear quite cloddy, but they can be pulverized readily; the soil then feels soft and floury. When wet, silt loam runs together in puddles. Either dry or moist, casts can be handled freely without breaking. When a ball of moist soil is pressed between thumb and finger, it will not press out into a small unbroken ribbon, but will have a broken appearance.
Sandy Clay Loam	Consists of 20% to 35% clay, less than 28% silt, and 45% or more of sand. When moist, a thin ribbon of 1/8" or less sized wire can be formed between the thumb and finger to a length of one to two inches before breaking under its own weight. Soil feels gritty when excessively wet.
Clay Loam	Consists of an even mixture of sand, silt, and clay, which breaks into clods or lumps when dry. When a ball of moist soil is pressed between the thumb and finger, it will form a thin ribbon that will readily break, barely sustaining its own weight. The moist soil is plastic and will form a cast that will withstand considerable handling.
Silty Clay Loam	Consists of a moderate amount of clay, a large amount of silt, and a small amount of sand. It breaks into moderately hard clods or lumps when dry. When moist, a thin ribbon or 1/8" inch wire can be formed between thumb and finger that will sustain its weight and will withstand gentle movement.
Silty Clay	Consists of even amounts of silt and clay and very small amounts of sand. It breaks into hard clods or lumps when dry. When moist, a thin ribbon or 1/8" inch or less sized wire can be formed between thumb and finger that will withstand considerable movement and deformation.
Clay	Consists of large amounts of clay and moderate to small amounts of sand. It breaks into very hard clods or lumps when dry. When moist, a thin long ribbon or 1/16" inch wire can be molded with ease. Fingerprints will show on the soil, and a dull to bright polish is made on the soil by a shovel.
Stream	A river, watercourse, creek, gully, ravine, or ditch, natural or manmade, which may or may not be serving as a drain, having

	definite banks, a bed, and visible evidence of flow, either continuous or intermittent, for a period of greater than two months in any one year.
Surface Water	Any natural or manmade body of water that exists on the ground surface for an extended period of time.
Test Pit	An open pit of defined size and depth, to permit thorough examination of the soil.
Vaulted Privy	A structure used for the disposal of human waste which is discharged into a watertight receptacle designed and constructed for the purpose of receiving sanitary sewage.

3-4 Premises Occupancy/Condemnation

It shall be unlawful for any person to occupy, or permit to be occupied, any premises not equipped with an approved OSTDS for the disposal of sanitary sewage unless properly connected to a public sewer. Any premises constructed or maintained contrary to these regulations may be declared unfit for habitation, posted, and ordered to be vacated by the Health Officer.

3-5 Public Sewer Connection

All facilities from which sanitary sewage flows shall be connected to an available sewer. When the Department has determined a lack of an available sewer, all facilities from which sanitary sewage flows shall be connected to an approved OSTDS.

3-6 Permits Required

3-6.1 Permit Application

A. An application to construct, alter, extend, or replace a residential or commercial OSTDS shall be provided by the Department.

B. An application for a permit to construct, alter, extend, or replace a residential or commercial OSTDS shall be submitted by the property owner or his authorized representative using the appropriate form provided by the Department.

C. The Department shall not act upon any application unless the application is complete.

D. Upon review of the application, the Department shall accept the application, reject the application, or require additional information for clarification and/or verification.

E. If the application is not acceptable, the Department shall notify the applicant in writing and state the deficiencies or actions, or both, necessary to bring the application into compliance with the requirements set forth in this code. When a completed application is deemed acceptable, the Department shall issue a permit.

3-6.2 Construction Permits

A. No person shall construct, alter, extend, or replace a residential or commercial OSTDS without first having been issued a construction permit from the Department.

B. Any permit issued pursuant to the requirements of this code shall be valid for the term of 24 months from the date of issuance unless declared void as provided in this code. After the expiration of the construction permit, a 30-day grace period shall exist for an extension request. A construction permit may be extended for a period of 24 months.

C. A permit shall not be transferable from one person to another.

D. A permit may be rescinded or declared void by the Department when one or more of the following conditions exist:

1. The location of the OSTDS specified on the permit is altered.

2. There is an increase in the scope of the project prior to, during, or following construction of the OSTDS.

3. The Department acquires new information indicating that the previous permit approval does not satisfy the requirements of this code.

4. The construction standards and prohibitions set forth in this code are violated before, during, or after construction.

5. The Department has reasonable cause to believe that an intentional misrepresentation has occurred, or continued operation of the OSTDS, constitutes a nuisance.

E. The Department shall not issue a construction permit for any residential OSTDS which does not meet the minimum criteria set forth in Section 3-14.1. The reasons for denial shall be furnished to the applicant in writing.

F. The Department shall not issue a construction permit for any commercial OSTDS having a sewage flow rate of greater than 1,000 gallons per day, which does not meet the

minimum criteria set forth in the Michigan Criteria for Subsurface Sewage Disposal, D48 Rev. 4/94, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State of Michigan requirement governing the installation of subsurface sewage disposal and treatment systems designed to handle sanitary sewage. The reasons for denial shall be furnished to the applicant in writing.

G. The Department may require specific technologies, procedures, or construction practices as a condition of the permit.

H. The Department may require a third-party operation and maintenance agreement. Operation and maintenance manuals for specific system designs may be required from manufacturers and contractors for homeowner and/or third-party use.

I. Any variance to the requirements of these regulations shall be documented by the Health Officer.

J. The Health Officer shall have the authority to issue a construction permit for an alternative OSTDS if the site does not meet the site requirements for a conventional OSTDS.

K. The OSTDS installation contractor shall have a valid permit in possession on-site at the time of construction.

3-6.3 Priority Over Building Permits

A. No municipality, township, county, or other governing body shall issue a building permit for, or otherwise allow commencement of construction or placement of, any habitable building on any land not served by an available sewer until a permit has first been obtained from the Department for an OSTDS and proof of a permit has been received.

B. No municipality, township, county, or other governing body shall issue a building permit for, or allow commencement of construction of, any addition to or alteration of any habitable building which would result in an increase in the number of bedrooms and/or additional sewage flows for any habitable building located on any land not served by an available sewer until a permit has first been obtained for construction of an OSTDS or acceptance of continued use of existing OSTDS has been obtained from the Department.

C. A municipality, township, or other agency or an officer or employee thereof shall not issue an occupancy permit for any newly constructed or placed habitable structure until final approval of the structure's water supply and sanitary sewage connection has been granted by the Department.

3-7 Use of Existing Systems

3-7.1 Authorization to Use an Existing OSTDS

A. No person shall connect any habitable structure to an existing OSTDS except where allowed, in writing, by the Department.

B. Sewage flow to an existing OSTDS shall not be increased beyond the original design capacity of the existing system except where permitted in writing by the Department.

C. Approval of a new/increased use is not required for the following:

1. A permit with a final inspection indicating OSTDS approval is on file and Department documentation indicates the water supply meets the required isolation distances and the proposed dwelling was not constructed and a new or increased use is not proposed.

2. A permit with a final inspection indicating OSTDS approval was performed within the past five years and Department documentation indicates the water supply meets the required isolation distances, the proposed dwelling was constructed, and new or increased use does not occur.

3. New or increased use was approved within the past two years, through the performance of an existing system evaluation, and an additional new or increased use has not occurred and is not proposed.

3-7.2 Existing OSTDS of Permit Record

When a permit record with a final inspection conducted by the Department is available for the existing OSTDS in question, the new or increased use of the system may be granted when the following conditions are met:

A. A system evaluation, conducted by the Department or an authorized representative thereof, reveals no signs of system failure.

B. The septic tank shall have been pumped and evaluated by a septage hauler within the last three years. A written report shall be provided by the septage hauler to the Department on forms provided. The report shall include information regarding the tank's materials and construction, condition, volume, and presence or absence of an outlet baffle.

C. The proposed new/increased use is no greater than a one bedroom increase for residential structures or 150 gallons per day in the projected sanitary sewage flow for commercial structures.

D. When the projected sanitary sewage flow is greater than 150 gallons per day or a one-bedroom increase, the OSTDS shall be modified or replaced to meet the requirements of these regulations. Permits shall be obtained for any modification or replacement.

3-7.3 Existing OSTDS of No Record or Permitted Systems with No Record of a Final Inspection Performed by the Department.

When a permit record is not available, or when no record of a final inspection conducted by the Department is available, for the existing OSTDS in question, the new or increased use of the OSTDS may be granted when the following conditions are met:

A. When adequate site and soil information, including water table information, is not recorded in the permit file, or when no permit exists, a site and soils evaluation shall be performed in the area of the existing OSTDS by the Department or an authorized representative thereof. It shall be the applicant's responsibility to provide excavations for the purpose of evaluation of soil conditions.

B. Minimum of 24" of soil exists between the limiting zone and the bottom of the absorption system.

C. Isolation distances meet the requirements of this code as specified in Table 3-14.2A.

D. The septic tank shall be pumped and evaluated by a septage hauler, as part of the existing system evaluation process, with results reported to the Department on forms provided.

E. An OSTDS evaluation, conducted by the Department or an authorized representative thereof, reveals no signs of OSTDS failure.

F. The proposed new or increased use is no greater than a one-bedroom increase for residential structures or 150 gallons per day in the projected sanitary sewage flow for commercial structures.

G. When the projected sanitary sewage flow is greater than 150 gallons per day or a one-bedroom increase, the OSTDS shall be modified or replaced to meet the sizing requirements of this code. Permits shall be obtained for any modification or replacement.

3-7.4 Failing Existing System

A. The Department shall condemn any existing OSTDS meeting the definition of a failing system per these regulations.

B. Any OSTDS so condemned shall be repaired, rebuilt, or replaced by an OSTDS constructed according to the provisions of these regulations where possible, or by another method approved by the Department in order to abate a public health nuisance, within a specified

period of time not to exceed 90 days after official notification from the Department, unless there is an imminent hazard to the public health, safety, and welfare by the continued improper drainage.

3-8 Connection of Discharges

A. All facilities such as flush toilets, urinals, lavatories, sinks, bathtubs, showers, laundry, or any other facility from which sanitary sewage flows shall be connected to an OSTDS, except that any such facilities hereafter installed on a premise where public sewer is available, shall be connected to said sewer.

B. The following shall not be connected to an OSTDS:

    1. Seepage water from footing drains or underground flows.

    2. Surface runoff or roof drainage from rainfall or snow melts.

    3. A swimming pool, hot tub (spa) or its appurtenances.

    4. Brine or recharge water from any water treatment system.

    5. Chemical solutions or other wastes which would interfere with biological action in the treatment facilities.

C. The Department may require suitable provisions for the proper discharge or disposal of liquid wastes listed above.

3-9 Public or Private Drain of Unknown Course and Origin

A. Whenever the Department determines that improperly treated sanitary sewage is flowing from the outlet of any public or private drain, the Department shall notify in writing persons owning, leasing, or residing on the premises from which sanitary sewage originates to connect to a public sewer, an approved OSTDS, or to otherwise abate the discharge.

B. The notice to the owners, leaseholder, or residents of such properties shall inform said persons of such unlawful discharge of improperly treated sanitary sewage into such drain and shall specify the maximum period of time not to exceed 90 days within which such unlawful discharge shall be terminated.

C. If after the expiration of the minimum period of time specified in the notice, such unlawful discharge continues, the Department may plug or cause to be plugged the outlet(s) from the drain to render it incapable of discharge of improperly treated sanitary sewage.

D. Where the Department is unable to plug the flow of sanitary sewage, the Department shall institute all necessary and proper legal remedies to abate the nuisance and threat to the public's health, safety, and welfare, which shall include restraining orders, temporary and permanent injunctions, and summary proceedings to vacate the premises or condemnation until such time as the sources of pollution have been eliminated or the pollution properly controlled. Citation and proceedings shall be consistent with Article XIV and Article XVI of this code.

3-10 Prohibitions

A. On-site storage and hauling of sewage, or the use of a pump and haul method, in lieu of the handling of sewage through an approved OSTDS or a municipal sewer connection, for sewage originating from structures other than privies shall be prohibited.

B. The disposal of sanitary sewage by facilities utilizing on-site storage, hauling, and final disposal at an off-site receiving facility (pump and haul) is prohibited, except as follows:

1. During construction of a public sewer or approved sewage treatment facilities to serve the proposed development.

2. The installation of an approved OSTDS has been delayed by weather conditions or seasonal construction limitations.

3. The holding tank is serving a temporary construction site.

4. For existing development where previous OSTDS have failed and there are no other alternatives for on-site sewage disposal as determined by the Health Officer.

C. Notwithstanding the prohibition in subsection A above, the on-site storage and hauling of sewage originating from existing structures, other than privies, may be approved by the Department or Director of Environmental Health under strictly short-term temporary emergency conditions, not longer than 1 year, for the purpose of the protection of public health and the environment until such time that conditions permit the installation of an approved OSTDS or municipal sewer connection.

D. On-site storage and hauling of sewage, or the use of a pump and haul method must meet the following conditions for short-term temporary use in an emergency:

1. Tanks used for the storage of sewage shall be watertight and designed in accordance with the code including statutes and guidelines referred to by reference.

2. Tanks used for the storage of sewage shall be sized with a capacity capable of meeting the flow demands of the structure to which they are connected with a capacity sufficient to meet the scheduling frequency of the licensed septage pumper and hauler with a designed safety margin of a minimum 33% additional capacity.

3. Under no circumstances shall a tank system used for the storage of sewage be of a capacity that is less than that capable 72 hours of retention of sewage flow from the structure with a 48-hour pump and haul frequency.

4. An ongoing contract for the pumping and hauling of sewage by a licensed septage hauler shall be obtained by the property owner at the property owner's expense. A copy of the current pump and haul contract shall be provided to LMAS and shall be congruent with the volume retention time of the sewage storage tank.

5. At no time shall sewage be discharged from the sewage storage tank to the environment.

6. Any discharge from the sewage storage tank to the environment, or any deviation from the approved on-site storage and hauling of sewage, or deviation from the approved pump and haul process shall be grounds for the immediate termination of any approval and/or condemnation of the structure from which sewage is generated.

E. On-site storage and hauling of sewage, or the use of a pump and haul method, in lieu of the handling of sewage through an approved OSTDS or a municipal sewer connection, shall not be approved for convenience purposes, financial purposes, or to circumvent environmental limitations that would preclude the installation of an approved OSTDS.

F. On-site storage and hauling of sewage, or the use of a pump and haul method, will not be approved in areas where the practice is prohibited by local zoning or where other statutes and/or ordinances prohibit the same without prior approval from the applicable authority.

G. No person shall discharge sanitary sewage to the ground surface or surface water.

H. Any substance not defined as sanitary sewage by this code shall not be discharged to the OSTDS without the approval from the Health Officer.

I. Cesspools are prohibited.

3-11 Site and System Evaluations

3-11.1 Minimum Test Excavations

A. Prior to the issuance of a permit to install a commercial or residential OSTDS, the Department shall conduct a site and soils evaluation to determine the ability of the parcel to meet the minimum requirements of these regulations. Backhoe cut excavations may be required and shall be provided at the expense of the applicant.

B. The depth, number, type, and location of soil excavations required to evaluate site suitability for the installation of a permitted OSTDS shall be determined by the Department and shall be consistent with the contract requirements of the State.

C. A complete site and soil evaluation shall include, but shall not be limited to, the following information:

1. Soil permeability, based upon soil texture and structure in the native soil profile to a depth of at least three feet below the proposed infiltrative surface beneath the absorption system.

2. A determination of the seasonal high water table elevation.

3. Slope limitations.

4. Location of the site in relationship to flooding or seasonal ponding of surface water.

5. Availability of sufficient area to install an adequate compliant OSTDS and an area for a replacement OSTDS when required.

6. Adequate area to maintain all required isolation distance.

7. A determination of any other limiting factor to the installation and performance of the proposed OSTDS.

D. The Department may require as part of a soil evaluation, information including, but not limited to, engineering plans or drawings, topographic maps of a site indicating surface relief and/or grade elevations, soil analyses, additional soil test borings, groundwater elevations, flood elevations, information specific to easements, rights-of-way, and parcel boundaries.

E. A site and soil approval for the suitability of installation of an OSTDS shall be valid for not more than 24 months.

F. Approval or denial of a site proposed for the installation of an OSTDS shall be provided in

writing to the applicant.

3-11.2 Seasonal/Weather Restrictions

A. A site and soils evaluation shall not occur when depth of snow cover, frost, or other impeding condition prohibits adequate evaluation of a parcel of land to determine the suitability of a site proposed for the installation of an OSTDS.

B. Installation of an OSTDS shall not occur when it is reasonable to assume that weather and site conditions will result in a compromise to the construction, installation, and/or long-term operation of the proposed system.

3-11.3 Final Construction Inspections

A. All permitted OSTDS installed shall receive a final construction inspection prior to being placed into use and prior to being approved by the Department.
B. It shall be unlawful to backfill or cover any portion of a newly installed component of any OSTDS until a final construction inspection has been completed and/or approval to backfill has been granted by the Department.

C. The Department shall deny final approval of any installation which does not comply with any permit condition, is of faulty workmanship and/or construction materials, or otherwise does not meet the requirements of these regulations.

D. Installation contractors shall notify the Department 72 hours in advance of the date of completion of the OSTDS to schedule the final construction inspection. The Department shall perform the final inspection of the OSTDS within 72 hours of completion of installation if advanced notification is provided as required.

E. After the Department final approval inspection of the construction of a newly installed OSTDS, or any newly installed component thereof, backfilling/covering shall be completed within 72 hours unless otherwise approved by the Health Officer.

F. When a final construction inspection cannot be performed due to unforeseen circumstances, the Health Officer may allow submission of an affidavit of construction on a form provided by the Department in lieu of a final construction inspection.

3-12 Commercial OSTDS

A. All OSTDS proposed to receive sanitary sewage from habitable buildings other than single and two-family residential structures shall comply with these regulations and the requirements of the Michigan Criteria for Subsurface Sewage Disposal, as written by the Division of Environmental Health, Bureau of Environmental and Occupational Health,

Michigan Department of Public Health, April 1994, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State requirements governing commercial OSTDS designed to receive sanitary sewage.

B. The minimum site criteria for residential systems as specified in Section 3-14.1 of this code shall apply to those OSTDS which serve buildings other than single and two-family residences with peak daily flows of less than 1,000 gallons per day.

C. The minimum size of any OSTDS proposed to receive sanitary sewage from habitable buildings other than single and two-family residential structures shall be a system of a 1,000 gallon septic tank connected to a 200 ft^2 absorption system or greater based upon estimated sewage flows and loading rates.

D. OSTDS other than private single or two-family residences, which utilize septic tanks and absorption system for peak daily flows between 1,000 and 10,000 gallons per day flow, shall be sited and constructed in accordance with the guidelines set forth by the Michigan Department of Environment Great Lakes and Energy in the most current revision of the publication entitled Michigan Criteria for Subsurface Sewage Disposal, as written by the Division of Environmental Health, Bureau of Environmental and Occupational Health, Michigan Department of Public Health, April 1994, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State statute.

F. All OSTDS proposed to receive sanitary sewage from habitable buildings other than single and two-family residential structures shall be equipped with the following:

1. A septic tank outfitted with an effluent filter designed for commercial applications.

2. A septic tank equipped with a water-tight access riser installed to facilitate the pumping of the septic tank and the maintenance of the effluent filter, or other internal components, without the need to excavate the lid.

3-13 Lots less than 1 Acre, Subdivisions and Site Condominiums

Site and soils evaluations for an OSTDS proposed to be located on a parcel of less than one acre as created after March 31, 1997, a parcel within a subdivision, a parcel which is classified as a site condominium, or a parcel that was otherwise created in excess of the allowable number of exempt parcel splits under the Land Division Act, Act 288, PA 1967, (Mich. Comp. Laws § 560.101 *et seq*) shall comply with all aspects of the rules entitled Part 4. Department of Environmental Quality On-site Water Supply and Sewage Disposal for Land Divisions and Subdivisions, being R560.401-R560.428 of the Michigan Administrative Code, or current State statute, prior to permitting.

3-14 Residential Single and Two-family On-site Sewage Treatment and Disposal System (OSTDS) Construction

The following requirements shall apply to the construction and installation of all OSTDS.

3-14.1 Minimum Site Requirements

A. Conventional Sewage System

1. Soil permeability rates of the native soil in the proposed infiltrative area of the absorption system shall be between 3 and 45 minutes per inch, as estimated by the USDA soil texture class.

2. The effective native soil depth or depth to seasonal high water table shall be a minimum of 24" from natural grade in stratified sand and gravel, medium sand; 18 in fine sand, loamy sand; 12" in sandy loam, loam, silt loam, sandy clay loam.

3. The natural slope in the proposed infiltrative area of the system shall not exceed 12%. When natural slopes are greater than 12%, the Department may require a detailed development plan to be submitted for review and approval by the Department.

4. Development plans shall be drafted by a licensed professional engineer, a professional surveyor, a registered sanitarian, a registered environmental health specialist, or other professional approved by the health department.
5. Development plans shall be to scale with a maximum 2' contour interval, with both the existing and proposed contours indicated. The development plan shall show the proposed design for the initial and replacement OSTDS, and shall indicate the location of the existing or proposed dwelling and water supply well. Locations of the OSTDS and the water supply well shall facilitate ease of access for future maintenance and/or replacement.
6. Deep cut excavations to remove undesirable soil horizons shall be made to a soil horizon meeting the requirements of Section 3.14.1.A.1 and 2.

7. The isolation distances shall meet the requirements set forth in Section 3-14.2.A of this code.

8. The site of the proposed system shall not be located in a floodplain of 100 years or less, or in an area subject to seasonal flooding, runoff, or ponding of surface waters. It shall be the property owner's responsibility to document the 100 year flood plain as recognized by the Michigan Department of Environment Great Lakes and Energy (EGLE), or appropriate agency, at the request of the Department.

(a) Flood plain delineation is currently the responsibility of EGLE and is subject to change.

(b) When a Sanitarian becomes aware of a concern regarding flood plain during a site evaluation, the applicant shall be instructed to coordinate with EGLE to obtain the requested flood plain information. It shall be the applicant's responsibility to provide the current EGLE flood plain information for the parcel to the Department prior to permit issuance.

(c) In instances when the permit applicant is unwilling to wait for a response from EGLE due to undesired project delays, the permit applicant shall have the option to contract with a third party engineer to delineate the 100-year flood plain boundary at the expense of the permit applicant. It shall be the permit applicant's responsibility to provide the engineering data to the Department in writing prior to permit issuance.

(d) For the purpose of flood plain enforcement through the code, the flood plain boundary will be defined as the first point in the landscape between the proposed septic system or well installation area, where the 100-year flood level, as determined by the appropriate State agency, intersects the land. All proposed septic system and well locations must be outside of this boundary as defined. Permit applications for parcels, which cannot meet this requirement, shall be denied in accordance with Department policy and must pursue a variance to move forward.

(e) Systems installed by variance must be installed so that the entire septic system, including the (up to) four feet of soil beneath the aggregate and soil interface, are elevated above the 100-year flood level as determined by the appropriate State agency.

9. The system shall be located so that it is accessible for cleaning or inspection Purposes.

10. The proposed site shall not have an available sewer by definition.

A. Alternative On-Site Sewage Treatment Systems

In the event a site does not meet the minimum requirements set forth in Section 3-14.1.A of this code regarding conventional sewage systems, the Health Officer may apply the provisions of the Alternative Manual contained in **Appendix A** if determined viable.

Alternative On-Site Sewage Treatment Systems are not guaranteed for every site that is found to be unsuitable for conventional sewage disposal.

B. Groundwater Control/Diversion

The Health Officer may consider the use of controls to modify surface runoff or groundwater elevation to permanently increase the effective soil depth by lowering the water table.

3-14.2 Construction Requirements

A. The proposed OSTDS shall satisfy the isolation requirements as summarized in Table 3-14.2.A.

B. The soil depth between the limiting zone and the aggregate/soil interface shall not be less than thirty-six inches (36”).

C. Prior to entering the soil absorption system, all sewage shall first be treated by a septic tank.

D. The absorption system selected for use in a specific soil shall meet the minimum application rates and required absorption area as determined by the native soil and Table 3-14.2.B.

E. The absorption system shall have a minimum absorption area of 400 ft^2 for a bed system, or 300 ft^2 for a trench system.

TABLE 3-14.2 A - Isolation Distance

From	To				
	Sewer Lines	Septic Tanks	Absorption System	Earth Pit Privies	Vaulted Privies
Residential Well	10	50	50	50	50
Type IIB and Type III Public Water Supply Wells	10	75	75	75	75
Type IIA and Type I Public Water Supply Wells	10	200	200	200	200
Property Lines	n/a	10	10	10	10
Foundation Wall/Footing Drains	n/a	5	10	10	5
Storm/Subsoil Drains	n/a	5	25	25	5

Water Lines	n/a	10	10	10	10
Embankments	n/a	10	20	20	10
Surface Water	n/a	75	75	75	75

TABLE 3-14.2 B - Absorption System Sizing - Minimum Sizing 400 ft² bed 300 ft² trench

Texture Class of Native Soil	Estimated Permeability Rate		Sewage Application Rate (gpd/ft²)		Minimum Absorption Area Required (ft²/bedroom)	
	inches/hour	minutes/inch	bed	trench	bed	trench
Coarse Sand, Gravel, Gravelly Sand	>20	<3	Not Suitable – Infiltrates too quickly to provide adequate treatment to protect groundwater/surface water.			
Stratified Sand and Gravel, Medium Sand	20-6.0	3-10	0.75	1.0	200	150
Fine Sand, Loamy Sand	6.0-3.0	11-20	0.5	0.75	300	200
Sandy Loam, Loam	3.0-2.0	21-30	0.375	0.5	400	300
Silty Loam, Sandy Clay Loam	2.0-1.35	31-45	0.3	0.4	500	375
Clay Loam, Silty Clay Loam	Not Suitable – Infiltrates too slowly to accept sewage at rates applied.					
Silty Clay						

3-14.3 Aggregate/Stone

A. Aggregate/Stone Material

1. Aggregate shall be washed stone ranging in size from 3/8" to two and one-half inches (2½") with a total fines content not exceeding 0.5% loss by washing. Stone aggregate shall rate three or more on Mohs scale of hardness. The goal is to have 90% of the aggregate retained by the 7/16" standard mesh, 100% passing the 2 ½" mesh and 0.5% or less of the aggregate passing the No. 200 mesh.

2. Alternative aggregate may be approved by the Department.

3. Documentation shall be provided to the Department upon request that all aggregate used in sewage systems complies with the above size and fines

requirements.

4. When compliance of drainfield aggregate is in question, the Sanitarian may require an official sieve analysis to be conducted on the aggregate in question with a report of analysis provided to the Department for review and approval.

5. If soil that will pass through a 3" sieve is passed through a No. 200 sieve, it will be divided into two portions based on particle size. The particles passing the No. 200 sieve are termed fines.

6. The tables below provide a general overview of some of the standard screen sizes used in sieve analysis. The highlighted values are for screens that would be used to determine drainfield aggregate acceptability.

Commonly used US Standard commercial sieve and mesh dimensions.
Source: http://engineeringtoolbox.com

Sieve size	**Opening**		**Standard Mesh**
(mm)	***(in)***	***(10^{-6} m)***	***US***
11.2	0.438	11200	7/16"
6.35	0.250	6350	¼"
5.6	0.223		3.5
4.75	0.187		4
4.0	0.157		5
3.35	0.132		6
2.8	0.110		7
2.36	0.0937		8
2.0	0.0787		10
1.7	0.0661		12
1.4	0.0555		14
1.18	0.0469		16
1.0	0.0394		18
0.841	0.0331	841	20
0.71	0.0278		25
0.595	0.0232	595	30
0.5	0.0197		35
0.400	0.0165	400	40
0.355	0.0139		45
0.30	0.0117		50
0.250	0.0098	250	60
0.210	0.0083	210	70
0.177	0.0070	177	80
0.149	0.0059	149	100
0.125	0.0049	125	120
0.105	0.0041	105	140
0.088	0.0035	88	170
0.074	0.0029	74	200
0.063	0.0024	63	230
0.053	0.0021	53	270
0.044	0.0017	44	325

Commonly used US Standard commercial sieve and mesh dimensions. **Source: http://engineeringtoolbox.com**			
Sieve size	**Opening**		**Standard Mesh**
(mm)	***(in)***	***(10^{-6} m)***	***US***
0.037	0.0015	37	400
0.025	0.0010		500
0.020	0.0008		632

Nominal apertures and permissible variation for selection of US woven sire sieves Source: Powder Sampling and Particle Size Determination, Terrance Allen, 2003				
Standard (mm)	Alternative (in)	Tolerance (+ or – mm)	Intermediate (mm)	Maximum (mm)
125.0	5	3.7	130.00	
63.0	2.500	1.9	65.6	66.2
31.5	1.250	1.0	32.9	33.2
16	0.625	0.5	16.7	17.0
8	0.312	0.25	8.41	8.58
4	0.157	0.13	4.23	4.35
2	0.0787	0.070	2.135	2.215
1	0.0394	0.040	1.080	0.135

7. While there may be slight variances in the naming convention of crushed stone the following are the most common names and sizes. The highlighted sizes of crushed rock would be suitable for aggregate use under the condition that fines content is 0.5% or less.

    (a) Crushed stone #5 – Sizes are from 1" down to fine particles. For road and paver base.

    (b) Crushed stone #67 – Sizes from 3/4" down to fine particles. For fill, road and slab base.

    (c) Crushed stone #1 – Sizes are from 2" to 4". The largest of the crushed stone grades. For larger jobs such a culvert ballast.

    (d) Crushed stone #8 – Sizes from 3/8" to 1/2". For concrete and asphalt mix.

    (e) Crushed stone #3 -Sizes from 1/2" to 2". For drainage and railroad projects.

    (f) Crushed stone #10 (also called stone dust) – Screenings or dust. For fabrication of concrete blocks and pavers and for riding arenas.

(g) Crushed stone #57 – Sizes of about 3/4". For concrete and asphalt mix, driveways, landscaping and French drains.

(h) Crushed stone #411 – A mixture of stone dust and #57 stone. For driveways, roads and as a base for retaining walls. It can also be used to patch holes in paved areas. The dust mixes with the larger stone and settles well.

Table of Crushed Rock Sizes
Source: http://www.rbsinc.com/limestone/pageone.htm

Size Number	Nominal Maximum	Nominal Minimum	Typical Use	Density, PCF (Estimate)
1	3 ½"	1 ½"	Free Draining Heavy Fill Road Base	80-90
2	2 ½"	1 ½"	Road Base, Difficult to Place	100
3	2"	1"		100
4	1 ½"	¾"	Road Base, Easier to Place/Grade	100
57	1"	#4	Free Draining Fill Used under Concrete Slabs	110
67	¾"	#4		110
7	½"	#4		100-110
8	3/8"	#8	Pipe Bedding	100-110
9	#4	#16	Drainage Bed, Snow and Ice	120
Sand (#10 MOD)	#4	#100		130
3" Crusher Run	3"	#100	Driveways, Roads, Compaction Required	130
1½" Crusher Run	1 ½"	#100	Driveways, Roads, Compaction Required	140
¾" Crusher Run	¾"	#100	Driveways, Roads, Compaction Required	140
Rip-Rap	10"	4"		

8. A tool known as the 'jar test' can be used to evaluate the relative fines content in a load of drainfield rock (or sand fill) delivered to a construction site. This tool has also been used by licensed installers and local inspectors to help evaluate fines in mound sand and single pass sand filters. For drainfield rock, the procedure can be used as a 'quick check' on fines in a load of drainfield rock. The jar test is not to be used as a replacement for sieve analysis. After settling for several hours, if the layer of fines that settle on top of the aggregate is thicker than 3.2 mm (1/8 inch), the aggregate contains too many fines and is not suitable for use in a drainfield. An eight-hour jar test must be conducted for best results. When in doubt the aggregate supplier should provide an aggregate analysis report to confirm the product meets the sieve specification. Details on jar test procedure are detailed in the Alternative Manual contained in **Appendix A**.

9. Below is a table describing the characteristics of each Michigan Department of Transportation (MDOT) aggregate classification. Per the code, ONLY the 4AA meets the sizing requirements, but ONLY under the condition that it is washed

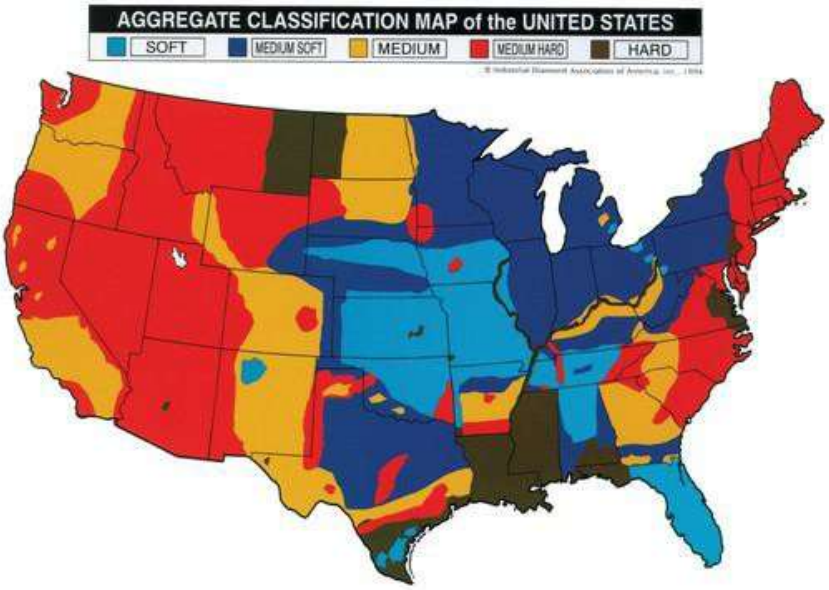
to reduce the fines to a max of 0.5%. The standard 2.0 maximum MDOT allowable fines content is not acceptable for drainfield aggregate.

Michigan Department of Transportation (MDOT) Grading Requirements for Coarse Aggregates, Dense-Grade Aggregates and Open-Graded Aggregates

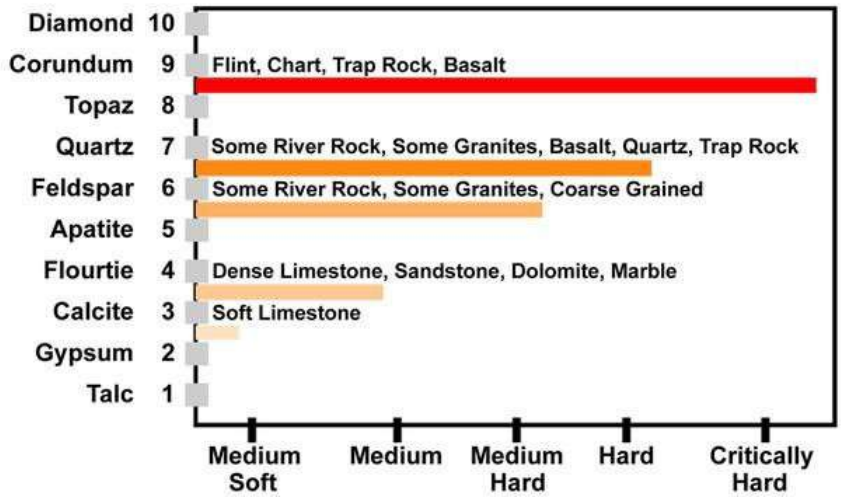
Material Type	Class	Item of Work by Section Number (Sequential) (a)	Sieve Analysis (MTM 109) Total Percent Passing										Loss by Washing (MTM 108) % Passing No. 200 (b)
			2.5 in	2 in	1.5 in	1 in	3/4 in	1/2in	3/8in	No. 4	No. 8	No. 30	
Coarse Aggregates	4 AA (c)	602	100	90-100	40-60		0-12						**2.0 max**
	6 AAA (c)	602			100	90-100	60-85	30-60		0-8			1.0 max (d)
	6 AA (c)	601,602 706,708,80			100	95-100		30-60		0-8			1.0 max (d)
	6 A	205,			100	95-100		30-60		0-8			1.0 max (d)
	17 A					100	90-100	50-75		0-8			1.0 max (d)
	25 A	508					100	95-100	60-90	5-30	0-12		3.0 max
	26 A	706, 712					100	95-100	60-90	5-30	0-12		3.0 max
	29 A	508						100	90-100	10-30	0-10		3.0 max
Dense-Graded Aggregates	21 AA	302,304,30			100	85-100		50-75			20-45		4-8 (e)(f)
	21 A	302,305											
	22 A	302,305,306,307				100	90-100		65-85		30-50		4-8 (e)(f)(g)
	23 A	306,307				100			60-85		25-60		9-16 (f)
Open-Graded Aggregated	2 G	303(h)			100	85-100		40-70			0-10	0-8	5.0 max
	3 G				100	85-100		40-70			0-30	0-13	5.0 max
	4 G (i)	303			100		60-80	35-65			10-25	5-18	6.0 max
	34 R	404						100	90-100		0-5		3.0 max
	34 G	404						100	90-100		0-5		3.0 m

10. Based upon the graph and the map shown below, all aggregate available in the Department's jurisdiction should meet the requirement of rating at three or higher on Mohs scale of hardness. Calcite (soft limestone) is considered to be a standard for three on the Mohs scale and is technically acceptable under the code.

Source: http://www.forconstructionpros.com/article/10745911/aggregate-hardness-map-of-the-united-states



Mohs Hardness Scale 1 through 10



B. Aggregate/Stone Installation

1. The aggregate in an absorption system shall be a minimum of 12” in depth. There shall be a minimum of 6” of aggregate below the distribution pipe. The aggregate in an absorption bed system shall extend a minimum of 2’ beyond the header, footer, and laterals.

2. The aggregate shall be continuous throughout the full width and length of the absorption bed or trench.

3. Aggregate shall not be mounded around the distribution pipe and shall be uniform in depth throughout the absorption bed or trench.

C. Aggregate Cover

1. Prior to backfilling the absorption system, the aggregate shall be covered with an approved filter fabric.

2. Straw is an approved material for covering the aggregate. Straw must be of sufficient thickness so that fines cannot filter through and clog the drainfield (enough so that no aggregate can be seen when covered). However, owner should be consulted on which cover they prefer as straw degrades over time eventually allowing sand into the aggregate. Hay is unacceptable. Other materials used as aggregate cover shall be approved by the Department.

3. Soils used to cover the drainfield should not be clay-based soils in order to maximize evapotranspiration. The septic system shall be backfilled with a minimum of 6" and a maximum of 30" of soil cover.

4. The field area shall be seeded and mulched to provide grass growth and prevent erosion of the field. The area around the field shall be landscaped to drain surface runoff away from the field area. Trees should not be grown on or near the field area as the roots will eventually plug the laterals. Grass is the best cover for your drainfield.

5. To avoid compaction and breakage of drainfield materials, the drainfield should not have structures built upon it and vehicle traffic should not be allowed.

3-14.4 Absorption System Distribution

A. Piping within a gravity distribution network of an absorption system shall meet the following conditions:

1. The septic tank effluent line shall be solid schedule 40 PVC and connect to the header at a 90° angle between the centermost laterals.

2. A double header or wye (Y) shall be required when seven or more laterals are used.

3. The header shall be solid piping installed to be level to allow even distribution of effluent throughout its length. The header shall connect all lateral distribution pipes within the absorption system.

4. The footer shall connect to all distribution line laterals within the absorption system.

5. Distribution line laterals for absorption bed installations shall be placed a

minimum of 3’ and a maximum of 4’ on center unless otherwise approved by the Department.

6. The slope of the distribution lines shall not exceed 4” in 100’.

7. Trenches shall be installed so that a minimum of 36” of undisturbed soil remains between each trench. The following shall be used to design trench absorption systems:

    (a) 36” wide trenches shall be spaced 7’ on center, which would leave approximately 4’ of undisturbed soil between trenches.

    (b) 30” wide trenches shall be spaced at least 6’ on center.

    (c) 24” wide trenches shall be spaced at least 5’ on center.

    (d) 18” wide trenches shall be spaced at least 4’ on center.

    (e) A common header shall be installed per 3-14.4(A). The required footer can be either perforated or solid pipe.

    (f) Aggregate and pipe trench systems must be constructed of State approved perforated pipe, placed with holes facing downward within the trench, and solid schedule 40 PVC pipe in the header and effluent line.

    (g) Aggregate must be installed at a thickness of 6” below the perforated pipe and extending to 2” above the perforated pipe and meet requirements noted in 3-14.3.

8. Chamber systems may be used for trench installations without gravel, must be installed in accordance with manufacturer’s recommendations on level and raked soil, and will be sized in accordance with current State guidance regarding chamber sizing.

    (a) Chamber systems can be installed as a bed configuration or a trench configuration. The number of chambers required for a bed configuration is determined by the make and model of the specific chamber used compared to the required number of chambers per 100 ft^2 of bed without sidewall. The number of chambers required for a trench configuration is determined by the make and model of the specific chamber used compared to the required number of chambers per 100 ft^2 of bed with sidewall infiltration allowed.

(b) The effluent line and the header must be constructed of solid schedule 40 PVC piping with glued joints. Headers must be set level. A standard footer pipe is not required but manufacturer end caps shall be installed.

(c) Observation ports shall be installed in the fittings provided by the manufacturer at the end of each row of chambers 1' from the corner of the footer on each outside lateral of the system using a 90◦ 'T' fitting oriented upward vertically. The inspection port shall be glued into the 'T' fitting for permanent installation." Observation ports shall extend to the ground surface; remain visible after installation; and be constructed of non-perforated PVC, which is 4" in diameter, equipped with a removable cap.

(d) Chambers shall be backfilled with clean permeable soil, which is free of rocks, cobbles and boulders, to avoid damage or offset to the chambers.

(e) A minimum of 6" and a maximum of 30" of soil cover shall be placed over the chambers after final installation.

9. All piping and distribution products shall be approved by the Department.

B. All perforated pipe shall be installed with centerline markings facing up to allow for proper drainage. All perforated piping used within trench or bed infiltration systems shall have a 4" diameter PVC meeting ASTM F810 or ASTM 2729 standards or equivalent.

C. Installation of technologies not comprising a conventional stone aggregate and perforated pipe design shall obtain approval of the Department prior to permitting and installation.

D. If a mound is required, the following preparation procedures should be followed:

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

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

3. Excess vegetation needs to be mowed and raked. Cut trees flush to the ground and leave stumps. Remove surface boulders that can be easily removed. You can also remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand. Prepare the site by breaking up, perpendicular to the slope, the top 6" to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. Chisel type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that a rough, un-smeared surface be left. The sand fill will intermingle between the clods of soil, which improves the infiltration rate into the natural soil. Immediate application of at least 6" of fill material is required after tilling. All vehicular traffic is prohibited on the tilled area. For sites where the effluent may move laterally, vehicle traffic is also prohibited for 15', down slope and 10' on both sides of level sites. If it rains after the tilling is completed, wait until the soil dries out before continuing construction.

4. Place the fill material, which has been properly selected, around the edge of the tilled or excavated area. Work from the end and up slope sides. This will avoid compacting the soils on the downslope side, which, if compacted, affects lateral movement away from the fill and could cause surface seepage at the toe of the fill on slowly permeable soils. Move the fill material into place using a small track type tractor with a blade or a large backhoe that has sufficient reach to prevent compaction of the broken up area. Do not use a tractor/backhoe having tires. Always keep a minimum of 6" of fill material beneath tracks to prevent compaction of the in situ soil.

5. Place the fill material to the required depth.

E. Clean medium sand with little or no fines is to be used to form a sand base to the elevation that is required on the permit and/or site evaluation. Sand fill shall be added from the upslope side or ends to reduce site disturbance whenever possible.

1. When fill is required on-grade (creating a mound), a berm (sand extension) around perimeter of aggregate bed is required. This sand extension prevents

effluent from leaching out of the toe of slope. Width is determined by native soil type. Fill should extend a minimum of 4' beyond all sides of the absorption system on sites where the native soil has permeability greater than or equal to 3" per hour. Fill should extend a minimum of 10' beyond all sides of the absorption system on sites where the native soil has a permeability less than 3" per hour.

Fill Amt on Grade	Total Height at Completion	3:1 slope	4:1 slope
1'	3'	9'	12'
2'	4'	12'	16'
3'	5'	15'	20'
4'	6'	18'	24'
5'	7'	21'	28'

2. In addition to berm extension, a minimum 3:1 slope to natural grade is required. It is recommended that a sand-based soil be used for this slope. A 4:1 taper slope is recommended in areas of a maintained lawn. Taper length shall be based on final height at completion of the mound and total length from top to toe.

3. The edge of the aggregate bed must be placed a minimum of 10' from property lines. In no case shall slope fill cross property lines without direct written and notarized consent of the owner of the impacted parcel.

Native Soil	Berm Width
Coarse sand, Gravel, Gravelly Sand	4'
Stratified sand & gravel, Medium Sand	4'
Fine sand, Loamy sand	4'
Sandy loam, Loam	10'
Silty loam, Sandy clay loam	10'
Clay loam, Silty clay loam	10'
Silty clay loam	10'
Silty clay, Clay	10'
Bedrock at surface	10'

3-14.5 Septic Tanks

A. Septic tanks shall be watertight and constructed of concrete or other materials approved by the Department. Manufacturers shall demonstrate, upon request of the Department, that the septic tanks which they manufacture are watertight. In order to provide technical guidance to meet this standard, the following specifications have been established:

1. Pre-cast concrete tanks shall have a minimum wall, compartment, and bottom thickness of 2.5" and shall be adequately reinforced. The top shall be at least 4" thick and able to withstand the load for which it was intended.

2. Concrete block tanks are not permissible.

3. A cast in place of a concrete tank shall be approved by the Health Officer prior to construction and comply with all specifications listed in part 1.

4. The use of polyethylene septic tanks is allowed provided the installer submits a spec sheet demonstrating the tank was manufactured for the purpose of holding sewage and the tank capacity meets minimum sizing requirements noted in permit.

B. Septic tanks shall have a liquid capacity of at least the average volume of sewage flowing into it during any 24-hour period, but in no case shall the liquid capacity of the first septic tank be less than 1,000 gallons. The liquid capacity of all prefabricated septic tanks shall be permanently marked on the uppermost tank surface.

C. The minimum capacity for septic tanks for a one, two, or three-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.

D. The minimum liquid depth of any compartment shall be 38". Liquid depths greater than 78" shall not be considered in determining the working liquid capacity.

E. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location. An effluent filter shall be constructed of durable and corrosion-resistant materials, be designed to prevent the escape of suspended solids during normal operation or malfunction, retain all particles greater than 1/8" in size, and be designed to accommodate the effluent discharge for the system it serves.

F. Effluent lines shall be 4" diameter schedule 40 PVC, or equivalent, piping with glued joints for the entire length of line between the filter outlet and the drainfield. Effluent lines serving systems that require pumping from the septic tank to the drainfield must be connected to the drainfield header at an angle of 45 degrees or greater. This configuration is to prevent the backflow of effluent from the drainfield to the tank when the pump cycles off.

G. Septic tanks shall be equipped with a water tight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or shall be equipped with other Department approved safety device to preclude accidental tank entry.

1. Septic tank access shall be provided for maintenance. The access lid shall be a minimum of 12" x 12" in diameter or a maximum of 20" x 20" in diameter. Each septic tank access lid shall be provided with a corrosion resistant strap or handle to facilitate removal. Inspection ports will not be accepted as septic tank access.

2. The tank access lid for cleaning and maintenance purposes shall extend to ground surface by a secure watertight riser. Existing tanks, which will be in continued use for a replacement system, will be required to be retrofitted with an effluent filter in the outlet baffle and an approved riser to grade in accordance with the manufacturer's recommendations.

D. The Department may require septic tank vendors delivering septic tanks to construction sites to record addresses and names of locations and individuals receiving tanks. These records may be required to be made available to the Department for a running 24-month period.

E. Tanks shall be located to assure accessibility for inspection and cleaning. No other construction or landscaping shall impede a tank's accessibility. All septic tanks shall be installed to be set level side to side and front to back and to flow in accordance with the manufacturer's design with the outlet closest to the drain field. When a high-water table is present, septic tanks shall be weighted to prevent floating or shifting.

F. Tanks shall be located on the same side of a building where the sewer line exists on the foundation wall. The building sewer shall be at least five feet long, but as short as possible, and contain no more than two 45^{o} degree bends, or one long sweeping 90^{0} bend.

G. The inlet and outlet specifications are as follows:

1. Have a minimum diameter of 4".

2. Be placed on opposite ends of the tank, unless otherwise specified by the Health Officer.

3. The invert elevation of the inlet shall be at least 2" higher than the invert elevation of the outlet.

4. The outlet shall be equipped with an effluent filter extending below the tank's liquid level, a distance equal to but not less than 35% or greater than 50% of the liquid level.

5. The tank inlet and outlet shall be installed with a rubber or neoprene gasket to provide watertight connections. The Health Officer may approve, in writing, other watertight connections.

H. Tank ventilation shall be provided by means of a minimum of 8" of air space between the underside of the top of the tank and the top of the 'T' fitting.

I. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000 gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.

J. As measured from the invert elevation of the outlet, the first compartment of multiple compartment tanks shall have at least two-thirds of the total required liquid capacity. Each compartment within a tank shall have an inspection port situated above the outlet baffle. A multiple compartment tank shall have a 4" minimum diameter 'T' or an effluent filter, placed in the common wall; utilizing the same specifications as established for the effluent filter.

K. When septic tanks, privies, temporary privies, or portable toilets are cleaned or serviced, the agency performing such service shall comply with Part 117 P.A. 451 of 1994 (Mich. Comp. Laws § 324.11701 et seq.), as amended, or current State of Michigan requirement, and 40 CFR, Part 503 or current Federal requirements.

3-14.6 Experimental Systems

The use of experimental systems may be authorized at the discretion of the Health Officer. This authorization shall be for the purpose of testing new technologies.

3-15 Privies/Outhouses

A. Permitting of Privies

1. Privies may be permitted for public or private use.

2. Privies shall not be installed where not compliant with State of Michigan construction codes, associated Technical bulletins, policies, and advisories.

3. Privies shall not be permitted in lieu of the installation of a septic system for structures served by pressurized plumbing, or otherwise generating water carried sewage.

4. Vaulted or earth pit privies may be permitted if there is no available sewer for connection.

5. Privies shall not be permitted within a 100 year floodplain boundary. The property owner shall be responsible for documenting the 100 year floodplain elevation as recognized by the Michigan Department of Environment Great Lakes and Energy upon the Department's request.

6. Privies/outhouses can only be permitted to be installed on parcels in remote location where power is not accessible and there is no plumbing in the dwelling.

7. Privy permits will not be issued in areas where the practice is prohibited by local zoning or where other statutes and/or ordinances prohibit without prior approval from the associated authority.

8. Privy Construction requirements are governed by Act 273 PA 1939 and the rules promulgated there under titled "Department of Environmental Quality, Division of Water and Radiological Protection, Outhouses" including Rule 325.421 through Rule 325.426.

    (a) A soil test hole must be evaluated for the primary privy location.

    (b) Soil conditions must be known, and must meet suitability requirements, for a minimum vertical distance of 4' below the intended bottom of the pit for an earth pit privy. This will require a test hole of a minimum of 8' depth.

    (c) The constructed earth pit shall have a depth minimum of 4.5' and a depth maximum of 6'. A minimum width of 3' X 3' square is recommended.

    (d) The floor should be solid and supported by sills to support the outhouse structure.

    (e) Pit curbing shall be installed to support the excavation from collapse and shall extend the depth of the pit. Pit curbing shall not be used to support the outhouse structure or sills.

    (f) The floor and seat riser shall be constructed of impervious material or tongue and groove lumber, and in a manner to exclude insects. The seat riser shall be bonded to the floor to prevent seepage, and shall be provided with a seat with a hinge lid.

    (g) The pit shall be ventilated from the riser to a point outside of the structure by a flue or vent having a cross-sectional area of a minimum 12 in^2. The joints of the vent shall be tight and the opening screened with 16-mesh screening.

    (h) The privy structure shall be fully enclosed and fly tight.

(i) Vaulted privies can be constructed by using an approved septic tank with a minimum capacity of 1,000 gallons, in substitution of a pit and meeting all criteria stated above. Vaulted privies shall be placed where they are accessible to a septic pumping truck.

B. Earth Pit Privies

Prior to an earth pit privy construction permit being issued the proposed location shall meet the following site requirements:

1. Soil permeability rates of the native soil in the proposed infiltrative area of the absorption system shall be between 3and 45 minutes per inch, as estimated by the USDA soil texture class.

2. The effective soil depth shall be a minimum of 60” from natural grade.

C. Privy Construction

1. All privies shall be constructed and maintained in accordance with Section 12771 of Act 368, P.A. of 1978 (Mich. Comp. Laws § 333.12771) and R 325.421 et seq. of the Michigan Administrative Code promulgated thereunder or current State requirement.

2. The bottom of the pit of an earth pit privy shall terminate a minimum of 36” above the limiting zone.

3. Vault privies shall have a minimum tank capacity of 1,000 gallons, shall be of water tight construction, and shall be located to facilitate pumping of waste.

4. Privies shall be located at least 50' from all habitable buildings other than that which they serve.

5. Privies shall be located as prescribed in Table 3-14.2.A of these regulations.

3-16 Abandonment of OSTDS

When an OSTDS is abandoned, it shall be rendered to prevent a potential safety hazard. Abandoned septic tanks shall be pumped and the contents disposed of by a licensed septage waste hauler according to law. The septic tank shall then be collapsed and filled with an approved material or shall be removed and transported and disposed of at a Type II landfill in accordance with law.

A. Septic Tank

1. If an abandoned septic tank is left in place after being pumped out in an approved manner, it may be completely filled with clean sand fill or concrete to prevent the safety hazard of a collapse.

2. If the abandoned septic tank is to be crushed in place after being pumped in an approved method, the tank must be thoroughly crushed and mechanically compacted prior to backfilling. Once crushed and compacted, the tank location shall be backfilled with clean soil and thoroughly mechanically compacted for stability.

3. If the tanks have to be removed, the tanks can be removed once not containing any free liquids and properly disposed of in a licensed landfill.

B. Absorption System

1. When it is practical to do so, the absorption system should be left in place. When the area is needed for other purposes, the absorption system may be removed.

2. To ensure the soil dispersal area does not contain excess liquid waste before removal, it is helpful to dig a hole in the four corners of the soil dispersal area along with a hole in the middle to create sump pits that the liquid septage waste can pool and collect to be pumped out by the licensed septage hauler. This process may take numerous days to ensure the surrounding soil, pipes, and dispersal media are drained. This method should be completed prior to the removal of the dispersal area and bringing it to the ground surface. Removing saturated dispersal media to dry at the ground surface will threaten the public health of nearby residents and the contractors removing the material due to potential exposure to pathogens in the process. Remove and haul the contaminated material to a licensed Type II landfill. Containment of the contaminated material must be provided during transport to avoid the creation of a nuisance or environmental hazard.

Article IV – Commercial OSTDS 1,000 gallons/day to 10,000 gallons/day

4-1 Applicability

This article shall apply to OSTDS other than private single or two-family residences, which utilize septic tanks and absorption system for peak daily flows greater than 1,000 gallons per day flow and less than 10,000 gallons per day flow. Appeals on all sites which serve buildings other than single and two-family residences, including those with peak daily flows of less than 1,000 gallons per day evaluated under these regulations, shall be made to the Michigan Department of Environment, Great Lakes, and Energy or current State agency responsible under the Michigan

Criteria for Subsurface Sewage Disposal, as written by the Division of Environmental Health, Bureau of Environmental and Occupational Health, Michigan Department of Public Health, April 1994, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State requirement.

4-2 Requirements

All OSTDS proposed to receive sanitary sewage from habitable buildings other than single and two-family residential structures shall comply with these regulations and the requirements of the Michigan Criteria for Subsurface Sewage Disposal, as written by the Division of Environmental Health, Bureau of Environmental and Occupational Health, Michigan Department of Public Health, April 1994, By authority of Act 368, P.A. 1978, as amended (Mich. Comp. Laws Ch. 333) and Act 451, P.A. 1994, as amended (Mich. Comp. Laws § 324.101 – 324.90106), or current State requirements governing commercial OSTDS designed to receive sanitary sewage.

Article V – Water Wells

5-1 Applicability

This Article is intended to regulate the installation of water wells and water supply systems. Installation, operation, alteration, and maintenance shall be consistent with, and complementary to the Administrative Rules, as amended, of the Michigan Public Health Code, 1978 PA 368, Part 127 (Mich. Comp. Laws §333.12701), the Michigan Safe Drinking Water Act, 1976 PA 399 (Mich. Comp. Law Section 325), or current State requirement. This Article does not apply to the installation of wells, water mains, service lines, etc., which are part of a Community water supply as defined by the Michigan Safe Drinking Water Act.

5-2 Technical Definitions

Abandoned Well — A well which has its use discontinued, has been left uncompleted, is a threat to the groundwater resource, is or may be a health or safety hazard, or that is in such disrepair, or its construction is such, that its use for the purpose of obtaining groundwater is impractical.

Bedrock — Consolidated and continuous geologic material, such as limestone, dolomite, shale, sandstone, basalt, or granite.

Bentonite — A plastic, colloidal clay which has extensive ability to absorb fresh water and swell in volume and which is composed predominantly of the mineral Montmorillonite.

Concrete Grout	A mixture of Portland cement, sand, and water in the proportion of one bag of cement (94 pounds), an equal volume (one cubic foot) of dry sand or gravel aggregate, and not more than 6 gallons of clean water.
Extensive Change	Includes, but is not limited to, replacing the entire well casing, removing a well casing from the ground, changing aquifers, or increasing well capacity by more than 10 gpm.
Hydraulic Fracturing	The application of liquids or gasses exceeding 250 pounds per square inch via confinement in a predetermined portion of borehole for the purpose of parting the rock matrix or opening existing rock fractures to increase permeability. The pressure is pump pressure, measured at the ground surface.
Neat Cement	A mixture of one bag of Portland cement (94 pounds) and not more than six gallons of freshwater. Drilling fluid bentonite that is not more than 5% by weight of cement and additional water that is not more than 0.6 gallons for each 1% of bentonite may be added to neat cement. Other additives and admixtures shall be approved by the Department before use.
Pump Installer	A person qualified to engage in the installation, removal, alteration, or repair of water well pumping equipment.
Rental Property	A tract of land or dwelling offered for lease to the public for human living purposes which may consist of short or long-term use.
Water Supply System	A system of pipes and structures through which water is obtained including, but not limited to, the source of water such as wells, surface water intakes, and hauled water; pumping and treatment equipment; storage tanks; pipes, and appurtenances, or a combination thereof, used or intended to furnish water for domestic or commercial use.
Well	An opening in the surface of the earth for the purpose of obtaining groundwater, monitoring the quality and quantity of groundwater, obtaining geologic information on aquifers, recharging aquifers, purging aquifers, utilizing the geothermal properties of earth formations, or removing groundwater for any purpose. Wells, as defined in this Section, include but are not limited to:

1. A water supply well used to obtain water for drinking or domestic purposes.

2. A test well/monitoring well used to obtain information on groundwater quality, quantity, or aquifer characteristics for the purpose of designing or operating a water supply system.

3. A recharge well used to discharge water into an aquifer.

4. A heat exchange well used for the purpose of utilizing the geothermal properties of the earth formations for heating or air conditioning. This includes both supply and return wells and vertical bore holes for closed-loop systems.

5. An industrial well used to supply water for non-potable uses.

6. An irrigation well used to provide water for plants, livestock, or other agricultural processes.

7. Wells, which are installed within the 100-year flood plain by variance or deviation, must have elevated casings, which raise the wellhead and screened vents above the 100-year flood level. Permits from EGLE, or appropriate State agencies, may be required prior to placing fill for the installation of a septic system or well below or in a 100-year floodplain elevation in accordance with Section 3-14.1(A)(8) of this Code.

Well Driller — A person qualified to engage in well construction, well alteration, or well repair and pump installation, who supervises the construction of water wells and the installation of pumps, and who owns, rents, or leases equipment used in the construction of water wells.

5-3 – Well Permits

5-3.1 Application for Permit

A. An application for a water supply construction permit shall be provided by the Department.

B. An application for a water supply construction permit shall be made by the property owner or his authorized representative.

C. The Department shall not act upon an application unless the application is complete. To avoid illicit sewage discharge which could create a public health threat or a threat to groundwater, surface water, or the environment, the availability of an OSTDS or municipal sewer serving the structure and suitable to handle water carried sewage must be verified prior to the issuance of a well permit.

5-3.2 Construction Permits

A. No person shall begin construction of a well or water supply or make an extensive change to an existing water supply without first obtaining a water supply construction permit from the Department.

B. Prior to the issuance of a well permit, the availability of a suitable OSTDS serving the structure must be verified by one of the following methods:

1. The parcel must have an existing home with an existing OSTDS.

2. The permit applicant must simultaneously apply for an OSTDS permit for vacant parcels. The OSTDS shall be installed prior to using the well. If the well is drilled first and the applicant does not install the required OSTDS, then owner will be ordered to abandon the unapproved water supply well.

3. If the well is proposed in a location in which municipal sewer is available then owner is responsible for contacting municipality to determine if any ordinance exists that prevents the installation of an on-site water supply well at the proposed site. Applicant must provide LMAS verification from municipality that a well is allowed at proposed location along with any stipulations imposed by municipality.

4. If the well is proposed to be an industrial, irrigation, test well, or other well proposed not to be connected to a structure, a site evaluation must be conducted by LMAS to verify that no structure exists on the parcel which could potentially be connected to the proposed water supply well. If a structure, which could potentially be connected to the proposed water supply well, is found to exist on the parcel, one of the conditions in 1-3 above must be satisfied prior to the issuance of the well permit.

C. Any construction permit issued pursuant to the requirements of this Code shall be valid for a term of 24 months from the date of issuance unless declared void as provided in this code. After the expiration of the construction permit, a 30-day grace period shall exist for an extension request. A permit may be renewed (extended) one time for a period of 24 months.

D. A permit shall not be transferable from one person to another.

E. The Department may deny a water supply construction permit when incomplete, inaccurate, or false information has been supplied or when determined that the requirements of this code and/or applicable state statutes have not or cannot be met. The reasons for denial shall be furnished to the applicant in writing.

F. The Department may allow a change in the proposed well location for a permitted supply without additional application fees. The Department may require a site plan signed by the property owner(s) or their authorized representative.

G. A permit may be rescinded or declared void by the Department when one or more of the following conditions exist:

    1. A change in the plans of the permit holder affecting circumstances relative to the water supply design, location, or use.

    2. Misrepresentation, omission, or withholding pertinent information upon which compliance with the minimum requirements contained within this code are based.

    3. Issuance of the permit, and/or the construction of facilities thereunder, may create a condition that constitutes a nuisance, or a threat to public health or the environment.

H. The Department shall issue a water supply construction permit when an application containing all of the requested information has been received and the proposal satisfies all the requirements of this code. An onsite evaluation may be required prior to the issuance of the permit.

I. The permit may impose limitations or require special construction practices which the Department deems necessary to protect public health or groundwater quality. An on-site inspection conducted by the Department during construction or portions thereof may be required as part of the water supply construction permit.

J. The well driller/contractor shall have a valid permit in possession and on-site at the time of construction, unless it operates under emergency conditions per Section 5-11.

K. A separate water supply construction permit for each well on the premises may be required by the Department.

L. Pressurized water shall not be plumbed to a building without an approved connection to an OSTDS, or available sewer.

5-3.3 Construction Permit Not Required

A. A permit is not required for minor repairs to the water supply system such as replacing a

telescoped well screen, changing a screen elevation, deepening or plugging back a bedrock well, installing a liner pipe, replacing a pump, pump controls, pump drop pipe or pressure tank, or chemical treatment or disinfection of the well.

B. A permit is not required from the Department for the installation of any wells under the jurisdiction of Michigan's *Mineral Well Act*, Part 625, 1994 P.A. 451, (Mich. Comp. Laws Section 324) amended, or current State statute regulating mineral exploration.

C. If the owner, owner's agent, well driller, or pump installer is required to obtain a permit directly from the Michigan Department of Environment, Great Lakes, and Energy in accordance with the requirements established under the provisions of the 1976 PA 399, Michigan's Safe Drinking Water Act (Mich. Comp. Laws Section 325), they shall not be required to obtain a permit from the local health department. When the Department issues a permit for the installation or extensive change of a public water supply system under agreement, contract or cooperative arrangement as stated in Act 399 (Mich. Comp. Laws Section 325), the permit shall be issued in accordance with Section 5-3 of this Article.

5-4 Availability of Public Water Supply

A. The existence or availability of a public water supply shall not preclude the issuance of an individual water supply construction permit under this Code unless prohibited by other regulations.

B. When a public water supply is available the Department will contact the municipal water supplier prior to issuing a permit.

5-5 Water Well and Pump Record

A water well and pump record shall be submitted to the Department in accordance with Administrative Rule 325.175 adopted under authority of Part 127, of Act 368 (Mich. Comp. Laws Section 333), Michigan's Public Health Code, or current State requirement, and when any of the following conditions apply:

A. A well is deepened after completion.

B. A liner pipe is installed.

C. The capacity of the well is increased by 10 gpm or more.

D. A well screen is replaced.

E. A different aquifer is utilized.

F. A bedrock well is plugged back.

G. A pump is replaced.

H. An underground pressure tank is installed.

I. A pitless adapter is installed.

J. A well is hydraulically fractured.

K. A water well and pump record is requested by the Department.

5-6 Priority Over Building and Occupancy Permits

Where a municipal water supply is not available, a municipality, township, or other agency shall not issue a building permit or otherwise allow construction to commence for any dwelling unless one of the following conditions exists:

A. A water supply construction permit has first been issued.

B. Provisions for a water supply system have been accepted by the Department.

C. The Department does not require a water supply system.

5-7 Stop Work Order

The Health Officer may issue a stop-work order when the water supply under construction does not comply with the requirements of this Code and all applicable laws, regulations and ordinances. Work shall not resume until the owner and/or authorized agent have agreed to comply and the Health Officer rescinds the stop-work order.

5-8 Notification

The Department may require the well driller to notify the Department prior to or during construction of the water supply.

5-9 Well Inspection and Approval

5-9.1 Inspection

A. The Department may inspect the water supply system construction or well drilling process.

B. An inspection of a new or extensively changed water supply system may be required by the Department before the system is put into use.

5-9.2 Approval

A. The final approval of a water supply system shall not be granted until all of the following conditions have been met:

1. The water supply system is found to be in compliance with this Code, other applicable codes, and the permit requirements.

2. A completed "Water Well and Pump Record," and the associated abandoned well plugging record if applicable, has been submitted, reviewed, and approved.

3. The Department, upon review of the required water sample analysis results, has determined that the water quality meets safe drinking water standards for the parameters tested.

5-10 Rental Properties

A. Water supplies serving rental properties may be condemned and ordered corrected by the Department when any one of the following conditions exists:

1. The water quality from the well does not meet safe drinking water standards.

2. The Department determines that continued use of a well represents a potential health hazard.

3. A well is found to be in violation of previous applicable rules which were in effect at the time of construction.

B. A condemnation order shall be provided by the Health Officer in writing to the owner of the water supply. The order shall specify the conditions and methods of correction and establish a compliance date not to exceed 90 days.

C. The owner, upon receiving an order of condemnation, shall notify all tenants that continued use of the water supply represents a potential health hazard, and that precautionary measures should be taken to protect their health.

5-11 Emergency Conditions

When a lack of water results in undue hardship and the Department is closed, a well driller or property owner may initiate repair work or construction of a new well or water supply without prior notification or permit. The well driller or property owner shall contact the Department on the next working day to obtain a permit. The well driller or property owner shall be responsible for complying with all other provisions of this code.

5-12 Grouting Requirements for Bedrock Wells

Where bedrock is encountered within 25' of ground surface, an oversized borehole shall be drilled and the entire length of casing grouted with neat cement or concrete grout.

5-13 Hydraulic Fracturing

A. Hydraulic fracturing to improve water well capacity shall be in accordance with the Michigan Department of Environment, Great Lakes, and Energy, Office of Drinking Water and Municipal Assistance, Policy and Procedure #ODWMA-368-127-005 (original effective date October 10, 1996, reformatted date April 3, 2013) which was developed to assist in the application of Administrative Rule 325.16137 adopted under authority of Part 127, 1978 PA 368 (Mich. Comp. Laws Section 333, Michigan's Public Health Code, or current State requirement.

B. All wells that have been hydraulically fractured shall be tested for the presence of coliform bacteria after completion of the hydraulic fracturing process and the disinfection/chlorination of the well.

5-14 Geothermal Wells

A. Vertical closed loop systems are any installations vertically or horizontally directionally bored which are at a depth of 15' or greater. Vertical closed loop systems require a permit from the local health department. One permit is required for single and two family residential sites or systems. One permit is required per 25 boreholes on a commercial site or system. Permit application shall include a site diagram, the number of proposed boreholes, and proposed heat transfer fluids to be used. A permit application must be submitted to the local health department a minimum of 14 days prior to installation.

B. Vertical closed-loop geothermal wells shall be permitted as a water well and shall be constructed in accordance with the Michigan Water Well Construction and Pump Installation Code (Part 127, Act 368, PA 1978 as amended) and administrative rules or current State and regional technical guidance and/or statute.

C. Geothermal boreholes must be constructed (drilled and grouted) by a Michigan licensed water well driller or individuals authorized under the Administrative Rules, as amended, of the Michigan Public Health Code, 1978 PA 368, Part 127.

1. All hydronic piping installation must abide by the rules set forth in the 2006 International Mechanical Code.

2. A preliminary site evaluation shall be conducted by the health department and a construction permit issued prior to any drilling or installation.

3. Geothermal boreholes must be constructed and grouted in accordance with Part 127.

4. Grouting of boreholes shall be completed within 24 hours of borehole completion.

5. One record representing the formation must be submitted for each geothermal permit. The formation information, as-built drawing, and all other requested information must be recorded on the EGLE Geothermal Closed – Loop Construction Notice and submitted to the health department within 60 days of completion of the boreholes.

6. Vertical loops shall be isolated in accordance with the following isolation distances: Household drinking water well - 50’ Type IIb or Type III public water well - 75’ Type I or II public water well -200’ Residential on-site sewage system - 25’ Buried water service line or sewer line - 10’ Property line -10’. Note: LMAS District Health Department shall have the authority to grant variances to or increase the isolation distance listed above as permitted in this code. Heat transfer fluids shall be food-grade propylene glycol, methanol, or ethanol (20%) or other nontoxic compounds that meet IGSHPA Closed Loop/Geothermal Heat Pump Systems, Design and Installation Standards, 2007 Edition, Section 3B and 3C, and are compatible with manufactures’ specifications. Flammable liquids shall not be used.

7. All underground piping must be a minimum of 160-psi pressure rated high-density polyethylene.

8. All joints in piping must be heat fused by butt, socket, sidewall or electro fusion in accordance with the pipe manufacture's procedures and in compliance with the 2006 International Mechanical Code.

9. Pressure testing must be conducted prior to transfer fluids being installed. Pressure testing must be at 100 psi for 30 minutes in compliance with the International Mechanical Code.

10. A leakage detected shall be immediately excavated and repaired or the loop shall be permanently abandoned in accordance with Part 127.

11. A tag listing the contractor's name, chemicals used for heat transfer fluids, and chemical concentrations must be installed on the heat exchanger unit.

12. All buried geothermal piping must have continuous locator tape attached.

13. All vertical boreholes that are to be abandoned must be abandoned in accordance with Part 127. If the loop cannot be removed, the loop shall be permanently sealed by pumping high solids bentonite grout into the loop and completely filling the loop with grout.

D. Vertical open loops systems utilize a water well to supply ground water to a heat pump. All open loop wells are regulated under Part 127, require a water well permit from the local health department, and shall be constructed by a Michigan licensed well driller. Wells that are part of a groundwater thermal exchange system may not serve another function, except water may be supplied to the domestic water system if the domestic water system is protected by an air gap or backflow prevention device in accordance with Michigan's Plumbing Code.

E. Horizontal closed loop systems are regulated by Mechanical Code Authorities.

5-15 Lots Less than 1 acre, Subdivisions, and Site Condominiums

Permit evaluations for wells proposed to be located on a parcel of less than one acre as created after March 31, 1997, a parcel within a subdivision, a parcel which is classified as a site condominium, or a parcel that was otherwise created in excess of the allowable number of exempt parcel splits under the Land Division Act, Act 288, PA 1967 (Mich. Comp. Laws § 560.101 *et seq*), shall comply with all aspects of the rules entitled Part 4. Department of Environmental Quality On-site Water Supply and Sewage Disposal for Land Divisions and Subdivisions, being R560.401-R560.428 of the Michigan Administrative Code, or current State statute, prior to permitting.

5-16 Well Abandonment and Plugging

A. Any abandoned well, dry hole, or well that has been determined to be contaminated or to be a safety hazard shall be plugged in accordance with Part 127 of Act 368, P.A. 1978 (Mich. Comp. Laws 333.12701 et seq.), as amended, or current State requirement.

B. The plugging of any well or dry hole on a parcel containing a well that serves the public, or a residence other than that of the owner, shall be plugged by a State of Michigan registered well-drilling contractor.

C. When a replacement well has been permitted and constructed, the existing well previously in service shall be abandoned and plugged unless remaining active and serving a beneficial use, or unless placed in a temporarily abandoned status in accordance with Part 127 of Act 368, P.A. 1978 (Mich. Comp. Laws 333.12701 et seq.), as amended, or current State requirement.

Article VI – Public Health Nuisance/Imminent Danger

6-1 Technical Definitions

Imminent Danger — An environmental health-related condition or practice which could reasonably be expected to cause death, disease, or serious physical harm immediately or before the imminence of the danger can be eliminated through enforcement procedures otherwise provided.

Public Health Nuisance — An environmental health-related activity, or failure to act, resulting in a condition known to, or reasonably expected to be capable of, significantly adversely affecting the health of the general public.

6-2 Public Health Nuisances Prohibited

A person shall not engage in an activity or create or permit a condition to exist, which is or may become a public health nuisance.

6-3 Public Health Nuisance Investigation

The Department may initiate investigations into public health nuisances and take all necessary action to abate the same. The Department may also investigate complaints concerning alleged public health nuisances as hereafter provided.

6-4 Complaints Concerning Public Health Nuisance

Complaints shall include specific details regarding the situation, including the nature and location of the alleged nuisance condition, the date and time of occurrence, the person responsible, the names of witnesses, and the contact information of the complainant. The Department may require such complaints to be submitted in writing and signed.

6-5 Investigation of Complaints

The Department, upon receipt of a complaint concerning a public health nuisance, may consider the information provided and may conduct such investigations as deems necessary. If the investigation by the Department discloses that the alleged public health nuisance no longer exists or does not represent a threat to the health and safety of the public, the complainant may be notified of such findings.

If the investigation of the Department reveals that the complaint pertains to an activity or condition subject to the statutory regulation of an official agency, bureau, or department other than the Local Health Department, the Department may notify the appropriate agency, bureau, or department of the complaint, or otherwise refer the complaint to the appropriate authority.

6-6 Abatement of Public Health Nuisance

A. The Department may issue an order to avoid, correct, or remove any condition the department reasonably believes to be a public health nuisance.

B. Upon issuance of an order by the Department to avoid, correct, or remove a public health nuisance, the person so named in the order shall immediately abate, mitigate, remove, or otherwise control the public health nuisance.

C. All costs incurred as a result of the abatement of a public health nuisance shall be at the expense of the owner of the parcel and/or property from which the nuisance emanates.

6-7 Imminent Danger

A. Upon determination that an imminent danger to the health or lives of individuals exists, the Department shall immediately inform the individuals affected by the imminent danger.

B. Where imminent danger has been determined to exist, the Department shall issue an order to the person authorized to avoid, correct, or remove the condition creating the imminent danger. The order may be posted by the Department at or near the imminent danger. The order may specify actions to be taken, or prohibit the presence of individuals in locations or under conditions where the imminent danger exists. Authorization for presence or access may be given to individuals whose presence is necessary to avoid,

correct, or remove the imminent danger.

C. Upon issuance of an order by the Department to avoid, correct or remove an imminent danger, the person so named in the order shall immediately abate, mitigate, remove, or otherwise control the imminent danger.

D. The owner of the parcel or property from which the imminent danger emanates, or the person otherwise responsible for the creation or control of the imminent danger shall be responsible for all costs and expenses associated with the abatement, mitigation, removal, or control of the imminent danger.

E. In accordance with Mich. Comp. Laws § 333.2451, the Department may petition the court to restrain the condition or practice or require action to avoid, correct or remove the imminent danger. Upon failure of the person to comply promptly with an order issued under this section, the Department may petition a circuit court or district court having jurisdiction to restrain a condition or practice which the Department determines causes the imminent danger or to require action to avoid, correct, or remove the imminent danger. Any action taken to correct, abate, or mitigate an imminent danger shall be at the expense of the owner of the parcel or property from which the imminent danger emanates.

Article VII – Food Service

7-1 Compliance with State Law

All operations, establishments, individuals, and entities providing food to the public shall fully comply with Michigan Food Law, Act 92 of 2000, as amended, (Mich. Comp Laws §§ 289.1101-289.8111), and the regulations adopted pursuant to this act, or current State requirement.

7-2 Plan review for New Construction

No jurisdiction of authority shall issue a construction permit or building permit for a structure proposed to be used as a food service establishment without prior approval from the Department. Commencement of construction without Department approval will result in the issuance of a stop work order by the Department.

Article VIII - Public Swimming Pools and Hot Tubs

8-1 Compliance with State Law

All public swimming pools and hot tubs shall be fully compliant with the requirements of Part 125 of Article 12, Act 368, PA 1978, (Mich. Comp. Laws §§ 333.12521-333.12534) and the regulations adopted pursuant to this authority, or current State requirement.

8-2 Certified Pool Operator

All facilities operating and/or housing a public swimming pool or hot tub shall employee an operator possessing the National Swimming Pool Foundation (NSPF) Certified Pool Operator (CPO) credential or equivalent. The certified swimming pool operator shall be available for immediate response to the facility within 15 minutes.

Article IX - Campgrounds

9-1 Compliance with State Law

All permanent and temporary campgrounds, except children's camps that are licensed by the Michigan Department of Health and Human Services, shall be fully compliant with the requirements of Part 125 of Article 12, Act 368, PA 1978 (Mich. Comp. Laws §§ 333.12501-333.12515) and the regulations adopted pursuant to this authority, or current State requirement.

Article X - Septic Tank Pumping and Land Application of Septage

10-1 Compliance with State Law

All entities providing septic tank pumping service, or performing land application of septage waste, shall fully comply with Part 117 of the Natural Resources and Environmental Protection Act, Act 451, PA 1994, (Mich. Comp. Laws § 324.11701 et seq.) and the regulations adopted pursuant to this authority, or current State requirement.

Article XI - Body Art

11-1 Compliance with State Law

All body art facilities, or individuals, performing tattooing, body piercing, branding, scarification, or other applicable body art activities shall fully comply with Act 375, PA 2010, as amended(Mich. Comp. Laws §§ 333.13101-333.13112) and the regulations adopted pursuant to this authority, or current State requirement.

Article XII – Cemeteries and Burials

12-1 Establishing Cemeteries

A. Prior to the establishment of a cemetery, the landowner shall make application to the Department for review and plat approval of the proposed cemetery.

B. The applicant shall submit two copies of a recorded survey with the location of the plat to the Department for review and approval. The plat plan shall include the following:

    1. The legal definition of the property.

    2. A scaled site plan with 8’ contour intervals, number lots, and the location of test holes.

    3. Soil information and seasonal water table elevation within the upper 10’ of the soil profile.

    4. Current groundwater well locations and construction records in the vicinity and any proposed wells to be located within the proposed cemetery.

    5. Distances and locations to the nearest surface water bodies.

    6. Information regarding land uses, both current and future, for adjacent properties.

    7. Signature and seal of registered land surveyor or professional engineer.

C. A landowner may establish a “Family Cemetery” as allowable and defined under Section 128.111 of Michigan Act 88 of 1875 as amended (Mich. Comp. Laws § 128.111), or current State regulation. A Family Cemetery shall meet the requirements of local zoning and Department review. Family cemeteries shall be one acre or less in size and be platted and

deeded as a cemetery. Individuals applying for approval of a Family Cemetery shall be advised of potential future complications during land sale or transfer and of the potential necessity of legally vacating and relocating the cemetery at a future date.

D. Backhoe cut test holes for the purpose of soil suitability determination shall be provided by the applicant for on-site evaluation by the department. The number of test holes required for approval shall be at the discretion of the department based upon local soil, geological and hydro-geological conditions. Test holes shall be excavated to a depth of ten feet (10') below natural grade, or to a depth at which bedrock or water table is encountered.

E. Crematory remains are exempt from these requirements. Cremated remains need not be buried. Ashes may be scattered, stored, or saved.

12-1.1 Minimum Site Criteria

A. Casket or Natural Burial

1. A minimum soil depth of 10 feet shall be required prior to encountering evidence of seasonal high-water table or bedrock for a site to be considered suitable, allowing 4 feet of suitable soil to lie beneath the casket/body and 4 feet of soil cover once buried.

2. The initial 4 feet of soil located beneath the casket or body shall not have a percolation rate greater than 3 minutes per inch.

B. Burial Using Burial Vault

1. Where a watertight burial vault is used, sufficient soil depth shall be available to install the burial vault so that the bottom of the vault is above seasonal high-water table, or bedrock.

2. A minimum of 4' of soil cover shall be installed over the burial vault.

C. Clean soil fill with a percolation rate less than 3 minutes per inch may be installed to meet the vertical isolation and cover requirements of these rules. Fill containing sufficient organic content and possessing a percolation rate that optimizes nutrient and contamination removal should be used.

D. Construction of cemeteries will not be allowed in environmentally sensitive areas, such as: floodplains, swamps, wetlands, ravines, steep slopes, or drainage areas to rivers, lakes, or other waterways.

E. No burials shall lie at the cemetery boundary. A buffer zone of at least 25 feet shall be required along the cemetery boundary. A fence shall also surround the cemetery.

F. There is no minimum lot size for gravesites. However, for a "family cemetery," the cemetery area cannot exceed one acre.

12-1.2 Required Isolation Distances

A. All burial sites within the cemetery shall be at least 100 feet from the surface water.

B. All burial sites in a cemetery shall be located beyond the 100-year floodplain boundary.

C. All burial sites shall be located 75' from any water wellhead.

D. All burial sites shall maintain required isolation distance to wellheads and/or wellhead protection zones of public water supply wells.

12-1.3 Approval of Cemetery Plat

A. Upon approval, one copy of the plat and a letter of approval shall be returned to the applicant and the second copy and a copy of the letter of approval shall remain on file at the Department.

B. The approved plat shall be recorded with the Register of Deeds by the applicant and shall meet the zoning/land use requirements of the local township.

C. The Department shall reject the proposed cemetery if the conditions of these regulations cannot be met, or if any potential threat to public health, public safety, or the environment would be created by its approval.

D. The owner of the cemetery shall be required to maintain retrievable and accurate records of burial dates and locations.

12-2 Disinterment and Vacating Cemeteries

A. Pursuant to Mich. Comp. Law § 333.2853, a permit application shall be submitted to the Department on forms provided by the State and signed by a funeral director prior to being granted an approval and permit from the Health Officer, associated with any disinterment and reinterment of human remains or the vacating of a cemetery containing human remains

B. The Health Officer shall approve any disinterment or re-interment requests pursuant to Mich. Comp. Laws § 333.2853. A fee may be charged for reviewing disinterment and re-interment requests. The affidavit for interment or burial shall be signed by a licensed funeral director and specify surviving relatives. If the required signatures cannot be obtained, the licensed funeral director shall be advised to obtain a circuit court order.

C. If a cemetery is to be vacated, a circuit court order is required, and the Michigan Historical Commission shall be contacted. The Health Officer shall supervise the actual disinterment and re-interment of bodies and remains as required by Mich. Comp. Laws § 333.2458.

12-3 Cemetery Related Complaints

A. All complaints regarding cemetery maintenance and operation are under the legal jurisdiction of the Cemetery Commissioner under authority of Michigan Cemetery Regulation Act, Act 251 of the Public Acts of 1968, as amended (Mich. Comp. Laws §§ 456.521-456.453), or current State regulations. Complaints regarding human cemeteries should be addressed to the Michigan Department of Licensing and Regulatory Affairs (LARA), or current designated State department.

B. Complaints associated with animal burial fall under authority of the Bodies of Dead Animals Act (Mich. Comp. Laws §§ 287.651-287.683) and administrative rules adopted thereunder (Mich. Admin. Code R287.651-R287.657). Complaints associated with animal burial should be referred to the Michigan Department of Agriculture and Rural Development (MDARD) or current designated State department.

Article XIII – Clandestine Drug Related Contamination

13-1 Clandestine Drug Laboratories

The Department shall condemn and prohibit occupancy of any habitable building, or portion thereof, for which credible evidence or notification has been received indicating that a clandestine drug laboratory has been operated within that habitable building in accordance with Michigan Public Health Code (Mich. Comp. Laws § 333.12103) and the Housing Law of Michigan (Mich. Comp. Laws § 125.485a).

13-2 Other Drug-Related Contamination

The Department shall condemn and prohibit occupancy of any habitable building or portion thereof for which credible evidence or notification has been received indicating that drug-related contamination exists within the structure posing a significant health risk to the occupants. Contaminants of concern may include, but are not limited to, methamphetamine, fentanyl, and carfentanyl.

13-3 Expansion of Condemnation

Condemnation of an individual residence or area within a habitable building may extend into other areas or residences in a habitable building based upon interconnectivity of building design. Justification for expansion of condemnation may include, but is not limited to, interconnectivity and environmental assessment of heating, ventilation and air conditioning (HVAC) ductwork. Environmental assessment and associated costs shall not be at the expense of the Department.

13-4 Lifting of Condemnation

Habitable buildings, or any portion thereof, condemned under this Article shall remain condemned until the Department has received and approved the laboratory results and reporting from an environmental assessment deemed acceptable by the Department and performed by a qualified third-party environmental consulting professional, company, firm or agency and until such time that the Department has lifted the condemnation. The decontamination, environmental assessment, and associated costs shall not be at the expense of the Department.

Article XIV – Enforcement

14-1 Criminal Enforcement

A. A person who violates this code or the rules promulgated under it is guilty of a misdemeanor.

B. By authority of Michigan's Public Health Code, Act 368, P.A. of 1978, Section 2443, as amended (Mich. Comp. Laws § 333.2443), a misdemeanor committed under this code is punishable by imprisonment for not more than six months, or a fine of not more than $200 or both.

C. Each act of violation shall constitute a separate offense.

14-2 Civil Enforcement

A. Whenever the Health Officer determines that this code has been violated, he shall issue a notice of violation to the person responsible. The Health Officer shall issue this notice no later than 90 days after the discovery of the alleged violation.

B. The notice shall be in writing and include the following information:

    1. The nature of the violation, stated with particularity, including reference to the section alleged to have been violated.

2. The civil penalty, if any, established for the violation.

3. The remedial action is required to comply with this code.

4. A reasonable time, not to exceed 90 days, for compliance.

5. A statement that failure to correct or abate the violation in the prescribed manner shall result in the issuance of an appearance ticket.

6. A statement that the alleged violator has the right to appeal the notice in accordance with Article XVI.

7. The notice of violation shall be served upon the alleged violator by delivering the notice to him in person; or by sending a copy of the notice by registered mail with proof of mailing to his last known address; or if the person to be served is unknown, by posting the notice in a conspicuous place on the premises.

14-3 Appearance Tickets

A. The Health Officer is authorized by authority of Michigan's Public Health Code Act 368, P.A. of 1978, Section 2463 (Mich. Comp. Laws § 333.2463), pursuant to Sections 9a to 9g of Chapter 4 of Act No. 175, P. A. of 1927, as amended, (Mich. Comp. Laws §§ 7.64.9a-7.64.9g), to issue and serve appearance tickets for violations of this code.

B. No appearance ticket shall be issued for a violation of this code without first having served the alleged violator with a written notice of violation.

14-4 Schedule of Civil Penalties

A. Monetary civil penalties shall be imposed according to the following schedule for subsequent violations occurring within a rolling 24-month period. Violations occurring beyond 24 months of the initial violation will be considered first violation:

1. First violation: $200.00

2. Second violation: $500.00

3. Third and subsequent violations: $1,000.00.

B. A civil penalty levied under this Section shall be for each violation or day that the violation continues. The civil penalty may be assessed for a specified violation of this code or order issued which the Health Officer has the authority and duty to enforce. A civil penalty may

be recovered in a civil action brought in the county in which the violation occurred or the defendant resides.

14-5 Inspections, Investigations and Warrants

To enforce this code, the Department may inspect or investigate any matter, thing, premises, place, person, record, vehicle, incident, or event. The Department may collect samples for laboratory examination. The standards and procedures for issuance of an inspection or investigation warrant shall be in accordance with Mich. Comp. Laws §§ 333.2242-2247.

14-6 Injunctions

The Health Officer, without posting bond, may maintain injunctive action to restrain, prevent, or correct a violation of a law, rule, or order which he has the duty to enforce, or to restrain, prevent, or correct an activity or condition which he believes adversely affects the public health. This remedy may be used notwithstanding the existence and pursuit of any other remedy.

14-7 Obstruction of Health Officer

It shall be unlawful for any person to molest, willfully oppose, or otherwise obstruct the Health Officer.

Article XV – Variances

15-1 Variances

A. A variance from the specific requirements of this code and the Alternative Manual contained in **Appendix A** may be granted by the Health Officer when all of the following conditions exist:

    1. No substantial health hazard or nuisance is likely to occur.

    2. Strict compliance with the code requirements would result in unnecessary or unreasonable hardship for the petitioner.

    3. No state, local statute, or other applicable laws would be violated.

    4. The protection of the health, safety, and general welfare of the public is assured.

B. The variance request shall be submitted in writing prior to the issuance of a permit. The applicant shall demonstrate that the variance would pose no hazard to the public or the environment.

C. The Health Officer may specify conditions necessary for the granting of the variance.

D. Variances thus granted apply only to the specific project under consideration and do not serve as precedence in other cases.

Article XVI - Appeals

16-1 Board of Appeals

A. In order to provide for reasonable and equitable interpretations of the provisions of this code and Alternative Manual, a board of appeals may be formed to hear appeals. The board shall have not less than three but not more than five members, appointed by the board of health. The appeals board shall be representative of varied interests.

B. The membership of the board of appeals shall elect their own chairperson from among its membership.

C. The Department shall provide administrative support to the board of appeals.

D. Appeals on all sites which serve buildings other than single and two-family residences, including those with peak daily flows of less than 1,000 gallons per day evaluated under these regulations, shall be made to EGLE or the State agency responsible for establishing criteria for subsurface sewage disposal.

E. Appeals relating to parcels that were otherwise created in excess of the allowable number of exempt parcel splits under the Land Division Act, Act 288, PA 1967, (Mich. Comp. Laws § 560.101 *et seq*) in compliance with Part 4. Department of Environmental Quality On-site Water Supply and Sewage Disposal for Land Divisions and Subdivisions, being R560.401-R560.428 of the Michigan Administrative Code, or current State statute, shall be made to EGLE or other the responsible State agency.

16-2 Informal Resolution of Disputes

A. A person who disagrees with a decision of the Health Officer, arising out of this code, is encouraged to meet and resolve the dispute with the Director of Environmental Health or the Health Officer. At any time, a person may cease efforts to reach an informal resolution and may request a formal hearing before the board of appeals.

B. Before the Health Officer suspends or revokes a license, the Health Officer shall give notice, personally or by mail, to the licensee. The licensee shall be given an opportunity, at an informal meeting, to show compliance with all lawful requirements for retention of the license.

C. In the absence of compliance, the Health Officer shall issue a notice of a formal hearing,

followed by a hearing, in accordance with the procedures outlined in Section 16-3 below. The Health Officer may order a summary suspension of the license if the public health, safety, or welfare requires emergency action.

16-3 Formal Hearings

A. A person who disagrees with the decision of the Health Officer, and who has been unable to resolve the dispute informally, may petition the Department for a formal administrative hearing before the board of appeals. The petitioner has 20 days after the receipt of an adverse decision to do so. The formal hearing shall be held within 30 days after the receipt of the petition. The petitioner shall be notified in writing by registered mail, or personally served, at least five days before the hearing, of the time, date, and place. After the administrative hearing, the board of appeals, by resolution of the majority of the board, may affirm, dismiss, or modify the decision. The board of appeals shall state its decision on the record or shall furnish the petitioner with a written decision within 15 days following the hearing.

B. Hearings shall be conducted in an impartial manner. The parties shall be given an opportunity to present oral and written arguments on issues of law and policy and an opportunity to present evidence and argument on issues of fact. The petitioner shall be allowed to present his argument and evidence first, followed by the respondent.

C. A party may cross-examine a witness, including the author of a document prepared by, on behalf of, or for use of the Department and offered in evidence. A party may submit rebuttal evidence.

D. The hearing shall be recorded but need not be transcribed unless requested by a party, who shall pay for the transcription.

E. The board of appeals shall set aside a decision of the Health Officer only if substantial rights of the petitioner have been prejudiced because the decision is any of the following:

    1. In violation of the constitution or a statute.

    2. In excess of the statutory authority or jurisdiction of the Department.

    3. Made upon unlawful procedure resulting in material prejudice to a party.

    4. Not supported by competent material and substantial evidence.

    5. Arbitrary, capricious or clearly an abuse or unwarranted exercise of discretion.

    6. Affected by other substantial and material error of law.

F. The decision of the board of appeals in all cases is final and shall be subject to judicial review as provided by law. A person aggrieved by a decision of the board of appeals may petition the circuit court of the county in which the principal office of the Department is

located for review. The petition shall be filed not later than 60-days following the receipt of the final decision.

APPENDIX A

LMAS DISTRICT HEALTH DEPARTMENT

Luce County • 14150 Hamilton Lake Road, Newberry, MI 49868 • (906) 293-5107 • Fax (906) 293-5453
Mackinac County • 749 Hombach Street, St. Ignace, MI 49781 • (906) 643-1100 • Fax (906) 643-0239
Alger County • E9526 Prospect Street, Munising, MI 49862 • (906) 387-2297 • Fax (906) 387-2224
Schoolcraft County • 300 Walnut St., Room 155, Manistique, MI 49854 • (906) 341-6951 • Fax (906) 341-5230

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Minimum Requirements for Alternative On-Site Sewage Treatment Systems

Technical guidance manual per Article III, Section 3-14.1(B) of the LMAS District Health Department Upper Peninsula Environmental Health Code

UPEHC draft revisions: 7/24/2025

Minimum Requirements for Alternative On-Site Sewage Treatment Systems

Technical guidance manual per Article III, Section 3-14.1(B) of the
LMAS District Health Department Upper Peninsula Environmental Health Code

UPEHC draft revisions: 3/11/2022

Preface

The minimum requirements set forth in this document were developed by the LMAS District Health Department, Environmental Health Division. The minimum requirements contained in this document have been developed for district wide application of alternative methods of residential sewage treatment including commercial systems discharging less than 1,000 gallons per day. This is a working document and modifications may be made as deemed necessary by the LMAS District Health Department ("Department").

MINIMUM REQUIREMENTS FOR

ALTERNATIVE ON-SITE SEWAGE TREATMENT SYSTEMS

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Section 1:
Alternative On-Site Sewage Treatment Systems – General Parameters

General

The minimum requirements set forth in this document apply to residential building sites and commercial sites discharging less than 1,000 gallons per day requiring on-site sewage treatment and disposal for compliance under the LMAS District Health Department Upper Peninsula Environmental Health Code ("Code"). The provisions of this manual shall only apply in the event that a site does not meet the minimum requirements set forth in Section 3-14.1.A of the Code for conventional sewage systems.

It is noted that alternative on-site sewage treatment systems are not viable options for every site as some sites are unsuitable for the construction of any type of on-site sewage treatment and disposal system. This manual does not apply to commercial sites regulated by the Michigan Criteria for Subsurface Sewage Disposal. Subdivisions, site condominiums, and land divisions under one acre in size shall comply with the Michigan Department of Environmental, Great Lakes, and Energy ("EGLE") Administrative Rules for On-Site Water Supply and Sewage Disposal for Land Divisions and Subdivisions.

Definitions

Advanced Treatment System	An OSTDS that treats effluent to a higher degree than a traditional OSTDS. These systems must meet NSF/ANSI Standard 40 or equivalent.
Absorption System	The part of an OSTDS in which septic tank effluent is distributed by arrangement of trenches or bed(s) that allows the effluent to be absorbed and treated by the surrounding soil.
Basal Area	The effective undisturbed natural soil surface area available to transmit the treated effluent from the sand fill media into the original receiving soils.
Design Consultant	The person responsible for designing the construction plans for alternative on-site sewage treatment systems. This can include (depending on type of system): Michigan Registered Sanitarian, Professional Engineer specializing in environmental or sanitary wastewater treatment, LMAS approved advanced treatment distributor/installer, or LMAS licensed septic installer.
Elevated Mound *(pump to gravity)*	An alternative method of on-site sewage treatment and disposal in which sand fill media is laid on top of properly prepared original soil surface. The sand fill media uses vertical separation to provide the necessary treatment. A pump is utilized in this type of system. The effluent from the septic tank flows by gravity to the dosing chamber where it

	is pumped up to the absorption system installed on top of the sand fill. The effluent then flows by gravity throughout the laterals of the absorption system.
Geotextile Fabric (*filter fabric*)	A non-woven fabric that is installed between the aggregate and soil cover used to impede or prevent the movement of sand, silt, and clay into aggregate/filter media.
Gravity Mound	An alternative method of on-site sewage treatment and disposal in which sand fill media is laid on top of properly prepared original soil surface. The sand fill media uses vertical separation to provide the necessary treatment. Pumps are <u>not</u> utilized for this type of system. The effluent out of the septic tank flows by gravity to the absorption system installed on top of the sand fill.
Greenbelt Area	The area measured horizontally downslope from the edge of the final treatment system, which is maintained undisturbed prior to, during, and after construction so as not to impede lateral movement of effluent.
Mottled soil (*redoximorphic features*)	Spots or blotches of contrasting colors, such as, but not limited to, gray or brown or gray and brown colors in close proximity, that are formed in the soil matrix by the processes of reduction, translocation, and oxidation of iron and manganese compounds in soils that have been periodically saturated.
Pressure Distribution	A system of small diameter pipes uniformly distributing effluent throughout a trench, bed, or chamber.
Pressure Mound System	An alternative method of on-site sewage treatment and disposal in which a specified sand fill media is laid on top of a properly prepared original soil surface. The pressure distribution and wastewater distribution cells are then placed entirely with the filter media at such a level that the desired vertical separation to provide necessary treatment exists. The fill material provides a measurable degree of wastewater treatment and allows effluent dispersal into the natural soil environment for final treatment.

<u>Site Criteria</u>

1. Purpose – This manual is established for sites that were evaluated by LMAS staff to be unsuitable for conventional sewage disposal and treatment as established in the Code. If additional site work is needed, the design consultant shall ensure that site work is completed per all applicable requirements.

2. Parcel Size
   a. The parcel size shall accommodate the proposed design in a way as to not create a nuisance for neighboring parcels and/or waterways and shall include a separate designated future replacement absorption system location.
   b. Lots that are less than one acre in size split after July 28, 1997 must be reviewed under EGLE Administrative Rules for On-Site Water Supply and Sewage Disposal for Land Divisions and Subdivisions.

3. Isolation Distances
   a. Standard *minimum* isolation distance requirements set forth in the Code shall be observed.
   b. Reductions to these isolation distances may be allowed under a variance for <u>existing</u> homes where a "change in use" that will result in an increase of water use is not proposed.
   c. The site shall not be located in an area subject to seasonal flooding or ponding of surface waters.
      i. The site of the proposed system shall not be located in a floodplain of 100 years or less, or in an area subject to seasonal flooding, runoff, or ponding of surface waters. It shall be the property owner's responsibility to document the 100 year flood plain as recognized by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), or appropriate agency, at the request of the Department.
   d. Construction shall not be allowed within 10 feet of easements and rights-of-way.
   e. The applicant is responsible for contacting other permitting agencies prior to obtaining any permits from the Department.
   f. Isolation from the absorption system shall be measured from the perimeter of stone.

4. Topography
   a. Areas with 12% or greater slope are to be avoided.
   b. Systems should not be installed where extensive cut and fill is required when other viable options exist. These earth moving practices destroy the natural soil structure which is relied upon for proper system operation.
   c. Systems are not to be installed at the base of slopes unless surface water draining toward the system is diverted.
   d. On sloping sites (i.e., those with slopes $\geq$5 %) it can be expected that flow will move laterally down gradient. So as to not adversely impede this lateral movement, a suitable downslope greenbelt area shall be provided. The greenbelt area is to be measured from the toe of the side slope of the distribution mound and located within property boundaries. The minimum required greenbelt area varies based on soil structure.

Soil Structure	Required Downslope Greenbelt (feet)
Medium sand	Not Required
Fine sand/Loamy Sand	10
Very Fine Sand/Sandy Loam	20
Loam/Sandy Clay Loam	30

Clay Loam/Silty Clay Loam	40
Silty Clay/Sandy Clay/Clay	Unsuitable

5. Minimum Soil Conditions

   There is no minimal native soil restriction. Vertical separation shall be achieved with clean, medium fill sand with no excessive fines (unless stated otherwise). Additional fill may be required in high water table situations where "wicking" may occur. LMAS reserves the right to require additional fill based on the particular site conditions or to require certain absorption system designs that have proven more effective in particular situations.

6. Installation Timeframe

   a. Installation of the alternative on-site sewage treatment system is limited to certain dry times of the year, typically from June 1 – October 15. Any installation outside of this The timeframe shall proceed only with express written approval from the design consultant on sites where soil conditions could result in soil smearing if worked on when wet which includes all sites with a permeability rate of >20 min/in. Certification that site conditions were favorable for installation will always be required as part of final approval for installations outside of the typical dry timeframe or if wet conditions are noted.
   b. Contact your local Sanitarian or the EH Director for approval if installation after Oct 15th.
   c. The issuance of an OSTDS permit does not guarantee the septic system can be installed to correlate with occupying the dwelling.

7. Site Preparation - Ultimate success or failure of a system also relies on clear communication along with the understanding of basic site preparation and construction principles. Critical issues include:

   a. Proper procedures must be followed to protect the location area including the required greenbelt area during and after construction. After establishing a suitable location for the initial and replacement area (including greenbelt), it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the system that is isolated from other anticipated home construction activities is encouraged.
   b. Soil smearing and compaction, which can reduce infiltration capacity, will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a ¼ inch or smaller "wire" it is considered too wet and should be allowed to dry before preparing. If the site is questionable, then certification from design consultant shall be required.
   c. Excessive vegetation should be removed from the basal area. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or

compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand.

d. The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.

e. Cleanliness of the sand fill should be checked prior to construction. Placement of fill material is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travel over the mound basal area and downslope of the greenbelt area. Total depth of fill shall be established on a benchmark provided by the design consultant on the design plan.

Limitation of Responsibility

1. Plan approval by LMAS may not be construed as an assumption of any responsibility for the design of the alternative on-site sewage treatment system and associated dispersal component(s).

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering of the system. Approval to use the system will not be granted until all the Water Tight Tank Testing documents are submitted to the Department.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of the Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

1. The Department reserves the right to require special restrictions, for rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site specific basis.

Product Distribution and Use

1. Any new technology proposed within the District must go through an approval process.
2. Any manufactured and/or mechanical treatment devices that provide additional biological treatment shall be NSF approved with the classification of Class I (Standard 40, July 2000 or subsequent versions) to achieve a 90% reduction or better in biological oxygen demand and suspended solids and shall comply with the requirements set forth by NSF.
3. The manufacturer must provide assurance that continued consultation and service will be provided in the event that the distributor fails to meet with the required oversight or in the event that the distributor should go out of business.
4. The manufacturer/distributor must demonstrate the capabilities of providing adequate training and certification of installers and maintenance providers. They must also be conveniently available for consultation both on and off site.
5. The manufacturer must demonstrate that they are a viable company with proven technical expertise in the wastewater industry and capable of providing assurance of product reliability and backing in the event of poor product performance.
6. The manufacturer must have an established hands-on training program for prospective designers, installers, and service providers in the proper design, installation, and maintenance of their system. Video training, alone, is unacceptable.
7. The manufacturer/distributor must demonstrate that replacement parts are readily available for all mechanical components of the product(s).
8. If approved, failure to meet and maintain these minimum requirements for alternative on-site sewage treatment systems may result in product acceptance being revoked by the Department.

Becoming an Approved Distributor/Installer

1. All individuals/companies interested in distributing and/or installing an advanced treatment system within the LMAS District shall submit the product to LMAS for product review as noted above. If product use is approved by LMAS, these individuals must:
    a. Submit a letter of interest to LMAS along with proof of training, but not limited to, location of training, number of hours of training, experience with wastewater treatment systems, and equipment experience.
    b. Be a septic installer properly licensed by LMAS; a plumber or septage hauler properly licensed by the State of Michigan; a person who by possession of a recognized degree or certificate of professional standing or who through extensive knowledge, training, and experience has successfully

demonstrated the ability to solve and resolve problems associated with that particular product

c. Include manufacturer certification(s), if applicable.

d. Any other information reasonably required by LMAS to determine whether applicant has the requisite knowledge, training, and experience to be the distributor/installer.

2. Once approved, future training to update siting, installation, start-up, and documentation procedures is required at a frequency recommended by the manufacturer.

Becoming an Approved Maintenance Service Provider

1. "Qualified maintenance provider" means a person approved by LMAS and who is:

   a. A septic installer properly licensed by LMAS; or a plumber or septage hauler properly licensed by the State of Michigan; or
   b. A person who, by possession of a recognized degree or certificate of professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated the ability to solve and resolve problems with the approved advanced treatment system(s); or
   c. The owner of the land where a permitted and approved advanced treatment system is installed, provided that the landowner consents to random inspections by LMAS and pays any established fees for that inspection.

2. A person seeking to become a qualified maintenance provider within the District shall submit a letter of interest along with sufficient proof that they are a qualified maintenance provider as defined in the manual.

3. The LMAS Health Officer may, by written notice, revoke qualified maintenance provider approval of any person who fails to adhere to any requirements of this manual or the Code. A person whose qualified maintenance provider approval is revoked may petition the LMAS Board for a formal administrative hearing pursuant to Article XVI of the Code.

Licensed Septic Installer Registration Process

1. Individuals interested in designing and/or installing systems under this manual shall submit a letter of interest along with proof of experience in designing and installing these systems. Individuals shall also indicate knowledge in the design of dosing systems, if applicable. Individuals shall specify the type of system(s) they will be able to design and/or install. Certain types of systems do require training from the unit manufacturer. Individual(s) must understand that all system design plans and installations shall comply with the requirements contained within this manual.

Section 3:

Minimum Design Parameters - Gravity and Elevated Mound

Description

A soil absorption system consisting of a septic tank, dosing/pump tank (if applicable), and an elevated absorption system (mound).

Sewage Treatment Components

1. Site Preparation - Ultimate success or failure of a system also relies on clear communication along with the understanding of basic site preparation and construction principles. Critical issues include:

    a. Proper procedures must be followed to protect the location area including required greenbelt area during and after construction. After establishing a suitable location for the initial and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the system that is isolated from other anticipated home construction activities is encouraged.
    b. Soil smearing and compaction, which can reduce infiltration capacity, will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a ¼ inch or smaller "wire" it is considered too wet and should be allowed to dry before preparing. If site is questionable then certification from Design Consultant shall be required.
    c. Excessive vegetation should be removed from the basal area. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand.
    d. The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.
    e. Cleanliness of the sand fill should be checked prior to construction. Placement of fill material is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction.

A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travelling over the mound basal area and downslope of the greenbelt area. Total depth of fill shall be established on a benchmark provided by the design consultant on the design plan.

2. Septic Tank

    a. Tank requirements are established in Section 3-14.5 of the Code.
    b. The minimum capacity for septic tanks for a one, two, or three-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department, increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.
    c. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location.
    d. Septic tanks shall be equipped with a watertight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or shall be equipped with other Department approved safety devices to preclude accidental tank entry.
    e. All septic tanks shall be installed to be level and to flow in accordance with the manufacturer's design intent.
    f. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000-gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.
    g. Septic tanks and pump tanks shall be tested and certified to be watertight. Testing and certification must be performed on-site and in-place, by the tank manufacturer, design consultant, or licensed septic installer. Hydrostatic or vacuum test may be utilized to determine if the septic tank and/or pump tank are watertight. Certification shall be submitted prior to or during the final inspection performed by the Department.

3. Pump - See Section 2 of this manual for pump tank and pump design parameters.

4. Mound Components

    a. Fill Requirements

        i. The texture of the fill material shall be clean sand with no excessive fines with a permeability rate of 3-10 min./in. A qualitative field check to assess the cleanliness of the sand delivered to the construction site should be conducted.
        ii. Fill shall be free of debris, stones, frozen clods, or ice.
        iii. The material shall be compacted to avoid settling (or allowed to settle through one fall-winter-spring time period). Settling through the fall-

winter-spring is the recommended method of compaction. Compaction of fill can be accomplished by utilizing only tracked equipment.

iv. The depth of fill must be such that the bottom of the absorption area is isolated $\geq$4 feet above the established high groundwater elevation or limiting layer. Total depth of fill shall be established based on a benchmark provided by the design consultant on the design plan.

b. See Section 3-14.2.B for the Code for Absorption System Sizing.

c. Berm

A berm shall be constructed around the perimeter of the absorption system. The berm shall be constructed of adequate size and texture to ensure optimum absorption system function. Soil texture shall consist of clean medium sand with no excessive fines. The size of the berm will be dependent on the native soil.

i. Extend a minimum of 4 ft beyond all sides of the absorption system on sites where the native soil has a permeability greater than or equal to 3 inches per hour.
ii. Extend a minimum of 10 ft beyond all sides of the absorption system where the native soil has a permeability less than 3 inches per hour.

d. Taper

The taper is the slope surrounding the berm. The taper shall be constructed of clean sand with no excessive fines and shall be evenly graded from the top of the berm to the natural soil surface with a slope of 3:1 (three horizontal to one vertical). For mounds constructed within a maintained lawn area, it is highly recommended that a slope of 4:1 or 5:1 be installed. Final grading of the mound area should divert surface water drainage away from the mound.

e. Observation port

At least one observation port to gauge ponding depth in the absorption area is necessary. This shall be placed within the aggregate and shall not be connected to a lateral.

f. Cover

i. Geotextile fabric shall be used between the top of the aggregate and soil cover.

ii. The entire mound shall be covered with sufficient suitable soil with a permeability $\geq$ 3.0 inches/hour to maintain vegetative growth and seeded/mulched upon completion. If the system is constructed after September 15, a vegetative cover must be provided. Cover may consist of sod, mulch, straw, or other suitable material to prevent freezing.

Operation and Maintenance

1. The owner at his/her sole expense shall comply with a specific maintenance, monitoring, and inspection program specified by the Department to ensure the optimum operation of the treatment system.

2. Septic Tank and Effluent Filter

    a. Inspect the septic tank at least once every two years under normal usage. The tank shall be emptied of sludge and floating material by a licensed septage hauler at a recommended frequency of 3-5 years.

    b. After pumping, inspect the integrity of the septic tank to ensure that no groundwater is entering it. Also check the inlet and outlet and repair if needed.

    c. Effluent filters require on-going maintenance due to their tendency to clog and cut off oxygen to the system. The effluent filter shall be cleaned at every septic tank pump out and inspected every 6-12 months. Follow filter manufacturer's maintenance instructions.

3. Pump Tank and Pump

    a. Inspect at least once a year to assure adequate operation of pump, floats, control panel, and alarm.

4. Infiltration Area

    a. It is important that the system site remain free of shrubs, trees, and other woody vegetation. Roots can infiltrate and cause damage or clogging of system components.

    b. Make sure the infiltration area is free of motorized vehicle traffic, is seeded, and that all water is diverted to avoid overloading.

    c. If the system has a vent, make sure it is not obstructed.

    d. Check and immediately report any odor or sign of water breakouts around the system.

Limitation of Responsibility

1. Plan approval by LMAS, if applicable, may not be construed as an assumption of any responsibility for the design of the alternative on-site sewage treatment system and associated components.

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering the system. Approval to use the system will not be granted until all required information has been received:

    a. Request for a final inspection of the alternative on-site sewage treatment system by the contractor, installer, or property owner shall serve as notice to the Department that the system is installed according to the permit and associated design plans. Final inspection conducted by the Department shall identify any items of noncompliance.

    b. No portion of the system shall be covered and the system shall not be placed into service prior to final inspection and approval. The property owner is responsible for maintenance and monitoring of the system following approval from the Department unless a contract agreement is in place between the property owner and a qualified maintenance provider.

    c. Any other information requested by LMAS such as watertight tank test results and pump installation certification.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

1. The Department reserves the right to require special restrictions, in rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site-specific basis.

Section 4:

Minimum Design Parameters – Pressure Distribution System

Description

An alternative method of treatment and disposal in which a specified sand fill media is laid on top of a properly prepared original soil surface. The pressure distribution system and wastewater cells are then placed entirely within the filter media at such a level that the desired vertical separation to provide the necessary treatment exists. The fill material provides a measurable degree of wastewater treatment and allows effluent dispersal into the natural soil environment for final treatment. Pressure distribution system is a system of small diameter pipes uniformly distributing effluent throughout a trench, bed, or chamber.

Conditions for Application Submittal

1. A Michigan Registered Sanitarian, Professional Engineer specializing in environmental or sanitary wastewater treatment, or licensed sewage system installer registered with LMAS to design the particular alternative on-site sewage treatment system proposed shall:

    a. Work with the Department to develop a detailed design plan for each specific application. This condition, however, does not preclude said contractors from submitting their own design plan for review and consideration by the Department; and
    b. Provide a scaled site plan detailing all aspects of the proposed work along with the Department application form.

        i. Plans shall be at least 8 ½" X 11" in size and shall be legible, clear, and permanent copies.

        ii. Plans shall include the name of the person who prepared the plan and shall be stamped if prepared by a Michigan Registered Sanitarian or Professional Engineer.

2. A *Submittal Checklist for Alternative On-Site Sewage Treatment System* is available per request for guidance.

Septic Tank Requirements

1. Tank requirements are established in Section 3-14.5 of the Code.
2. The minimum capacity for septic tanks for a one, two, or three-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department, increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.
3. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location.
4. Septic tanks shall be equipped with a watertight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or

shall be equipped with other Department approved safety device to preclude accidental tank entry.

5. All septic tanks shall be installed to be level and to flow in accordance with the manufacturer's design intent.
6. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000-gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.
7. Septic tanks and pump tanks shall be tested and certified to be watertight. Testing and certification must be performed on-site and in-place, by the tank manufacturer, design consultant, or licensed septic installer. Hydrostatic or vacuum test may be utilized to determine if the septic tank and/or pump tank are watertight. Certification shall be submitted prior to or during the final inspection performed by the Department.

Dosing/Pump Tank and Pump Requirements

Pump tank and pump shall be installed per minimum requirements noted in Section 2 of this manual.

Minimum Soil Conditions

There is no minimal native soil restriction. Vertical separation per DEQ Guidance shall be achieved with clean sand fill as noted below. Additional fill may be required in high water table situations where "wicking" may occur. LMAS reserves the right to require additional fill based on particular site conditions or to require certain absorption system designs that have proven more effective in particular situations.

Sand Fill Requirements - It is important that the specification of the sand fill material be closely controlled from both a performance and longevity standpoint. Sand fill should be clean and meet the Michigan Department of Transportation 2NS gradation without excessive fines. A qualitative field check to assess the cleanliness of sand delivered to the construction site should be conducted. (See Appendix A within this section.)

Design Parameters - Refer to DEQ Pressure Mound System Technical Guidance within this Section.

Operation and Maintenance

1. The owner at his/her sole expense shall comply with a specific maintenance, monitoring, and inspection program specified by the Department to ensure the optimum operation of the treatment system.
2. Septic Tank and Effluent Filter

a. Inspect the septic tank at least once every two years under normal usage. The tank shall be emptied of sludge and floating material by a licensed septage hauler at a recommended frequency of 3-5 years.

b. After pumping, inspect the integrity of the septic tank to ensure that no groundwater is entering it. Also check the inlet and outlet and repair if needed.

c. Effluent filters require on-going maintenance due to their tendency to clog and cut off oxygen to the system. The effluent filter shall be cleaned at every septic tank pump out and inspected every 6-12 months. Follow filter manufacturer's maintenance instructions.

3. Pump Tank and Pump

   a. Inspect at least once a year to assure adequate operation of pump, floats, control panel, and alarm.

   b. The dose of wastewater shall be verified once a year to ensure it meets the permitted design plan.

   c. The distribution laterals shall be inspected at least once a year to ensure even distribution.

4. Infiltration Area

   a. It is important that the system site remain free of shrubs, trees, and other woody vegetation. Roots can infiltrate and cause damage or clogging of system components.

   b. Make sure the infiltration area is free of motorized vehicle traffic, is seeded, and that all water is diverted to avoid overloading.

   c. If the system has a vent, make sure it is not obstructed.

   d. Check and immediately report any odor or sign of water breakouts around the system.

Limitation of Responsibility

1. Plan approval by LMAS may not be construed as an assumption of any responsibility for the design of the alternative on-site sewage treatment system and associated components.

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering the system. Approval to use the system will not be granted until all required information has been received:

    a. Request for a final inspection of the alternative on-site sewage treatment system by the contractor, installer, or property owner shall serve as notice to the Department that the system is installed according to the permit and associated design plans. Final inspection conducted by the Department shall identify any items of noncompliance.

    b. No portion of the system shall be covered and the system shall not be placed into service prior to final inspection and approval. The property owner is responsible for maintenance and monitoring of the system following approval from the Department unless a contract agreement is in place between the property owner and a qualified maintenance provider.

    c. Any other information requested by LMAS such as watertight tank test results and pump installation certification.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

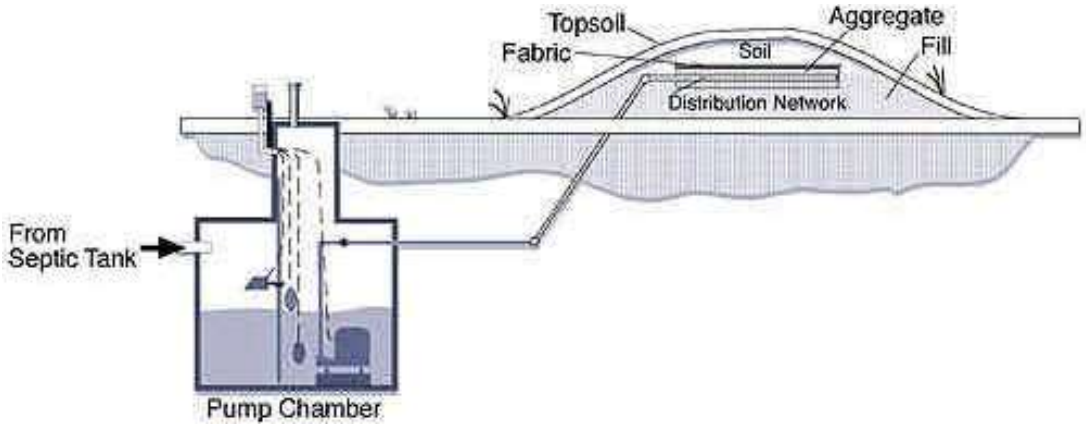
    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

The Department reserves the right to require special restrictions, in rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site-specific basis.

Pressure Mound Systems

Technical Guidance for Site Suitability, Design, Construction
and Operation and Maintenance



Michigan Department of Environmental Quality

Water Division Land Division and Local Health Department

Support Program June 2003

PREFACE

The technical guidance contained in this document has been developed for statewide application pursuant to R 560.424(2) of the Michigan Department of Environmental Quality Administrative Rules, "On-site Water Supply and Sewage Disposal for Land Divisions and Subdivisions." This technical guidance represents minimum standards for application of the described alternative method of sewage treatment and disposal for a development site less than one acre, subdivision lots, and site condominium units. The Michigan Department of Environmental Quality supports application of this technical guidance at the full discretion of the local health department having jurisdiction.

The standards may be used as minimums at the local level as written or modified to reflect more stringent requirements deemed necessary based on local conditions. Please note that pursuant to R 560.424(3), the specific alternative must be provided for under the regulations of the city, county, or district health department having jurisdiction and formal authorization must be granted by the Michigan Department of Environmental Quality.

R 560.424. Alternative methods of sewage treatment and disposal.

Rule 424. (1) The department may approve an alternative treatment and subsurface disposal system for a development site less than 1 acre in size or a lot deemed suitable or not suitable for a conventional subsurface sewage system.

(2) The department of environmental quality shall provide technical guidance in defining minimum site suitability and design and long-term operation and maintenance requirements considered essential for the proper functioning of specific alternative systems.

(3) The owner may utilize an alternative system if the specific alternative is provided for under the regulations of the city, county, or district health department having jurisdiction and if the department of environmental quality has authorized the alternative system's use.

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DEFINITIONS

Alternative System: A treatment and disposal system that is not a conventional system and provides for an equivalent or better degree of protection for public health and the environment than a conventional system.

Approved: A written statement of acceptability issued by the local health officer or the Department of Environmental Quality.

Basal Area: The effective in situ soil surface area available to transmit the treated effluent from the sand fill media into the original receiving soils.

Conventional System: As defined in the Code.

Cover Material: The material used to cover a mound system, usually selected on its availability, cost, and ability to support vegetation, transfer oxygen, and shed water.

Distribution Cell Area: The area within the mound where the effluent is distributed into the fill material.

Effluent: As defined in the Code.

Excessively Permeable Soils: Soil that contains a high percentage of coarse to very coarse sands (2.0 mm and larger) and often including fine gravels and/or cobbles. Water passes through the soil very rapidly (i.e., soil permeability < 3 minutes/inch) and internal free water is very rare.

Greenbelt Area: As defined in the Code.

High Groundwater Elevation: The uppermost part of the soil or underlying material wholly saturated with water. The term includes perched and apparent conditions that are seasonally saturated for a time period in excess of two weeks, or permanently saturated.

Hydraulic Linear Loading Rate: The volume of effluent applied per day per linear foot of system along the natural ground contour.

Influent: Wastewater flowing into an on-site sewage system component.

In Situ Soil: Soil present in the natural or original position.

Limiting Layer: High groundwater elevation, soils with an expected permeability above 60 minutes/inch, or bedrock.

Original Grade: The natural land elevation which exists immediately prior to the construction of the mound system.

Permeable Soil: Soils with a textural classification, according to the U.S. Department of Agriculture Soil Conservation Service classification system, of silt loams, and some silty clay loams that are well structured with expected permeability less than or equal to 60 minutes/inch.

Permeability: The ability of soil to transmit liquids through pore spaces in a specified direction, e.g., horizontally, or vertically.

Pressure Distribution: As defined in the Code.

Pressure Mound System: As defined in the Code.

Pump Chamber: A watertight tank or compartment following the septic tank or other pretreatment process that contains a pump, floats, and volume for storage of effluent.

Reserve Area: An area of land with site conditions deemed suitable for the installation of a replacement system upon failure of the initial system.

Sand Fill: Sand meeting specific criteria regarding particle size and installation technique to ensure adequate wastewater treatment.

Sanitary Sewage: As defined in the Code.

Septic Tank: As defined in the Code.

Slowly Permeable Soil: Soils with a textural classification according to the U.S. Department of Agriculture Soil Conservation Service classification system of silt loams and some silty clay loams that are well structured with expected permeability above 60 minutes/inch.

Soil Compaction: An increase in the soil bulk density and decrease in soil porosity by the application of mechanical forces to the soil that results in a soil that retains less water and resists root penetration. Soils with high clay content are more easily compacted than sandy soils.

Soil Loading Rate: The allowable application rate to the basal area required for absorption of effluent based upon soil texture for a given soil structure.

Soil Mottling (also known as redoximorphic features): Spots or blotches of contrasting colors, such as, but not limited to, gray or brown or gray and brown colors in close proximity, that are formed in the soil matrix by the processes of reduction, translocation, and oxidation of iron and manganese compounds in soils that have been periodically saturated.

Timer-Controlled System: A pressure distribution system where a pump's "on" and "off" times are preset, discrete time periods.

Uniform Distribution: A method of distribution that results in equal distribution of the effluent throughout the distribution network. This will help ensure a vertical, unsaturated flow regime.

Vertical Separation: The total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell and a limiting layer.

INTRODUCTION

When properly sited, designed, constructed, operated, and maintained pressure mounds provide a proven effective alternative method of on-site treatment. A pressure mound system relying on subsurface distribution to in situ soils can be an effective solution where site conditions are not suitable for conventional treatment and disposal systems. Typical situations where mound systems might be applied include:

Permeable or slowly permeable soils with a high ground water elevation. Where permeable or slowly permeable soils with a high groundwater elevation prevent the installation of a conventional treatment system, a mound with pressure distribution of effluent to promote unsaturated flow along with elevating the infiltrative surface to provide vertical separation maximizes final treatment efficiency.

Slowly permeable soils without high groundwater. Slowly permeable soils are most effective for final treatment and disposal where the nature soil profile is maintained in an undisturbed condition. Utilizing a mound system with pressure distribution for these sites offers a number of advantages as opposed to attempts to construct a conventional below grade final treatment and disposal system including:

- Damage to the natural soils during construction including compaction and smearing is minimized.
- Treated effluent is discharged and dispersed into the uppermost soil horizons, which are typically more permeable.
- The mound sand fill media provides additional treatment, which minimizes clogging of the slowly permeable soils while maintaining their hydraulic conductivity.
- Utilizing pressure distribution promotes unsaturated flow resulting in more efficient treatment, extended life of the system and improves overall hydraulic performance by minimizing groundwater mounding.

Excessively permeable soils or creviced bedrock. Excessively permeable natural soils or shallow soils over creviced bedrock present distinct concerns related to contamination of groundwater supplies or surface waters. In conjunction with a comprehensive evaluation of site specific environmental and/or public health concerns, mounds may be evaluated as a potential treatment alternative to minimize adverse impacts.

SITE SUITABILITY

Those sites meeting the following criteria for the initial, replacement, and greenbelt areas may be considered for pressure mounds:

- Soils - undisturbed natural soils only. Historical agricultural activities are not generally considered as disturbance.
- Soil texture and structure - the most limiting horizon encountered in the upper 18 inches must be a suitable soil texture and structure as shown in Table 1.
- Permeability of uppermost soil horizon - soils with an estimated permeability of 60 minutes/inch or less based on soil texture and structure.
- Depth to high groundwater elevation - 18 inches minimum from the undisturbed natural

ground surface. The depth to high groundwater elevation shall be confirmed by a soil profile with 6 inches or more of soil without mottling (a.k.a. redoximorphic features) below the “A” horizon (topsoil) or groundwater monitoring in accordance with R 560.423 of the Michigan Department of Environmental Quality Administrative Rules, “On-site Water Supply and Sewage Disposal for Land Divisions and Subdivisions.”

- Depth to creviced bedrock - 24 inches.
- Slope - natural ground slope should be ≤ 25 percent in mound area to promote safety of workers during construction.

SITE EVALUATION AND PLANNING

A critical step in the successful application of mound technology is the site evaluation and planning process. This step provides the site-specific information necessary to evaluate overall site suitability and is used as the foundation for actual design.

Prior to completing the site evaluation, available site-specific information related to soils, and slopes should be reviewed in detail. For the majority of counties, USDA soil surveys are a valuable resource in this regard. This information will provide general guidance as to the potential for application of mound technology. After a thorough review of this information, preliminary site plans can be developed and a site evaluation conducted.

For each lot where a mound is intended, a minimum of three soil profile evaluations are considered sufficient to delineate the area under investigation for initial, replacement systems, and greenbelt areas and to establish consistency. Soil evaluations should be completed during those time periods where soils are sufficiently dry to avoid damage to the absorption area. In areas of complex soils, additional evaluations may be necessary. Soil evaluations should be completed by observation of shallow soil pits of adequate size, depth, and construction to safely enter and exit the pit and complete a soil profile description. All of the following shall be accurately reported by a competent soil consultant for each soil horizon or layer:

- Thickness
- USDA soil textural class
- Presence of soil mottles or redoximorphic features
- Soil structure - grade and shape
- Occurrence of saturated soil, groundwater, bedrock, or disturbed soils Site planning for development sites less than one acre, subdivision lots, or site condominium units must also consider the following features:
- Property lines and lot lines
- Slope
- Required setback distances
- Existing or proposed structures
- Existing or proposed wells
- Surface waters

For projects involving multiple lots or units, overall planning should also consider and mitigate any negative impacts from other off-lot development activities, including grading, road construction, and surface water drainage.

DESIGN

Sufficient design detail must be provided for a development site less than one acre, subdivision lot, or site condominium unit to assure that adequate, suitable area is available for construction of initial and reserve mound systems and required greenbelt areas. These areas must be at locations that are readily accessible for construction and for future maintenance and repair. A proper design must allow for the home and any proposed improvements while maintaining required setbacks. The following design criteria are recommended:

Design Flows - For design purposes an allowance of 150 gallons per day per bedroom is suggested. This figure provides an adequate factor of safety necessary to promote satisfactory long-term function of the distribution cell and mound.

Distribution Cell Sizing - The absorptive bottom area in the distribution cell should be designed to provide the minimum required by the city, county, or district health department having jurisdiction. The maximum loading rate should never exceed.

1.0 gallon per day per square foot. More conservative loading rates will provide a higher factor of safety. Horizontal separation between distribution cells shall be based on allowable soil loading rate with a minimum of three feet.

Reserve Area - Reserve area with suitable site conditions must be set aside and protected for future use. The reserve area shall include a basal area, sized in accordance with Table 1, which is totally separate from the basal area of the initial mound.

Mound Orientation - The absorptive area should be long and narrow with the long dimension running parallel to the contour for a sloping site.

Soil Loading Rate - The minimum mound basal area required for absorption of effluent is based upon soil texture for a given soil structure. Table 1 suggests recommended maximum soil loading rates based upon the most limiting soil texture and structure encountered in the upper 18 inches of the soil profile. The basal area for sloping sites (i.e., those with slopes $\geq$ 2 percent) includes the area under the distribution cell and area downslope only. On flat sites (i.e., those with slopes $\leq$ 2 percent) the minimum required basal area includes that under the distribution cell and either side of it. Generally, the minimum required basal area will be found to be less than the actual area filled after accounting for required depth of fill and side slopes.

Hydraulic Linear Loading Rate - The hydraulic linear loading rate is the volume of effluent applied per day per linear foot of system along the natural ground contour. From a hydraulic standpoint, a long and narrow mound design is most efficient and better promotes aerobic conditions under the distribution cell. Table 1 suggests recommended maximum hydraulic linear loading rates based upon the most limiting soil texture and structure encountered in the upper 18 inches of the soil profile.

Setbacks - Table 2 summarizes minimum horizontal isolation distances which should be maintained from the toe of the mound fill.

Depth of Fill - The depth of fill must be such that the bottom of the distribution cell is isolated ≥ 3 feet above established high ground water elevation or limiting layer.

Limiting layer includes soils with an expected permeability above 60 minutes/inch based on soil texture and structure. The minimum depth of fill at the outer edge of the distribution cell area shall be 12 inches. The approved plan shall indicate the location of a suitable benchmark to be used by the contractor during construction to judge that the required depth of fill has been provided.

Final Cover - The settled depth of final cover at the outer edge of the distribution cell should be a minimum of 12 inches and the top of the mound graded to promote positive drainage. Final cover over the mound should support the growth of a suitable vegetative cover while shedding rainfall and promoting aeration of the mound. Final cover should have a texture no heavier than sandy loam.

Side Slopes - The final side slope of the mound surface should be 4:1 or flatter.

Greenbelt Area - On sloping sites (i.e., those with slopes ≥ 2 percent) it can be expected that flow will move laterally down gradient. So as to not to adversely impede this lateral movement, a suitable downslope greenbelt area shall be provided. The greenbelt area is to be measured from the toe of the mound and located within property boundaries. The minimum required greenbelt area varies based on soil texture as indicated in Table 1.

Pressure Distribution System - Pressure distribution of effluent is required in the distribution cell to promote maximum achievable treatment, and is critical from a hydraulic standpoint, especially where slowly permeable soils are encountered. Pressure distribution system design should generally comply with currently accepted design practice including the following features:

- Septic tank effluent filters or screen pump vaults are necessary.
- Small frequent doses to the mound by means of time dosing to promote unsaturated flow and enhanced treatment and hydraulics are required. Design shall provide uniform doses with no more than 0.5 gallons per orifice per dose.
- Distribution cell area per orifice shall not exceed 12 ft^2.
- To reduce orifice plugging, high head pumps are recommended.
- Orifice shields should be provided.
- Provisions for flushing must be incorporated at the ends of all laterals.
- Geotextile fabric which prevents the downward migration of fine materials but allows for free passage of air and water should be placed over the stone in the distribution cell prior to placement of final cover.

Sand Fill Requirements - It is important that the specification of the sand fill material be closely controlled from both a performance and longevity standpoint. From a treatment standpoint, the mound functions in a similar fashion to a sand filter sand fill should be clean and meet the Michigan Department of Transportation 2NS gradation without excessive fines. A qualitative field check to assess the cleanliness of sand delivered to the construction site should be conducted. (See Appendix A.)

Observation Ports - At least one observation port to gauge ponding depth in the distribution cell is necessary. Where the distribution cell is divided into multiple zones, at least one per zone is required.

SITE PREPARATION AND CONSTRUCTION

Ultimate success or failure of a mound also relies on a clear communication and understanding of basic site preparation and construction principles. Critical issues include:

- Proper procedures must be followed to protect the mound area including required greenbelt area during and after construction. After establishing a suitable location for the mound and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the mound that is isolated from other anticipated home construction activities is encouraged.
- Soil smearing and compaction, which can reduce infiltration capacity will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a 1/4 inch or smaller “wire” it is considered too wet and should be allowed to dry before preparing.
- Excess vegetation should be removed from the mound basal area. Trees should be cut flush to the ground and other vegetation over six inches in length should be mowed and cut vegetation removed. Where an excessive number of stumps and large boulders are encountered, the absorption area should be enlarged or an alternate site should be selected.
- The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.
- Cleanliness of sand fill should be field checked prior to installation. Placement of fill material then is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travel over the mound basal area and downslope greenbelt area. Total depth of fill shall be established based on a benchmark provided by the design consultant on the approved plan.
- Final grading of the mound area should divert surface water drainage away from the mound. Sod the entire mound area or seed and mulch.

OPERATION AND MAINTENANCE

The system owner is responsible for assuring the continuous operation and maintenance of the system. Deed advisories need to be recorded to communicate to the system owner and subsequent future owners the importance of routine and regular maintenance activities. It is suggested that a maintenance inspection be conducted on an annual basis by a trained maintenance provider. The local health department or other management entity may require oversight of the on-site system by a properly certified operator. In such cases, the operator must

be responsible for the continuous operation and maintenance of the system and must submit appropriate records routinely to the local health or other appropriate jurisdiction.

Routine and preventative maintenance aspects are:

- Scum and sludge levels in the septic tank as well as the pump chamber need to be inspected routinely on an annual basis and tanks pumped, as necessary. Depending on tank size and usage, pumping will typically be required at intervals exceeding every 3 to 5 years.
- Periodic inspections of system performance are required. Liquid levels in the observation ports should be checked and examinations made for any seepage around the toe of the mound. The pressure distribution system should be assessed, and laterals flushed, as necessary. It is recommended that mounds be visited at least once per year. A suggested maintenance visit checklist is attached (Appendix C).
- A good water conservation plan within the house or establishment will help ensure that the mound system will not be hydraulically overloaded.
- Avoid traffic in the initial and replacement mound areas and downslope greenbelt area. No vehicular traffic or livestock should be permitted. With lawn care equipment, such as a riding lawn mowers or tractor, it is important not to travel on the mound or the downslope area when the soil is saturated. Winter traffic on the mound should be avoided to minimize frost penetration in colder climate areas and to minimize compaction in other areas.

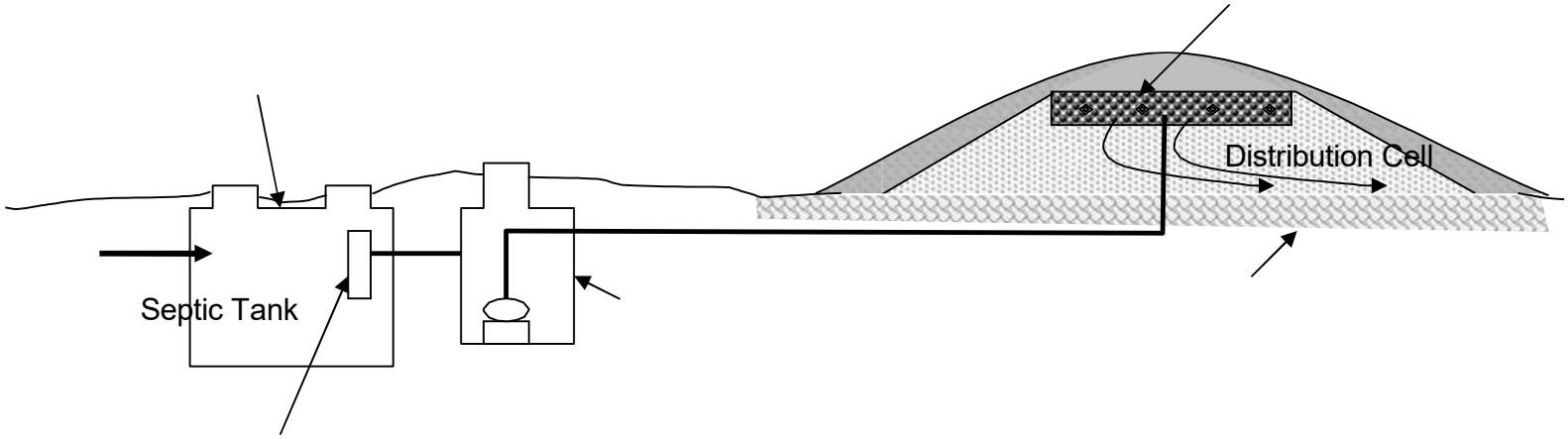
Owner's Manual - A user's manual needs to supplement the construction plan and must be submitted to the local health department for final approval. A copy of this manual must be provided to the property owner after completion of the mound system. The manual needs to contain the following as a minimum:

1. As-built drawings of all system components and their location are to be provided. The location of the reserve area also needs to be clearly defined and its importance communicated to the owner.
2. Specifications for all electrical and mechanical components.
3. Names and phone numbers of local health authority, component manufacturer, or management entity to be contacted in the event of an alarm, or other problems, or failure.
4. Information on the periodic maintenance of the mound system, including electrical/mechanical components.
5. Information on what activities can or cannot occur on and around the mound, reserve area, and greenbelt area.
6. A standard homeowner "Do's and Don'ts" list for proper system operation.
7. Information regarding suitable landscaping and vegetation for the mound and surrounding areas.

APPENDIX A

Figure 1

Typical Mound System Components



Dosing Tank

Prepared Natural Ground Surface

Effluent Filter

Figure 2
Typical Site Plan

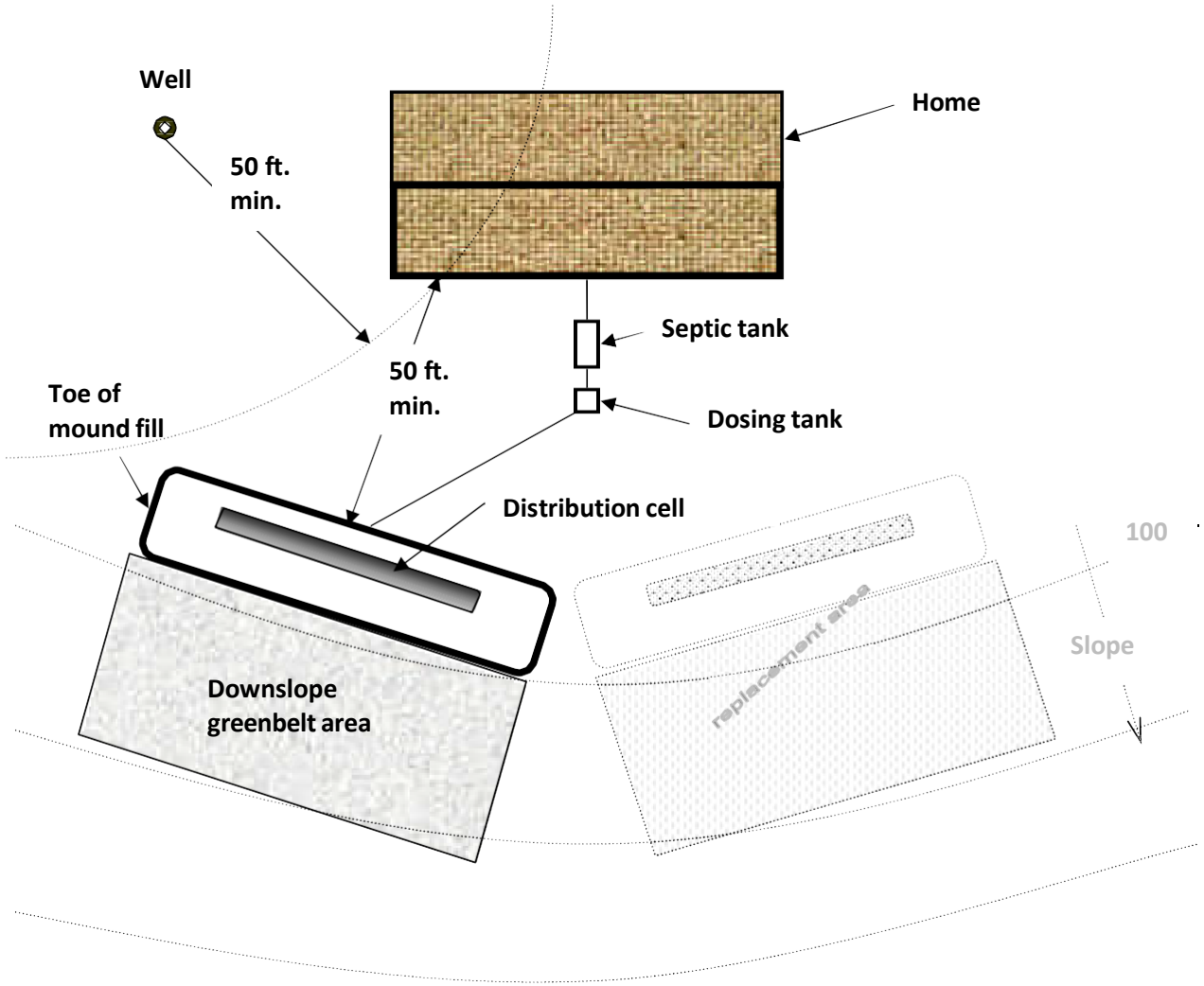
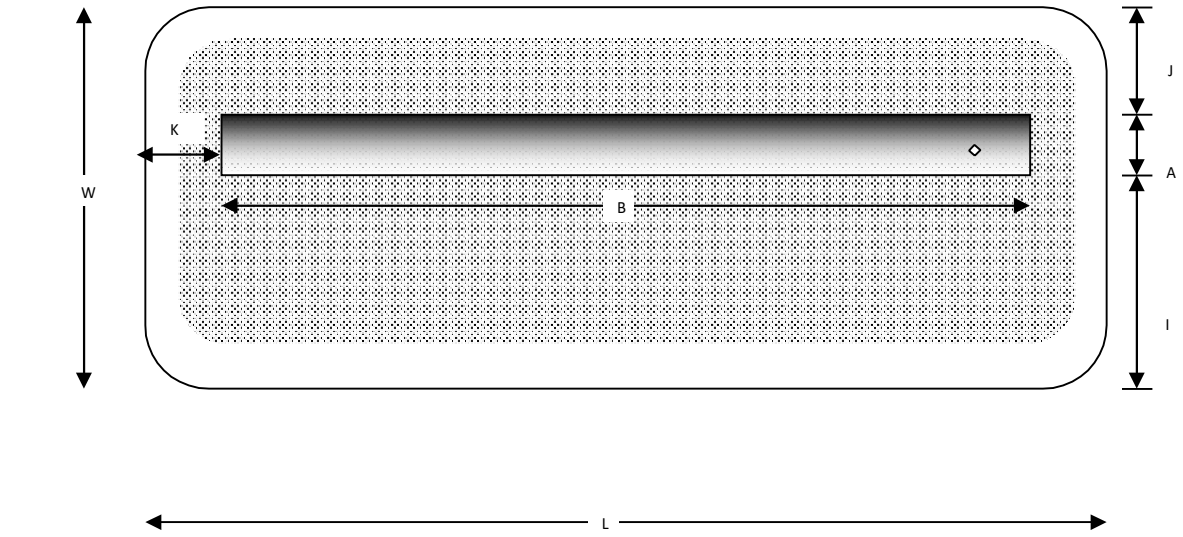
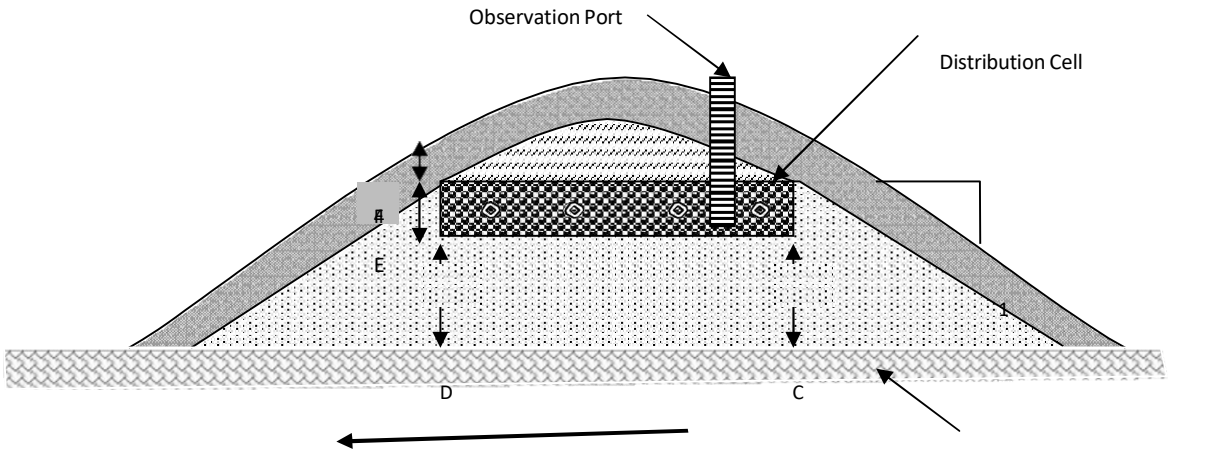


Figure 3

Mound Plan View and Cross Section





Legend

A - Distribution cell width B
- Distribution cell length

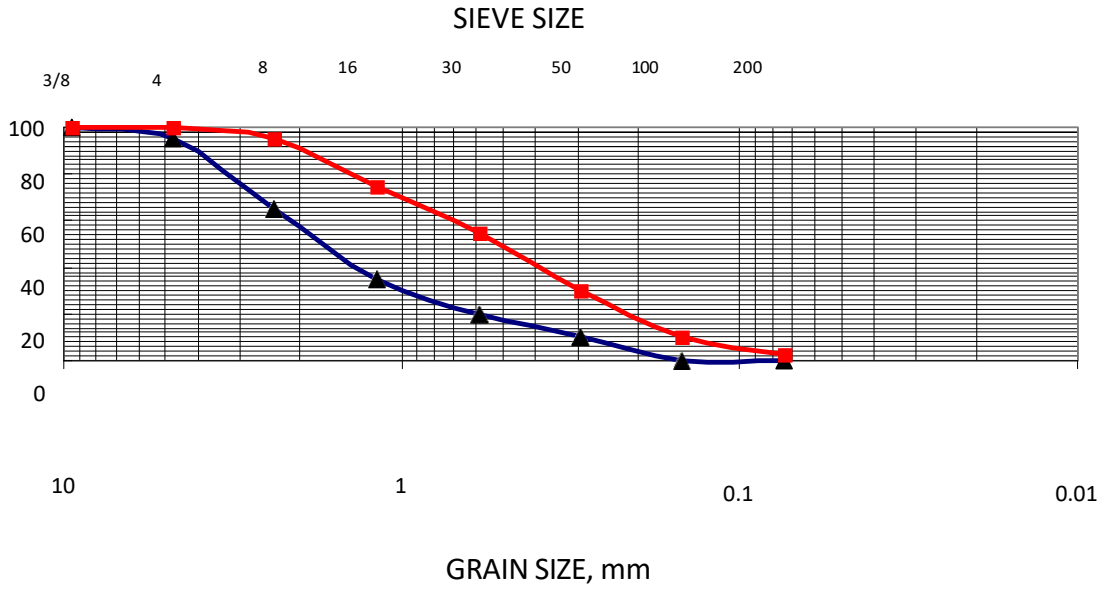
C - Up slope fill depth under distribution cell D -
Downslope fill depth under distribution cellE -

Distribution cell depth
F - Depth of final cover
I - Distance from edge of distribution cell to downslope edge of fillJ -
Distance from edge of distribution cell to up slope edge of fill K -
Distance from end of distribution cell to edge of fill
L - Overall mound fill lengthW
- Overall mound fill width

Figure 4

MDOT 2NS Sand Specification

Sieve Size	Grain Size (mm)	Percent Passing %	Percent Passing %
3/8	9.52	100	100
4	4.76	95	100
8	2.38	65	95
16	1.19	35	75
30	0.59	20	55
50	0.297	10	30
100	0.149	0	10
200	0.074	0	3



Procedure for

Qualitative Field Test of Sand Cleanliness

Sand fill materials for mound construction should be obtained from a supplier that hasdocumented through sieve analysis that the 2NS specification is met. As results of sieve analyses will typically vary over time, it is recommended that a qualitative field assessment of the cleanliness of the sand delivered to the construction site also be conducted. The following procedure is suggested:

1. Fill a quart jar one half full of the sand fill material to be tested.

2. Add water to fill the jar.

3. Shake the jar contents vigorously after which it should be allowed to settlefor 30 minutes.

4. If after settling a perceptible layer of fines greater than 1/8 inch in thickness has accumulated on the surface, the fill material should not beconsidered clean enough and an alternate source should be explored.

Figure 5 – Observation Port Example Details

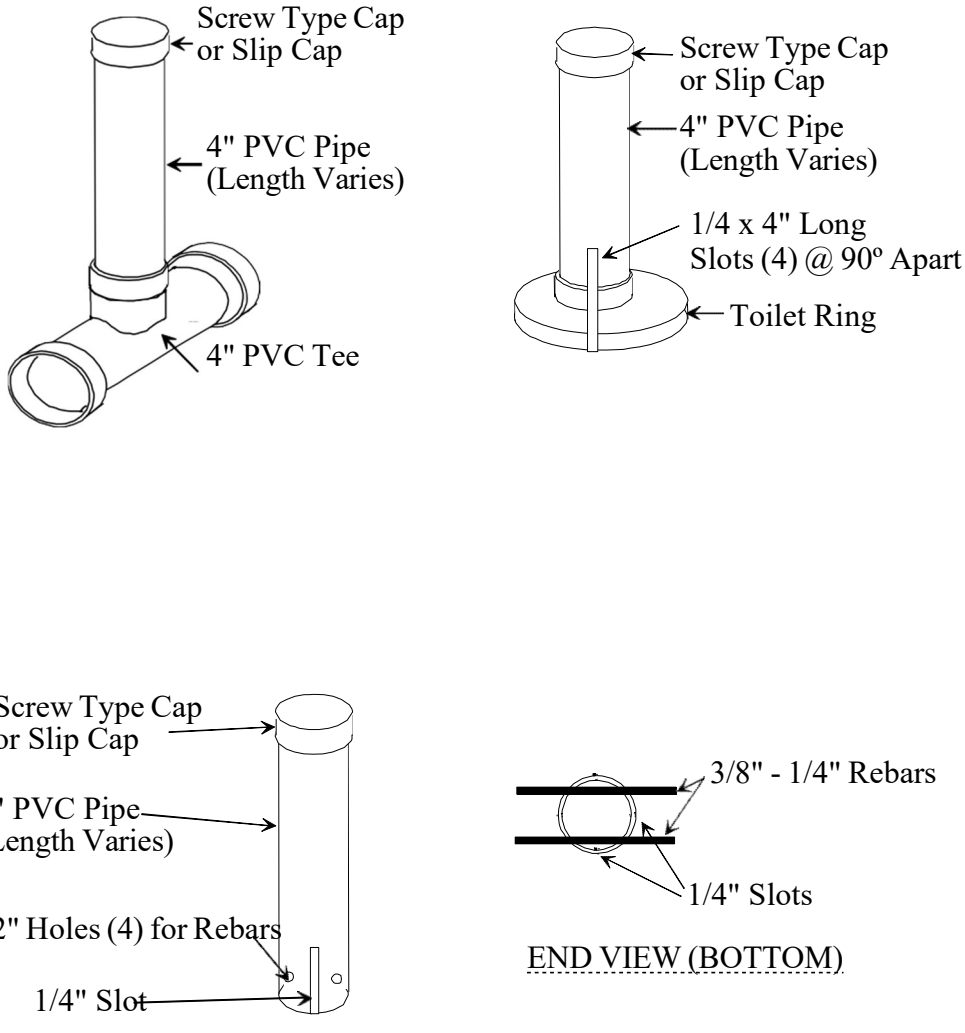


Table 1

Allowable Soil Loading Rates

SOIL STRUCTURE* → / SOIL TEXTURE* ↓	MAXIMUM SOIL LOADING RATE GPD/FT^2					MAX. HYDRAULIC LINEAR LOADING RATE, GPD/LF					REQUIRED DOWNSLOPE GREENBELT** (SLOPE > 2%, FEET)
	BK/GR			PL	M	BK/GR			PL	M	
	1	2	3			1	2	3			
COARSE SAND / MEDIUM SAND	1.0	1.0	1.0	0.5	0.5	5.0	5.0	5.0	2.5	2.5	NR
FINE SAND / LOAMY SAND	0.4	0.5	0.6	0.4	0.4	3.5	4.0	4.5	2.0	2.0	10
VERY FINE SAND / SANDY LOAM	0.3	0.4	0.5	U	0.2	3.0	3.5	4.0	U	1.0	20
LOAM / SANDY CLAY LOAM	0.2	0.25	0.3	U	0.2	2.5	3.0	3.5	U	U	30
CLAY LOAM / SILTY CLAY LOAM	0.15	0.2	0.25	U	U	1.8	2.5	3.0	U	U	40
SILTY CLAY/ SANDY CLAY / CLAY	UNSUITABLE										

* MOST LIMITING LAYER IN UPPER 18 INCHES

** MEASURED FROM TOE OF MOUND FILL

TABLE LEGEND

BK = BLOCKY	1 = WEAK
GR = GRANULAR	2 = MODERATE
PL = PLATY	3 = STRONG
M = MASSIVE	U = UNSUITABLE

Table 2

Minimum Horizontal Isolation Distances

From Toe of Mound Fill To:	Minimum Horizontal Isolation Distance (feet)
Private individual well	50
Surface waters	100
Basement foundation walls	50*
Top of drop-off	20
Property lines	10
Footing drains installed in water table without direct connection to surface water	25
Footing drains installed in water table with direct connection to surface water	50
Drains designed to lower the water table	100

*The downslope edge of the greenbelt area may be located within 25 feet of thefoundation walls.

APPENDIX B

Design Example

Site Criteria

1. Soil Profile:

    A. 0-8 in. - Dark grayish brown medium sand, weak granular structure.

    B. 8-29 in. - Yellowish brown medium sand, single grain with common fine distinct light brownish gray iron oxide depletions evident below 18 inches.

    C. 29-32 in. - Reddish brown clay loam, massive with many fine distinct greenish gray iron oxide depletions.

2. Slope: 4%

3. This is a site for a proposed 3 bedroom home.

Step 1. Evaluate the quantity and quality of wastewater generated.

For this example, it is intended to serve a three bedroom home and the designer hasproposed to discharge domestic septic tank effluent to the mound. Design flows areestablished based on an estimate of 150 gallons per day (gpd) per bedroom, whichequates to a design flow rate of 450 gpd. Using a design flow of 150 gpd/bedroom provides for a factor of safety resulting necessary to promote greater system performance and longevity.

Step 2. Evaluate the soil profile and site description for maximum soil loadingrate and hydraulic linear loading rate.

From the soil profile description there are indications of a seasonal high groundwaterelevation at 18 inches. The most limiting soil horizon in the upper 18 inches from a texture and structure standpoint is brown medium sand with weak granular structure. Using Table 1, the soil loading rate and linear loading rate are selected.

Soil Loading Rate (SLR) = 1.0 gpd/ft^2
Linear Loading Rate (LLR) = 5.0 gpd/lineal foot

Step 3. Select the sand fill loading rate and calculate the distribution cellwidth (A).

The maximum sand fill loading rate for septic tank effluent is 1.0 gpd/ft^2. For this example, the maximum rate will be used. Use of this rate is based on the assumptionthat the sand fill under the distribution cell will meet the requirements of Figure 4 andthat a factor of safety has been provided in design flows as discussed in Step 1. Thewidth of the distribution cell (A) can then be calculated as follows:

A = Linear Loading Rate ÷ Sand Fill Loading Rate
= 5.0 gpd/ft. ÷ 1.0 gpd/ft^2
= 5.0 ft.

Step 4. Determine the distribution cell length (B).

B = Design Flow ÷ Linear Loading Rate
= 450 gpd ÷ 5.0 gpd/ft.
= 90 ft.

Step 5. Determine the soil infiltration area width (IW).

The soil infiltration width represents the width required to absorb the effluent into the natural soil. To provide a factor of safety, it is based on the most limiting horizon in theupper 18 inches. For this example, the most limiting horizon is medium sand which hasa maximum soil loading rate of 1.0 gpd/ft^2.

IW= Design flow ÷ (soil loading rate x B)
= 450 ÷ (1.0 x 90)
= 5 ft.

For this example, the infiltration width and distribution cell width (A) are equal. For other situations where the most limiting horizon is less permeable, it will be found that the infiltration width will exceed width of the distribution cell. The infiltration width defines theminimum overall dimensions of the basal area and is important when evaluating the adequacy of the mound fill area and horizontal spacing when using multiple distribution cells.

Step 6. Determine mound fill depth (C) at the upslope edge of the distributioncell.

In this case, the depth of fill (C) at the upslope edge of the distribution cell will be the fillrequired to elevate the stone three feet above high groundwater elevation, which is
1.5 ft.

Step 7. Determine the mound fill depth (D) at the downslope edge of the distribution cell.

For a 4% slope, the following can be used:D =

C + 0.04(A)
= 1.5 + 0.04(5)
= 1.7 ft.

Step 8. Determine mound depths (E) and (F).

E = 1.0 ft. (total depth of stone)

F = 1.0 ft. (minimum amount of final cover)

Step 9. Determine the downslope width (I).

Using a recommended side slope of 4:1 the calculations is as follows: Downslope

correction factor = 100 ÷ [100-(side slope x % ground slope)]
= 100 ÷ [100-(4 x % slope)]
= 100 ÷ [100-(4 x 4)]
= 1.19

I = 4(D+ E+ F) x downslope correction factor
= 4(1.7 +1.0+ 1.0)(1.19)
= 17.6 ft.

Step 10. Determine the upslope width (J).

Using a recommended side slope of 4:1 the calculations is as follows:

Upslope correction factor = 100 ÷ [100+(side slope x % slope)]
= 100 ÷ [100+(4 x % slope)]
= 100 ÷ [100+(4 x 4)]
= 0.86

J = 4(C+ E+ F) x upslope correction factor
= 4(1.5 +1.0+1.0)(0.86)
= 12.0 ft.

Step 11. Determine the end slope length (K).

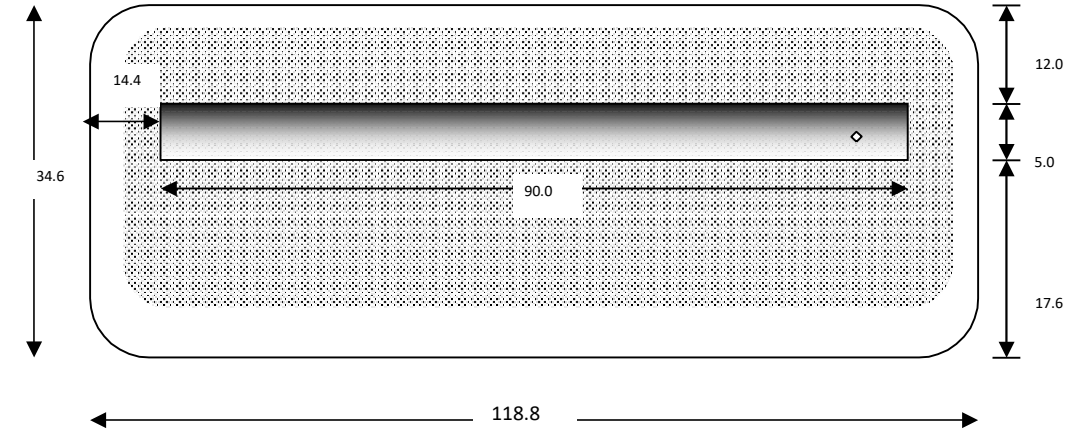
Using a recommended side slope of 4:1 the calculations is as follows:K =

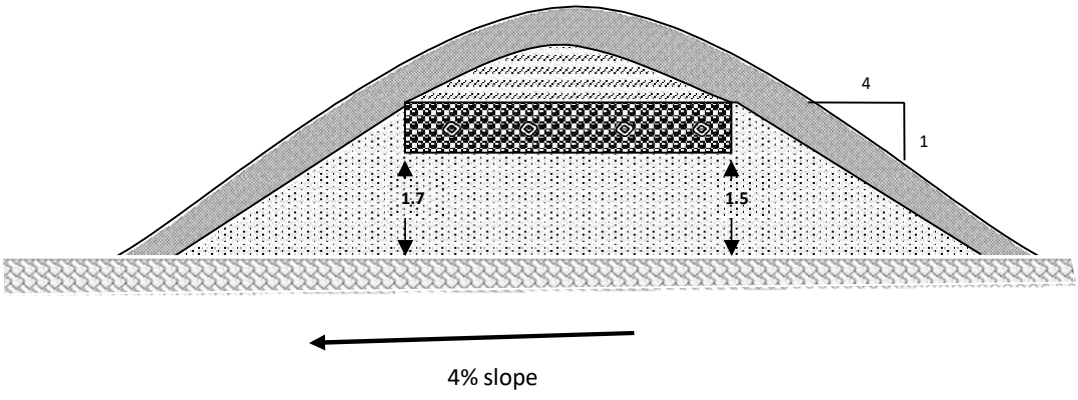
4[(C+D)/2 +E +F]
= 4[(1.5 +1.7)/2 + 1.0 +1.0]
= 14.4 ft.

Step 12. Determine the overall width (W) and length (L) of the mound fill.

W = A + I + J
= 5 + 17.6 +12.0
= 34.6 ft.
L = B + 2K
= 90 + 2(14.4)
= 118.8 ft.

The calculated dimensions are summarized on the following plan view and crosssection:





APPENDIX C

Mound Maintenance Visit Checklist

General Observations

Mound Appearance (check items that may apply)Erosion has

☐ Occurred
Explain_____
☐ Greener vegetation visible in spots
Explain_____

Toe of Slope Wetness
☐ Soil at downslope toe is soggy Water
☐ at surface of downslope toeSewage
☐ odor around wet spots

General Condition
☐ Attractive, well groomed, completely sodded
☐ Mostly vegetated, evidence of mowing
☐ Overgrown with weeds
☐ Overgrown with brush

Observation Tube in Stone Bed

☐ Observation tube is present
☐ Depth of ponding in tube_____

Other Observation Tubes

Describe and note distance to water below soil surface:

_____
_____

Pump Chamber

Appearance: (Note any apparent problems or concerns)

_____
_____

☐ Water level normal

Pump operation is:
☐ Demand (float) controlled
☐ Timer controlled

Number of floats: _____

☐ Check float operation and desirable function of each (first visit only)

If timer is present, note settings
_____ On time
_____ Off time

Flush Laterals

☐ Access is provided to ends of lines
☐ Have to dig up ends of lines (recommend addition of sumps for access)

Perform flush of each line by opening the end of one lateral at a time. Have helper turnpump on while you observe end of line. Note what flushes out of each line. Provide sketch to identify laterals.

Lateral #1 _____

Lateral #2 _____

Lateral #3 _____

Lateral #4 _____

Lateral #5 _____

Lateral #6 _____

After flushing all lines, make head measurement at the end of the line farthest from the pump. Note head and compare with previous records (if available) of how residual headin the system is supposed to be set. If head is more than 20 percent above previous value, bottle brush the lines – or otherwise clean – and measure head again.

Note final head:_____ft.

APPENDIX D

Mound Design Worksheet

Site Criteria

1. Soil Profile

   _____
   _____
   _____

2. Slope:_____%

3. This is a site for a proposed_____bedroom home.

Step 1. Evaluate the quantity and quality of wastewater generated.

Daily Flow = # of bedrooms x 150 gpd/bedroom
= (_____x 150) gpd
=_____gpd

Step 2. Evaluate the soil profile and site description for maximum soil loadingrate and hydraulic linear loading rate.

Seasonal High Groundwater Elevation =_____inches

Depth to Limiting Layer =_____inches

Limiting Layer texture, structure, grade_____,_____, _____

Using Table 1 the soil loading rate (SLR) and linear loading rate (LLR) are selected.Soil

Loading Rate (SLR) =_____gpd/ft^2
Linear Loading Rate (LLR) =_____gpd/lineal foot

Step 3. Select the sand fill loading rate and calculate the distribution cellwidth (A).

The maximum sand fill loading rate for septic tank effluent is 1.0 gpd/ft^2. For this design,the following rate will be used_____gpd/ft^2. The width of the distribution cell (A) can then be calculated as follows:

A = Linear Loading Rate ÷ Sand Fill Loading Rate

=_____gpd/ft. ÷_____gpd/ft^2
=_____ft.

Step 4. Determine the distribution cell length (B).

B = Design Flow ÷ Linear Loading Rate
=_____gpd ÷_____gpd/ft.
=_____ft.

Step 5. Determine the soil infiltration area width (IW).

The soil infiltration width represents the width required to absorb the effluent into the natural soil. To provide a factor of safety it is based on the most limiting horizon in theupper 18 inches. For this design, the most limiting horizon is_____with a_____, which has a maximum soil loading rate of_____gpd/ft^2.

IW= Design flow ÷ (soil loading rate x B)
=_____÷ _____

=_____ft.

For situations where the most limiting horizon is slowly permeable it will be found thatthe infiltration width will exceed width of the distribution cell. The infiltration width is important when evaluating the adequacy of the overall mound fill area and horizontal spacing when using multiple distribution cells.

Step 6. Determine mound fill depth (C) at the upslope edge of the distributioncell.

In this case, the depth of fill (C) at the upslope edge of the distribution cell will be the fillrequired to elevate the stone three feet above high groundwater elevation or limiting layer, which is _____feet.

Step 7. Determine the mound fill depth (D) at the downslope edge of the distribution cell.

For a given slope, the following can be used:

D = C + (slope x A) Note: express slope as decimal, i.e., 4% = 0.04
=_____+ (_____x_____)
=_____ft.

Step 8. Determine mound depths (E) and (F).

E =_____ft. (total depth of stone) F
=_____ft. (amount of final cover)

Step 9. Determine the downslope width (I).

Using a recommended side slope of 4:1 the calculations is as follows: Downslope

correction factor = 100 ÷ [100-(side slope x % ground slope)]
= 100 ÷ [100-(4 x_____% slope)]
= 100 ÷ [100-(4 x_____)]
= _____

I = 4(D+ E+ F) x downslope correction factor
= 4(_____+_____+_____)(_____)
=_____ft.

Step 10. Determine the upslope width (J).

Using a recommended side slope of 4:1 the calculations is as follows: Upslope

correction factor = 100 ÷ [100+(side slope x % slope)]
= 100 ÷ [100+(4 x_____% slope)]
= 100 ÷ [100+(4 x_____)]
= _____

J = 4(C+ E+ F) x upslope correction factor
= 4(_____+_____+_____)(_____)
=_____ft.

Step 11. Determine the end slope length (K).

Using a recommended side slope of 4:1 the calculations is as follows:K =

4[(C+D)/2 +E +F]
= 4[(_____+_____)/2 +_____+_____]
=_____ft.

Step 12. Determine the overall width (W) and length (L) of the mound fill.

W = A + I + J

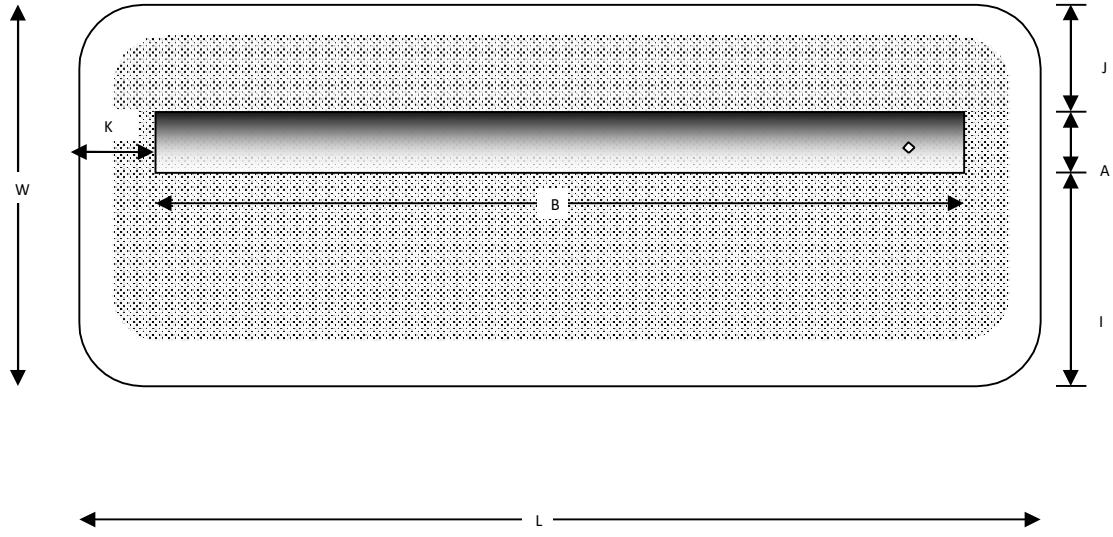
=_____+_____+ _____

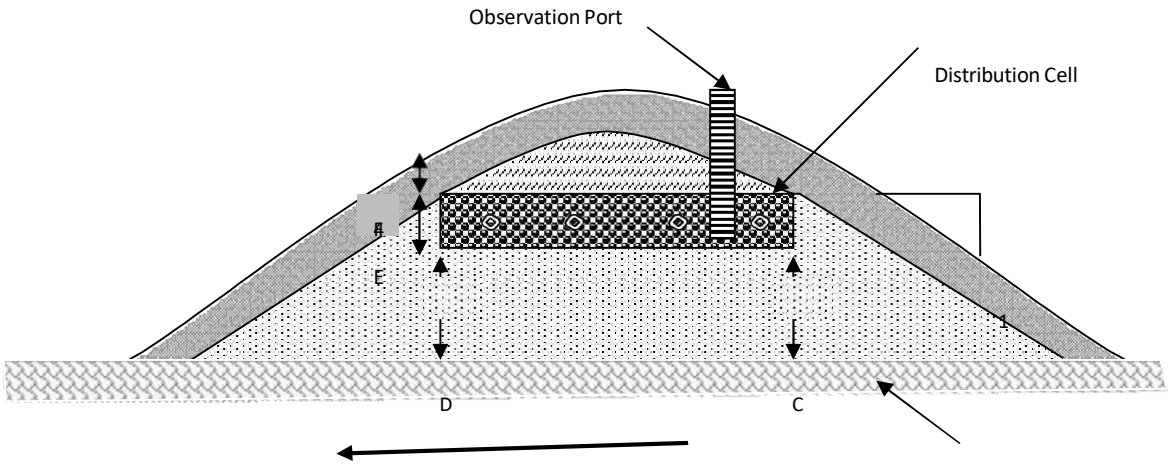
=_____ft.

L = B + 2K

=_____+ 2(_____)

=_____ft.





Prepared Natural Ground Surface

slope

Mound Component Dimensions

A	Distribution cell width	
B	Distribution cell length	
C	Up slope fill depth under distribution cell	
D	Downslope fill depth under distribution cell	
E	Distribution cell depth	
F	Depth of final cover	
I	Distance from edge of distribution cell to downslope edge of fill	
J	Distance from edge of distribution cell to up slope edge of fill	
K	Distance from end of distribution cell to edge of fill	
L	Overall mound fill length	
W	Overall mound fill width	

Section 5:

Minimum Design Parameters – Aerobic Treatment

Description

Manufactured and packaged advanced treatment that uses mechanical means to bring sewage effluent into contact with oxygen by maintaining aerobic conditions within the treatment component tank. These units can be categorized as either: 1) suspended growth, 2) attached growth (submerged fixed media), or 3) combination of both.

Conditions for Application Submittal

1. A Michigan Registered Sanitarian, Professional Engineer specializing in environmental or sanitary wastewater treatment, or licensed sewage system installer registered with LMAS to design the particular alternative on-site sewage treatment system proposed shall provide a detailed design plan for each specific application.
2. Provide a scaled site plan detailing all aspects of the proposed work along with the Department application form.
    a. Plans shall be at least 8 ½" X 11" in size and shall be legible, clear, and permanent copies.
    b. Plans shall include the name of the person who prepared the plan and shall be stamped if prepared by a Michigan Registered Sanitarian or Professional Engineer.
3. A *Submittal Checklist for Alternative On-Site Sewage Treatment System* is available per request for guidance.
4. A contract/attachment to the deed shall be filed with the County Clerk indicating the property contains a secondary treatment system and the property limitation imposed by such a system. The property owner shall provide evidence that such contract/attachment has been filed before the Department issues the construction permit.
5. An initial 2-year maintenance agreement signed by both the land owner and the product distributor/installer is required. Annual maintenance thereafter shall be performed by a qualified maintenance provider.
6. Plans will not be reviewed until all required components described herein are submitted with the applicable fee.

Sewage Treatment Components

1. Site Preparation - Ultimate success or failure of a system also relies on clear communication along with the understanding of basic site preparation and construction principles. Critical issues include:
    a. Proper procedures must be followed to protect the location area including required greenbelt area during and after construction. After establishing a

suitable location for the initial and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the system that is isolated from other anticipated home construction activities is encouraged.

b. Soil smearing and compaction, which can reduce infiltration capacity, will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a ¼ inch or smaller "wire" it is considered too wet and should be allowed to dry before preparing. If the site is questionable then certification from Design Consultant shall be required.
c. Excessive vegetation should be removed from the basal area. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand.
d. The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.
e. Cleanliness of the sand fill should be checked prior to construction. Placement of fill material is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from traveling over the mound basal area and downslope of the greenbelt area. Total depth of fill shall be established on a benchmark provided by the design consultant on the design plan.

2. Septic Tank

a. Tank requirements are established in Section 3-14.5 of the Code.
b. The minimum capacity for septic tanks for a one, two, or three-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department, increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.
c. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location.

d. Septic tanks shall be equipped with a watertight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or shall be equipped with other Department approved safety device to preclude accidental tank entry.
e. All septic tanks shall be installed to be level and to flow in accordance with the manufacturer's design intent.
f. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000-gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.
g. Septic tanks and pump tanks shall be tested and certified to be watertight. Testing and certification must be performed on-site and in-place, by the tank manufacturer, design consultant, or licensed septic installer. Hydrostatic or vacuum test may be utilized to determine if the septic tank and/or pump tank are watertight. Certification shall be submitted prior to or during the final inspection performed by the Department.

5. Pump - See Section 2 of this manual for pump tank and pump design parameters.

6. Aerobic Unit
    a. Any aerobic treatment unit that is not on the most current LMAS District Health Department approved list will not be considered under this manual. Approval for use in the District is required prior to the application process. Products must meet the minimum requirements established in Section 1 of this manual.
    b. The aerobic treatment unit shall be placed on a stable, level surface. A minimum of 4" thickness of sand or granular bed overlaying a form and uniform base is required per manufacturer specifications for installation. Backfill should be free of any large stones (greater than 3") or other debris. Sites with silty soils, high water table or other poor bearing characteristics must have specifically designed bedding and bearing surfaces to prevent settling. Units that will be located within a saturated soil condition must be designed in a manner that considers all other structural issues including, but not limited to, buoyancy and structural effects on the treatment unit.
    c. A sample port shall be installed such that a sample of the treated effluent can be easily taken without contamination to the sample bottle. The sample port shall be located on the outlet side of the unit between the unit and the dispersal mound.
    d. Only an Approved Alternative System Distributor/Installer shall install the aerobic unit and must be present at all times during the installation. No work on the aerobic unit may be conducted unless under the direct supervision of an Approved Alternative System Distributor/Installer.

7. Dispersal Area
    a. Infiltrative surface – The infiltrative surface of unsaturated soil to which treated effluent is discharged shall be ≥ 24 inches above the estimated highest limiting layer such as groundwater elevation, bedrock, or clay.

b. Effluent Distribution

i. Pressure distribution is preferred as it distributes the effluent evenly and allows for final treatment (polishing) as the effluent moves through the soil. Gravity flow is not recommended as it may permit excessive loading in one area, which may preclude final treatment (polishing) before effluent reaches the groundwater.

ii. For Absorption System Requirements, refer to Table 1.

Table 1: Absorption System Requirements

Soil Texture	Soil Loading Rate	Sizing Requirements for Pressure Distribution Throughout Field *	Sizing Requirements for Gravity Flow Throughout Field *	Minimum Depth of Unsaturated Soil for Treatment Purposes
	gal/ft^2/day	ft^2/bedroom	ft^2/bedroom	Inches
Medium Sand	1.3	115	160	24
Fine Sand, Loamy Sand	0.9	170	235	24
Sandy Loam	0.6	250	325	24
Loam, Silt Loam	0.5	300	400	24
Sandy or Silty Clay Loam	0.3	500	625	24
Clay Loam	0.2	750	875	24

Notes:

1. The absorption system shall not be sized for less than two bedrooms.

2. As a recommendation, for sites with extremely high-water table, shallow restrictive layers or slowly permeable soils, long narrow units instead of short wide units, are necessary so the effluent can be conveyed away from the unit. (Converse, 1997, revised 1999)

* Dispersal bed sizing does not include 4:1 side slope or basal area.

8. At least one observation port to gauge ponding depth in the absorption field is necessary

9. Geotextile fabric shall be used between the top of the stone and soil cover.

10. Taper - The slope surrounding the dispersal area. A taper shall be installed when the dispersal area is installed "on" or "above" the natural grade. The taper shall be constructed of clean sand with no excessive fines and shall be evenly graded from top of the dispersal area to the natural soil surface with a slope of 4:1 or flatter if within a maintained lawn. Final grading of the area should divert water drainage away from the system.

11. The entire mound shall be covered with sufficient suitable soil with a permeability ≥3.0 inches/hour to maintain vegetative growth and seeded/mulched upon completion. If the system is constructed after September 15th, a vegetative cover must be provided. Cover may consist of sod, mulch, straw, or other suitable material to prevent freezing.

Maintenance and Monitoring

1. The landowner at his/her sole expense shall comply with a specific maintenance, monitoring, and inspection program specified by this manual to ensure the optimum operation of the treatment system.

2. As a condition of approval, LMAS staff may randomly spot check any aerobic treatment unit.

3. Each owner of land where an aerobic treatment system is located shall have a written operation and maintenance agreement with a qualified maintenance provider for the life of the system. Approval of the initial maintenance agreement shall be made by LMAS prior to the issuance of the construction permit to ensure required maintenance and inspection frequency. A list of qualified maintenance providers is available upon request. In the event the qualified maintenance provider fails to perform maintenance, the land owner shall make arrangements with another qualified maintenance provider to maintain the aerobic treatment unit.

4. Failure to submit annual maintenance reports to the Department is a violation of the permit and, unless corrected in a timely manner, will result in enforcement action (pursuant to Article XIV of the Code) against the land owner and possible revocation of operating approval.

5. All aerobic treatment units shall be maintained in accordance with the manufacturer's specifications.

6. The distributor/installer shall provide the manufacturer's operation and maintenance manual to the homeowner.

7. The aerobic treatment unit along with the complete septic system shall be inspected by a Qualified Maintenance Service Provider on the following schedule, at a minimum:

    a. Within 6-8 weeks after sewage first enters the unit.

    b. Twice per year for the first 2 years of operation (at least one every six months); once per year thereafter.

    c. Maintenance, after the first two years of operation, may be reduced if the unit is equipped with a telemetry control panel which is attached to an internet-based interface that provides continuous remote monitoring, information management and control of the aerobic unit. Sites that do not have internet access can use an active phone line equipped with an auto dialer to notify the authorized service provider of alarm conditions, including if power to any of the system equipment is disconnected. The system should also include a control panel that tracks, at a minimum, pump elapsed time, cycle counts and high-level alarm counts or other means to determine flow through the system and other system information for troubleshooting purposes, as recommended by the manufacturer.

    d. A meeting with a new owner is recommended at the time of transfer of the property. The Department should be notified of this meeting and invited to participate. The new owner of the property shall be provided with all information regarding the advanced treatment system which includes, but is not limited to,

permit and final inspection, manufacturer installation, operation, and maintenance manual, deed notices, maintenance contract, and annual maintenance reports. The new owner shall be informed about annual maintenance requirements. The new owner then becomes responsible for submitting annual maintenance reports to the Department.

e. Due to difference in wastewater strength, increased user abuse, and hydraulic surges, additional treatment units and/or increased maintenance may be required.

8. Operation and maintenance procedures for seasonal or intermittent use facilities.

    a. Frequently, aerobic treatment systems are installed at facilities that are used intermittently or seasonally. Because of the reduced or sporadic loading that these installations receive, the routine service and maintenance requirements are different from that normally expected of a year-round residence. The qualified maintenance service provider shall refer to the manufacturer's recommendations for this type of use and include any additional maintenance and monitoring requirements in the service contract.

9. Owner Request for Service

    a. Any qualified maintenance provider (under contract) that does not provide service within 3 days of an owner request may be assessed civil penalties in accordance with Article XIV of the Code and could result in revocation of qualified maintenance provider approval.

10. The maintenance agreement must be signed by the landowner and the qualified maintenance provider. If the qualified maintenance provider is the landowner, then the landowner shall submit a statement in writing acknowledging that he/she is responsible for any and all maintenance. This statement shall also provide consent to random inspections that may be performed by the Department.

    a. A copy of the initial contract shall be submitted to LMAS as part of the permitting process. The initial two-year contract shall indicate all required inspections as noted above.

    b. It is the responsibility of the landowner to submit a current maintenance agreement to the Department. Failure to submit is a violation of the permit conditions and unless corrected in a timely manner could result in enforcement action pursuant to Article XIV of the Code and possible revocation of operating approval.

    c. Notice of expired maintenance agreements will be mailed to all landowners once LMAS is aware of the expired agreement.

11. Minimum reporting requirements for maintenance inspections performed by a qualified maintenance provider – report shall include information for each with "N/A" written if not applicable.

    a. All aerobic treatment units need servicing consistent with the manufacturer's recommendations to assure long-term system performance.

b. At a minimum, the inspection report shall include:

    i. A walk-over of the drainfield and noted conditions;

    ii. Reporting of conditions observed in the observation port location in the drainfield. (Port shall be installed if there is not one);

    iii. At least once per year (after the initial 2-year period), it is recommended to measure sludge and scum levels in the septic tank and notify the homeowner if the tank is in need of pumping. Check effluent filter for clogging and clean as needed;

    iv. Condition of the aerobic unit;

        1. Effluent quality inspection consisting of a visual check for color, turbidity, appearance of scum layer, and examination of odors;

        2. Condition of filters, if applicable.

    v. Alarm check;

    vi. Filter cleaning (if applicable);

    vii. Check of all electrical and/or mechanical components include pump cycle and run time meters;

    viii. Homeowner education in:

        1. Product use,

        2. Proper maintenance of system,

    ix. Number of persons occupying the dwelling;

    x. List of corrections or alterations that were made during the visit;

    xi. Septage pumping records shall be submitted each time any of the tanks are pumped, including the septic tank

        1. Provider shall obtain from homeowner and shall provide a copy to LMAS.

12. Maintenance Service Report Submittal to LMAS

    a. A copy of the maintenance report shall be submitted to LMAS annually and by no later than December 31st. Telemetry reports shall be submitted for systems on a reduced inspection frequency. Failure to submit an annual report as required is a violation of the operating approval and could result in enforcement action.

    b. Reports must include information necessary to identify it to the correct property. This shall include, at a minimum: date of inspection, owner's name, and property information including Town (T), Range (R), and Section along with property ID number. The report shall also indicate if the facility is used year-round, seasonally, or intermittently.

c. It is recommended that providers submit their report forms to LMAS for review to ensure that all necessary information is included. This should be done prior to using the form.

Noncompliance Monitoring

1. The owner is responsible for the proper operation and performance of the system. If additional monitoring is required, the owner shall be responsible for all costs associated with the monitoring and/or system repair.

2. In the event that the aerobic treatment unit or associated dispersal component(s) are found to be in noncompliance with the requirements in which it was permitted, the following actions must be taken at the owner's expense:

    a. The qualified maintenance service provider shall inspect the system in the presence of LMAS staff and correct any deficiencies noted.

    b. If LMAS deems it necessary, samples shall be taken to determine compliance at a frequency determined by LMAS. These samples include, but not limited to, BOD, TSS, and FC.

    c. If LMAS deems necessary, the installation of a telemetry panel may be required to constantly monitor system function.

    d. The qualified maintenance service provider shall submit a written report to landowner at the completion of the inspection and/or servicing.

    e. Use of the system may need to be discontinued if the system malfunctions and is found to be non-repairable or is non-compliant with the permit and results in an imminent health hazard.

3. LMAS shall have access to the property during regular business hours in order to conduct surveillance monitoring.

    a. Surveillance monitoring resulting from noncompliance may be charged a monitoring fee in accordance with the Department fee schedule.

    b. LMAS shall be allowed to initiate required maintenance at the owner's expense if non-compliance with the permit or Code results in an imminent health hazard.

4. If compliance with the conditions in which the aerobic treatment unit and/or associated dispersal component(s) was permitted cannot be achieved, or if LMAS determines that the Code has been violated, a notice of violation will be issued to the owner.

Limitation of Responsibility

1. Plan approval by LMAS may not be construed as an assumption of any responsibility for the design of the alternative on-site treatment system and associated components.

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering the system. Approval to use the system will not be granted until all required information has been received:

    a. Request for a final inspection of the alternative on-site sewage treatment system by the contractor, installer, or property owner shall serve as notice to the Department that the system is installed according to the permit and associated design plans. Final inspection conducted by the Department shall identify any items of noncompliance.

    b. No portion of the system shall be covered and the system shall not be placed into service prior to final inspection and approval. The property owner is responsible for maintenance and monitoring of the system following approval from the Department unless a contract agreement is in place between the property owner and a qualified maintenance provider.

    c. Any other information requested by LMAS such as watertight tank test results and pump installation certification.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

The Department reserves the right to require special restrictions, in rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site-specific basis.

Section 6:

Minimum Design Parameters – Geotextile Sand Filter (GSF)

Description

The Geotextile Sand Filter (GSF) is a passive advanced treatment assembly consisting of a proprietary GSF module(s), which contains a biomat fabric and a cuspated plastic core for treatment of septic tank effluent. This is placed on a specified sand base to provide supplemental wastewater treatment before discharge to the native soil.

Conditions for Application Submittal

1. A Michigan Registered Sanitarian, Professional Engineer specializing in environmental or sanitary wastewater treatment, or licensed sewage system installer registered with LMAS to design the particular alternative on-site sewage treatment system proposed shall provide a detailed design plan for each specific application.
2. Provide a scaled site plan detailing all aspects of the proposed work along with the LMAS District Health Department application form.
    a. Plans shall be at least 8 ½" X 11" in size and shall be legible, clear, and permanent copies.
    b. Plans shall include the name of the person who prepared the plan and shall be stamped if prepared by a Michigan Registered Sanitarian or Professional Engineer.
3. A *Submittal Checklist for Alternative On-Site Treatment System* is available per request for guidance.
4. Plans will not be reviewed until all required components described herein are submitted with the applicable fee.

Sewage Treatment Components

1. Site Preparation - Ultimate success or failure of a system also relies on clear communication along with the understanding of basic site preparation and construction principles. Critical issues include:
    a. Proper procedures must be followed to protect the location area including the required greenbelt area during and after construction. After establishing a suitable location for the initial and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the system that is isolated from other anticipated home construction activities is encouraged.
    b. Soil smearing and compaction, which can reduce infiltration capacity, will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a

depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a ¼ inch or smaller "wire" it is considered too wet and should be allowed to dry before preparing. If the site is questionable then certification from design consultant shall be required.

c. Excessive vegetation should be removed from the basal area. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand.
d. The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.
e. Cleanliness of the sand fill should be checked prior to construction. Placement of fill material is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of six inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travel over the mound basal area and downslope of the greenbelt area. Total depth of fill shall be established on a benchmark provided by the design consultant on the design plan.

2. Septic Tank

a. Tank requirements are established in Section 3-14.5 of the Code.
b. The minimum capacity for septic tanks for a one, two, or three-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department, increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.
c. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location.
d. Septic tanks shall be equipped with a watertight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or shall be equipped with other Department approved safety device to preclude accidental tank entry.
e. All septic tanks shall be installed to be level and to flow in accordance with the manufacturer's design intent.
f. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000-gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.
g. Septic tanks and pump tanks shall be tested and certified to be watertight. Testing and certification must be performed on-site and in-place, by the tank manufacturer, design consultant, or licensed septic installer. Hydrostatic or vacuum test may be utilized to determine if the septic tank and/or pump tank are

watertight. Certification shall be submitted prior to or during the final inspection performed by the Department.

8. Pump - See Section 2 of this manual for pump tank and pump design parameters.

9. Dispersal Area

    a. Infiltrative surface – the infiltrative surface of unsaturated soil to which treated effluent is discharged to shall be ≥ 24 inches above the limiting layer noted in the site evaluation report. Allowance granted for the 12 inches of specified sand (2NS) required below the GSF modules.
    b. The system shall be constructed per the GSF design manual within this section.
    c. Effluent Distribution – pressure distribution throughout the dispersal system is preferred. Gravity flow distribution may be allowed only when gravity flow can be achieved throughout the entire system. Pump to gravity flow at the modules will not be allowed.
    d. Taper – the slope surrounding the dispersal area. A taper shall be installed when the dispersal area is installed "on" or "above" the natural grade. The taper shall be constructed of clean sand with no excessive fines and shall be evenly graded from the top of the dispersal area to the natural soil surface with a slope of 4:1 or flatter if within a maintained lawn. Final grading of the area should divert water drainage away from the system.

Operation and Maintenance

Passive treatment systems do not require a maintenance and monitoring agreement, however they do require minimal maintenance as is standard for conventional onsite systems, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will ensure system longevity. The premise shall be used for the purpose intended when permitted. Any modification in usage of the premise shall be reported to the Department for evaluation. As a condition of operating approval, LMAS staff may conduct random site inspections.

1. Septic Tank and Effluent Filter

    a. Inspect the septic tank at least once every two years under normal usage. The tank shall be emptied of sludge and floating material by a licensed septage hauler at a recommended frequency of 3-5 years.

    b. After pumping, inspect the integrity of the septic tank to ensure that no groundwater is entering it. Also check the inlet and outlet and repair if needed.

    c. Effluent filters require on-going maintenance due to their tendency to clog and cut off oxygen to the system. The effluent filter shall be cleaned at every septic tank pump out and inspected every 6-12 months. Follow filter manufacturer's maintenance instructions.

    d. Owner must keep copies of the pump-out invoice and shall provide maintenance as required by the GSF manufacturer. The use of enzymes or any septic system additives is prohibited.

2. Pumped Systems

    a. Inspect at least once a year to assure adequate operation of pump, floats, control panel, and alarms.

    b. The dose of wastewater shall be verified once a year to ensure it meets GSF requirements per the permitted design plan.

    c. The distribution laterals shall be inspected at least once a year to ensure even distribution between the GSF modules.

3. Infiltration Area

    a. It is important that the system site remains free of shrubs, trees, and other woody vegetation. Roots can infiltrate and cause damage or clogging of system components.

    b. Make sure the infiltration area is free of motorized vehicle traffic, is seeded, and that all water is diverted to avoid overloading.

    c. If the system has a vent, make sure it is not obstructed.

    d. Check and immediately report any odor or sign of water breakouts around the system.

Noncompliance

1. The owner is responsible for the proper operation and performance of the system. If additional monitoring is required, the owner shall be responsible for all costs associated with the monitoring and/or system repair.

2. In the event that any part of the system is found to be in noncompliance with the requirements in which it was permitted, the following actions must be taken at the owner's expense:

    a. The distributor shall inspect the system (with LMAS staff person present) to determine any deficiencies.

    b. If LMAS deems necessary, effluent samples shall be taken to determine system compliance.

    c. Use of the system may need to be discontinued if the system is found to be non-repairable, is non-compliant with the permit, or results in an imminent health hazard. If compliance with the conditions in which the GSF and/or associated components were permitted under cannot be achieved, or if the Department determines that the Code has been violated, a notice of violation will be issued to the owner.

Limitation of Responsibility

1. Plan approval by LMAS may not be construed as an assumption of any responsibility for the design of the alternative on-site sewage treatment system and associated components.

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering the system. Approval to use the system will not be granted until all required information has been received:

    a. Request for a final inspection of the alternative on-site sewage treatment system by the contractor, installer, or property owner shall serve as notice to the Department that the system is installed according to the permit and associated design plans. Final inspection conducted by the Department shall identify any items of noncompliance.

    b. No portion of the system shall be covered, and the system shall not be placed into service prior to final inspection and approval. Property owners are responsible for maintenance and monitoring of the system following approval from the Department unless a contract agreement is in place between the property owner and a qualified maintenance provider.

    c. Any other information requested by LMAS such as watertight tank test results and pump installation certification.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

The Department reserves the right to require special restrictions, in rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site-specific basis.

GSF®

Geotextile Sand Filter

Michigan

Design & Installation Manual

eljen

CORPORATION

Innovative Onsite Products & Solutions Since 1970

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Glossary of Terms

A42 Module	48” x 24” x 7” (L x W x H)
A22 Module	24” x 24” x 7” (L x W x H) *Note: A22 Half Modules are half the length of the standard A42 Module and are utilized to round up trench rows to equal length.*
B43 Module	48” x 36” x 7” (L x W x H)
B23 Module	24” x 36” x 7” (L x W x H) *Note: B23 Half Modules are half the length of the standard B43 Module and are utilized to round up trench rows to equal length.*
Bio-Matt™ fabric	Proprietary filter fabric within the Geotextile Sand Filter Modules upon which the primary biomat layer forms.
Cover Fabric	The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.
Cuspated Core	The rigid plastic core of the GSF module. It separates the geotextile fabric and creates downward infiltration channels and upward aeration channels to provide primary filtration and biological treatment of the septic effluent. The curvilinear shape of the cuspations offers increased treatment surface area and greater effluent storage.
Design Flow	The estimated peak flow that is used to size a GSF system is 150 gallons per day per Bedroom.
Distribution Box	A plastic or concrete box that receives effluent from a septic tank and splits the flow to pipes placed above the GSF modules. For equal distribution, the outlet pipe orifices are typically set at the same elevation to equalize the flow to each line.
EHGWT	The Estimated High Ground Water Table (EHGWT) is the elevation of saturated condition as measured or as estimated from evaluation of soil color.
Flow Dial/Equalizer	Special insert placed in the end of distribution pipes within the distribution box to compensate for possible unlevel installation and promote favorable flow to the distribution pipes.
GSF	The Eljen Geotextile Sand Filter Modules and the 12-inch sand layer at the base and 6 inches along the sides of the modules.
GSF Module	The individual module of a GSF system. The module is comprised of a cuspated plastic core and corrugated geotextile fabric.
LTAR	Long Term Acceptance Rate (LTAR) is the average equilibrium absorption rate for effluent in a system, usually expressed in gallons per day per square foot. It should not be confused with the soil loading rate that is used by regulatory officials in their regulations.
SHGWT	Seasonal High Ground Water Table (SHGWT) is the elevation to which the ground or surface water can be expected to rise due to a normal wet season.

Specified Sand

To ensure proper system operation, the system MUST be installed using either MDOT 2NS sand or ASTM C33 Sand.

MDOT 2NS sand will have less than 10% passing the #100 Sieve and less than 3% passing the # 200 sieve. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS

MDOT 2NS SAND SPECIFICATION		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
3/8 inch	9.52 mm	100
No. 4	4.76 mm	95 - 100
No. 8	2.38 mm	80 - 100
No. 16	1.19 mm	50 - 85
No. 30	590 µm	25 - 60
No. 50	297 µm	5 - 30
No. 100	149 µm	0 - 10
No. 200	75 µm	0 - 3

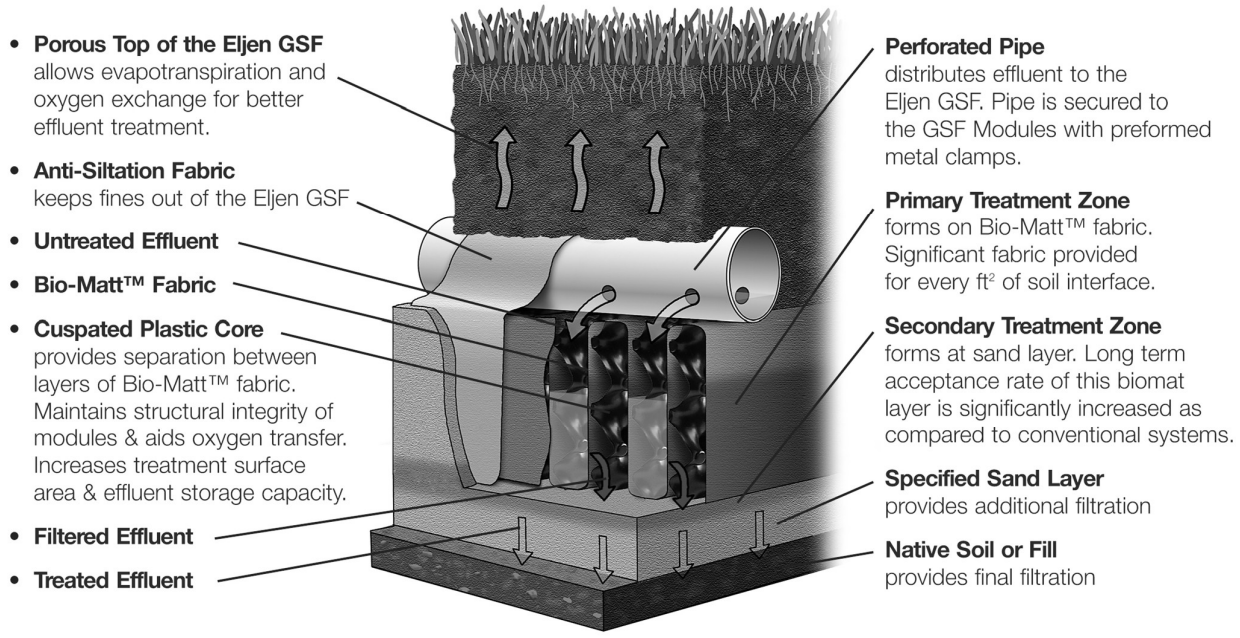
Primary Treatment Zone

- Perforated pipe is centered above the GSF module to distribute septic effluent over and into corrugations created by the cuspated core of the geotextile module.
- Septic effluent is filtered through the Bio-Matt fabric. The module's unique design provides increased surface area for biological treatment that greatly exceeds the module's footprint.
- Open air channels within the module support aerobic bacterial growth on the modules geotextile fabric interface, surpassing the surface area required for traditional absorption systems.
- An anti-siltation geotextile fabric covers the top and sides of the GSF module and protects the Specified Sand and soil from clogging, while maintaining effluent storage within the module.

Secondary Treatment Zone

- Effluent drips into the Specified Sand layer and supports unsaturated flow into the native soil. This Specified Sand/soil interface maintains soil structure, thereby maximizing the available absorption interface in the native soil. The Specified Sand supports nitrification of the effluent, which reduces oxygen demand in the soil, thus minimizing soil clogging from anaerobic bacteria.
- The Specified Sand layer also protects the soil from compaction and helps maintain cracks and crevices in the soil. This preserves the soil's natural infiltration capacity, which is especially important in finer textured soils, where these large channels are critical for long-term performance.
- Native soil provides final filtration and allows for groundwater recharge.

FIGURE 1: GSF System Operation



Testing and Performance

GSF Modules were subjected to independent third-party testing in accordance with NSF/ANSI Standard 40 Protocol. Three different methods of distribution were tested:

- Pressure Distribution
- Lift Pump/Gravity Demand Dosed Distribution
- Gravity Distribution

The data and detailed reports for each system tested were reviewed by NSF in accordance with NSF/ANSI Standard 40 Protocol and the Pennsylvania Department of Environmental Protection Technical Verification Program. This independent review validates the performance data listed below for Demand Dosed, Pressure Dosed, and Gravity systems.

Testing Arrangement & Common Factors:

Common Factors for all tested systems listed in Table 2:

- A42 modules: (L x W x H) 48" x 24" x 7" plus Specified Sand.
- Six modules per bedroom at 150 gal/day, 18 modules total for three bedrooms per house equals 450 gal/day.
- Standard distribution pipe with orifices at the 5 & 7 o'clock position,
- 12 inches of Specified Sand base extending 6 inches at either edge of the modules.

Lift Pump/Gravity Demand Dosed System:

- 1000 gal septic tank – 500 gallon pump chamber to distribution box.
- Dial-a-flow fittings set level to deliver effluent into each of the three rows of laterals via a 4-inch perforated distribution pipe with orifices at the 5 & 7 o'clock position.
- A non-perforated pipe connects the distal end to the end of other rows.

Time Pressure Dosed System:

- 1000 gal septic tank – 500 gal pump chamber – 1.25" low-pressure pipe (LPP) or other diameter as required.
- LPP placed inside a 4-inch perforated distribution pipe with orifices at 12 o' clock, at least one drain hole per line at 6 o'clock.
- The 4-inch perforated pipe orifices are placed at the 5 & 7 o'clock positions with the end of pipe capped

Gravity System Trench Design:

- 1000 gal septic tank–gravity to distribution box.
- Dial-a-flow fittings set level to deliver influent into three individual trenches.
- Perforated distribution pipe with orifices at the 5 & 7 o'clock positions with the end of pipe capped.

TABLE 2: TESTING RESULTS

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Demand Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2.0	2.7
Median	1.0	2.5
Min Value	1.0	2.5
Max Value	7.2	7.0

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 190 mg/L

Timed Pressure Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2.6	2.7
Median	2.2	2.5
Min Value	1.0	2.5
Max Value	14.0	9.0

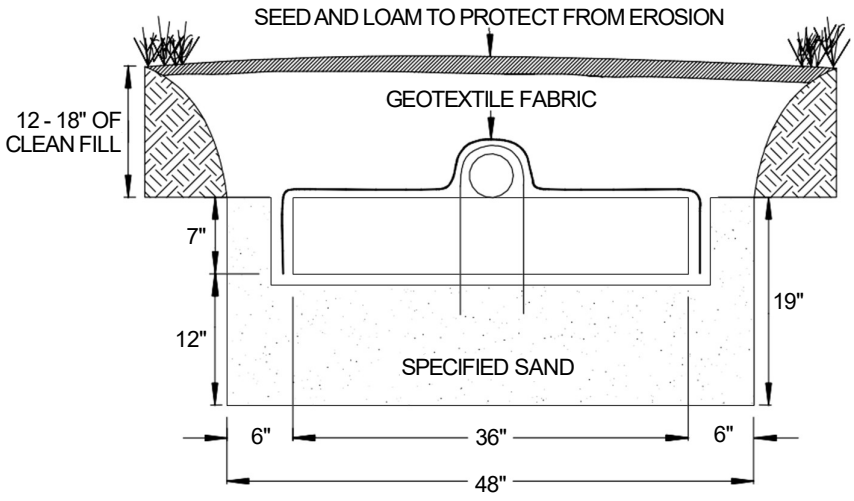
GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Gravity

	CBOD (mg/L)	TSS (mg/L)
Mean	8.0	7.4
Median	7.6	5.0
Min Value	1.0	2.5
Max Value	18	55

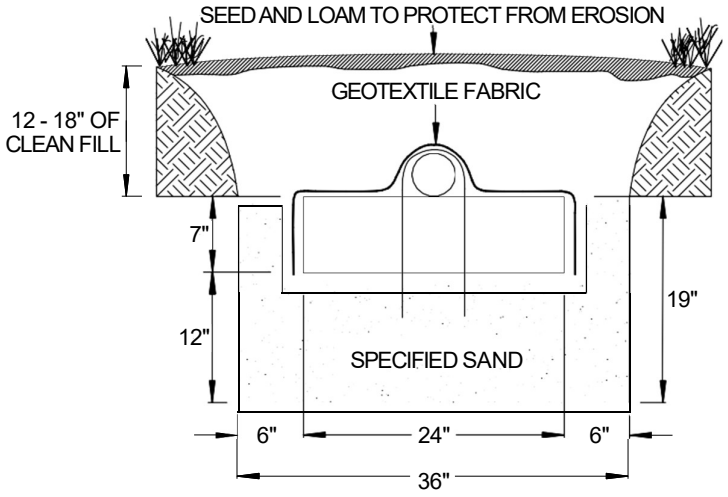
TSS 2.5mg/L = sample was below detection limits
CBOD 1.0mg/L = sample was below detection limits

FIGURE 2: Typical B43 GSF Cross Section



B43 MODULE (L x W x H) 48" x 36" x 7"

FIGURE 3: Typical A42 GSF Cross Section



A42 MODULE (L x W x H) 48" x 24" x 7"

All Systems are Required to Have a Minimum of:

- 6 inches of Specified Sand is at the edges of the GSF module.
- 6 inches of Specified Sand is at the beginning and end of each GSF Trench.
- 12 inches of Specified Sand is directly below the GSF module.
- Minimum 12 inches of native soil fill above the module.

1.0 Design and Installation

1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The Michigan Criteria for Subsurface Sewage Disposal and the local regulations will be referred to as the *guidelines* in this manual.

The sizing charts apply to residential systems only. Sizing charts are found in section 1.15. Please contact Eljen's Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

1.2 SPECIFIED SAND SPECIFICATION FOR TRENCH SYSTEMS: The first 12 inches of sand immediately under, between rows and around the perimeter of the GSF system must be ***MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT) 2NS SAND, WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 3% PASSING A #200 SIEVE.*** Please place a prominent note to this effect on each design drawing. See Table 1 for more information on the sand and sieve specifications.

1.3 CONNECTIONS AND FITTINGS: Connections of lines to tanks and distribution boxes must be made using watertight mechanical seals. Use of any grouting material is not permitted.

1.4 PLACING GSF MODULES: The "White Stripe" on the GSF modules indicates the top of the module and is not intended to indicate the location of the distribution pipe. With the white stripe facing up, all rows of GSF modules are set level, end to end on the Specified Sand layer. No mechanical connection is required between modules.

1.5 DISTRIBUTION PIPE: SDR-35 or equivalent is required. Place perforated pipe on top of GSF modules with holes at 5 and 7 o'clock. Secure pipe to GSF modules with provided wire clamps, one clamp per Eljen module. All distribution piping must meet a minimum 2,500 pound crush test specification or meet the requirements of the most recent revision of ASTM D 2665 for polyvinyl chloride (PVC) drain and waste pipe. Furthermore, all piping must meet state and local regulations.

1.6 DISTRIBUTION BOX: Set the gravity system D-box outlet invert a minimum of ⅛ inch drop in elevation per linear foot to the top first module in the trench. Set a 2-inch minimum drop for dosed systems from the D-box to the modules. Ensure that the distribution box and pipes feeding the system are placed on settled soil. Flow Dials may be used in either Gravity or Dosed installations.

1.7 COVER FABRIC: Geotextile cover fabric is provided by Eljen Corporation for all GSF systems. It is placed over the top and sides of the module rows to prevent long term siltation and failure. **Cover fabric substitution is not allowed.** Fabric should drape vertically over the pipe and must *not* block holes in the distribution pipe or be stretched from the top of the pipe to the outside edge of the modules. "Tenting" will cause undue stress on fabric and pipe.

1.8 BACKFILL & FINISH GRADING: Complete backfill with 12-18 inches of clean porous fill measured from the top of modules. Backfill exceeding 18 inches requires venting at the far end of the trench or bed. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff from the Effluent Disposal Area, (EDA). Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.

1.9 ADDITIONAL FACTORS EFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water usage may consider increasing the septic tank volume as well as incorporating a multiple compartment septic tank. Consideration for disposal area may be up-sized for expected higher than normal water use.

For example:

- Luxury homes, homes with a Jacuzzi style tubs, and other high use fixtures.
- Homes with known higher than normal occupancy.
- Homes on high-pressure city water: recommend that the homeowner install a water pressure regulator to reduce pressure.

1.10 GARBAGE DISPOSALS: Eljen discourages the use of garbage disposals with septic systems. If a GSF system is to be designed and installed with garbage disposals the following measures must be taken to prevent solids from leaving the tank and entering the GSF system:

- Increase the septic tank capacity by a minimum of 30% or
- Installation of a second septic tank installed in series or
- Installation of an appropriately sized septic tank outlet effluent filter.

Eljen strongly recommends the use of septic tank outlet effluent filters on all systems especially on those systems that have single compartment tanks, even if up sized, and when the dwelling has a garbage disposal installed.

1.11 WATER SOFTENER BACKWASH: At no time should water softener backwash be disposed of in the septic system. Water softener backwash should be discharged to a separate soil absorption field.

1.12 SEPTIC TANKS: Many designers are now specifying dual compartment tanks for all their systems. Eljen supports this practice as it helps to promote long system life by reducing TSS and BOD to the effluent disposal area. Gas baffles and/or effluent filters are also recommended.

1.13 SEPTIC TANK FILTERS: Wastewater filters are strongly recommended as a means of preventing solids from leaving the tank and entering your system. Filter manufactures require that filters be cleaned from time to time. Ask your installer or designer for specific cleaning requirements based on the type or make of the filter installed. Eljen requires the septic tank to be pumped every three years or as needed which would be a good time to check and conduct filter maintenance.

1.14 SYSTEM VENTING: It is strongly recommended to vent all systems that are over 18" below finished grade and systems beneath any surface condition that would not allow for surface air exchange with the system such as patios. See Section 8.0 for a more detailed explanation of venting GSF products.

1.15 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of six (6) A42 modules per bedroom or five (5) B43 modules per bedroom. See Section 1.16 for more information on systems sizing.

1.16 SIZING GSF SYSTEM FOR TRENCHES, BEDS & SAND MOUNDS: To remain consistent with advanced treatment sizing practices within Michigan, Eljen recommends a 50% reduction to current state, county and/or local wastewater soil application rates for trenches, beds and mounds.

Based on third-party performance testing data, NSF verification letters and over 20 years of success using similar sizing across the country, Eljen Corporation feels this is a reasonable and rational approach to system sizing based on the improved effluent quality achieved by septic tank effluent going through the Eljen Module and 12 inches of Specified Sand.

Table 3 below shows adjusted soil application rate numbers for Michigan Pressure Sand Mounds based on sizing requirements found in the Michigan Department of Environmental Quality *Pressure Mound Systems: Technical Guidance for Site Suitability, Design, Construction, and Operation and Maintenance, June 2003*.

TABLE 3: GSF B43 & A42 PRESSURE SAND MOUND SOIL APPLICATION RATES

Soil Structure	Maximum Soil Loading Rate GPD/FT²					Maximum Hydraulic Linear Loading Rate GPD/LF					Required Downslope Greenbelt**
	BK/GR			PL	M	BK/GR			PL		
Soil Texture*	1	2	3			1	2	3			
	2.0	2.0	2.0	1.0	1.0	5.0	5.0	5.0	2.5	2.5	NR
Fine Sand / Sandy Loam	0.8	1.0	1.2	0.8	0.8	3.5	4.0	4.5	2.0	2.0	10
Very Fine Sand / Sandy Loam	0.6	0.8	1.0	U	0.4	3	3.5	4	U	1.0	20
Loam / Sandy Clay Loam	0.4	0.5	0.6	U	0.4	2.5	3.0	3.5	U	U	30
Clay Loam / Silty Clay Loam	0.3	0.4	0.5	U	U	1.8	2.5	3.0	U	U	40
Silty Clay / Sandy Clay / Clay	***UNSUITABLE***										NA

* Most Limiting Layer in Upper 18 inches

** Measured From Toe of Mound Fill

Trench Example:

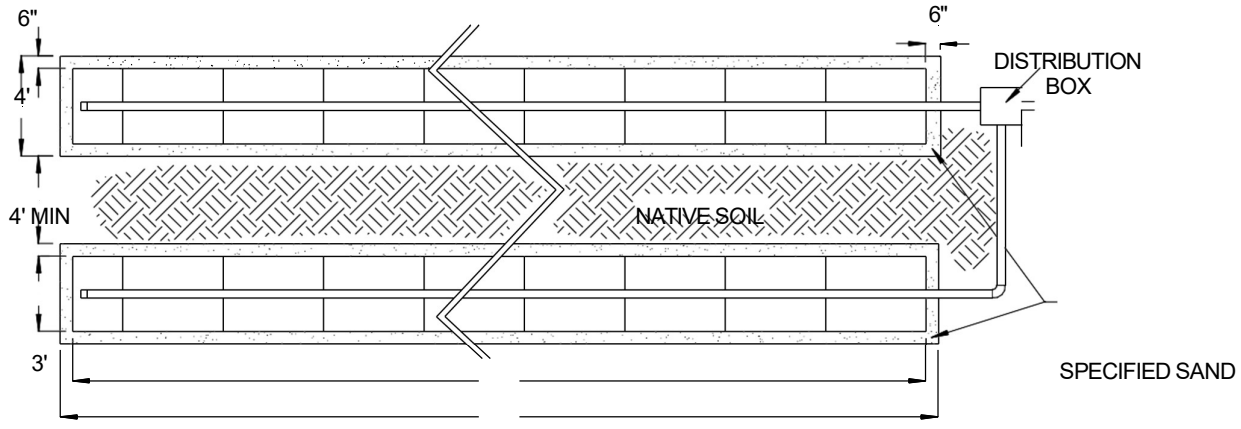
House size –	4 Bedrooms
Soil Permeability min/in –	15 min/in
Design Flow – 150 gpd x 4 bedrooms =	600 gpd
Existing Soil Application Rate (for this example) –	0.75 gpd/ft^2

(Note: Please refer to your State, County, and/or Local regulations for specific application rate information)

How to calculate reduced application rate:	
0.75 gpd/ft^2 ÷ 0.5 (50% reduction) =	1.5 gpd/ft^2
How to calculate the modules necessary:	
Field Size with Reduction = 600gpd ÷ 1.5 gdp/ft^2 =	400 ft^2
Number of units required = 400 ft^2 ÷ 16 ft^2 / module =	25 modules
For this example, assume the number of trenches equals two:	
Trench Width – Module width (3ft) + Sand Sidewalls (6” + 6”) =	4 ft
Trench Length – 25 modules ÷ 2 trenches = 12.5, use Modules (12.5) x 4 lf/module + 1 ft (6” sand at each end of trench) =	12 B43 & 1 B23 modules per row 51 ft
Trench area (width x length x trenches) – 4 ft x 51 ft x 2 trenches =	408 ft^2

Trench Dimensions:	
Length =	51 ft/trench
Width =	4 ft
Trenches =	2

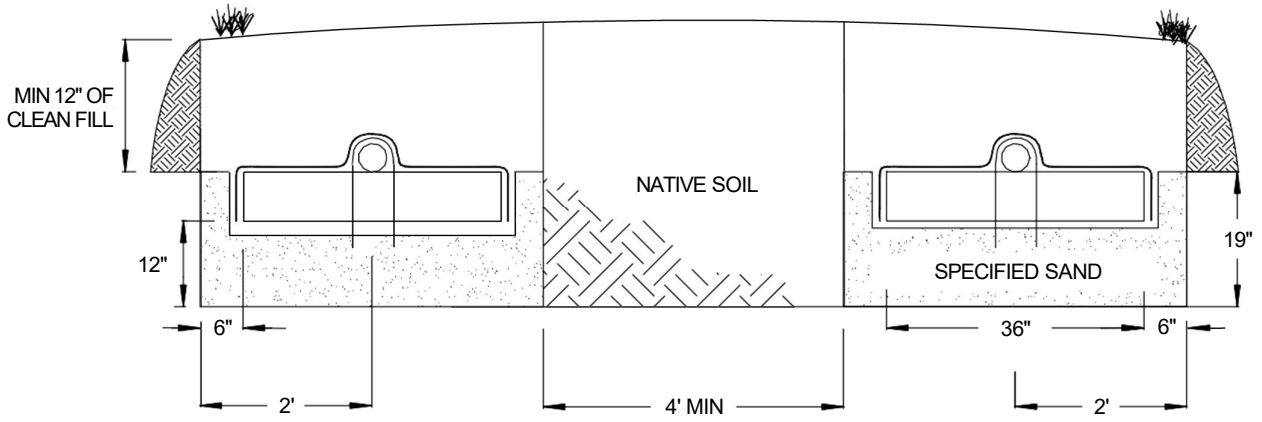
FIGURE 4A: PLAN VIEW – 600 GPD – TRENCH SYSTEM – LEVEL SITE



2.0 Trench Installation Sizing and Guidelines

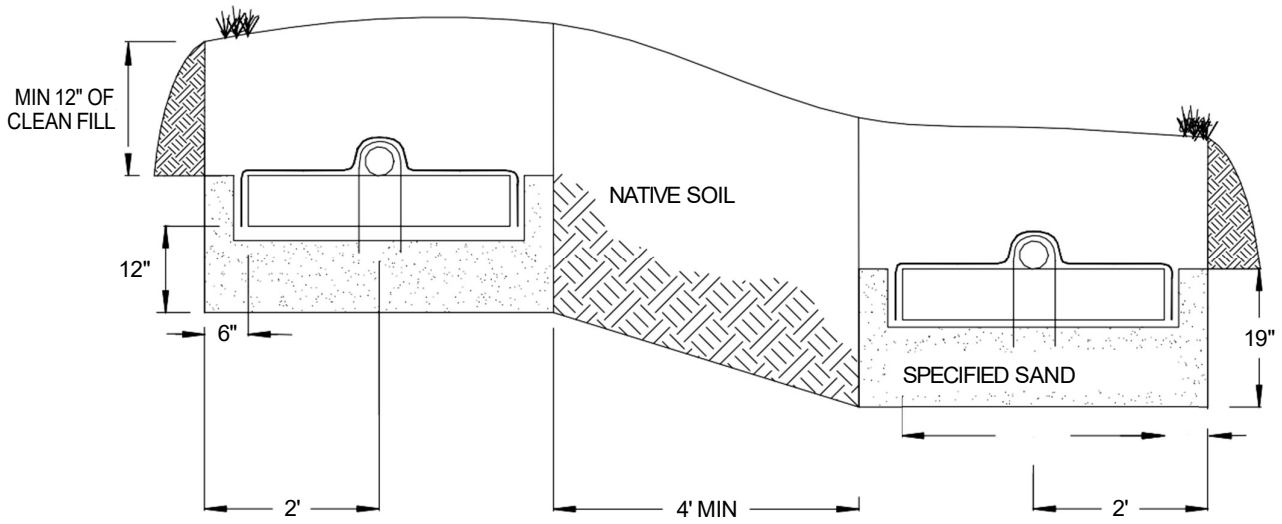
Design Flow 150 gpd x 4 Bedrooms = 600 gallons per day.
(12 B43 & 1 B23 Modules per Trench)

FIGURE 4B: SECTION VIEW – 600 GPD – TRENCH SYSTEM – LEVEL SITE



Design Flow 150 gpd x 4 Bedrooms = 600 gallons per day.
(12 B43 & 1 B23 Modules per Trench)

FIGURE 4C: SECTION VIEW – 600 GPD – TRENCH SYSTEM – SLOPING SITE



Design Flow 150 gpd x 4 Bedrooms = 600 gallons per day.
(12 B43 & 1 B23 Modules per Trench)

2.1 Trench Installation Sizing and Guidelines

Trench Installation Guidelines Additional guidance in State and Local regulations	
Determine the Number Modules	Determine the number of GSF Modules required using the trench sizing example.
Plan all Drainage Requirements	Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.
Excavating the Trench Area	Scarify the receiving layer to maximize interface between the native soil and Specified Sand. Minimize walking in the trench prior to placement of the Specified Sand to avoid soil compaction.
Placing Specified Sand Base	Place Specified Sand in two 6 inch lifts, compact each lift at a time. The compacted height below the GSF module must be level at 12 inches. A hand tamping tool or vibrating compactor is both acceptable.
Place GSF Modules	Place the GSF Modules, ***PAINTED STRIPE FACING UP***, end to end on top of the Specified Sand along their 4-foot length.
Distribution Pipes Gravity & Lift Pump/Gravity Systems	A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 5 & 7 o'clock position. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
Distribution Pipes: Pressure Systems	A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 5 & 7 o'clock position. Insert a pressure pipe *(size per design and code)* into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 7. Each pressure lateral will have a drain hole at the 6 o'clock position. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
Place Geotextile Cover Fabric	***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the trench, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by: • Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe. • Place shovel fulls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.
Placing Specified Sand after Cover Fabric is in place	Place 6 inches of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each trench.
Backfilling the System	Complete backfill with native soil to 12 - 18 inches over the GSF modules. Backfill exceeding 18 inches requires venting at the distal end of the trench. Fill must be clean, porous and devoid of rocks. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff. Finish grade to prevent surface ponding. Topsoil and seed to protect from erosion.

Bed Example:

House size –	3 bedrooms
Soil Permeability min/in –	18 min/in
Design Flow – 150 gpd x 3 bedrooms =	450 gpd
Existing Soil Application Rate (for this example)	0.5 gpd/ft^2

(Note: Please refer to your State, County, and/or Local regulations for specific application rate information)

How to calculate reduced application rate:

0.5 gpd/ft^2 ÷ 0.5 (50% reduction) =	1.0 gpd/ft^2

How to calculate the modules necessary:

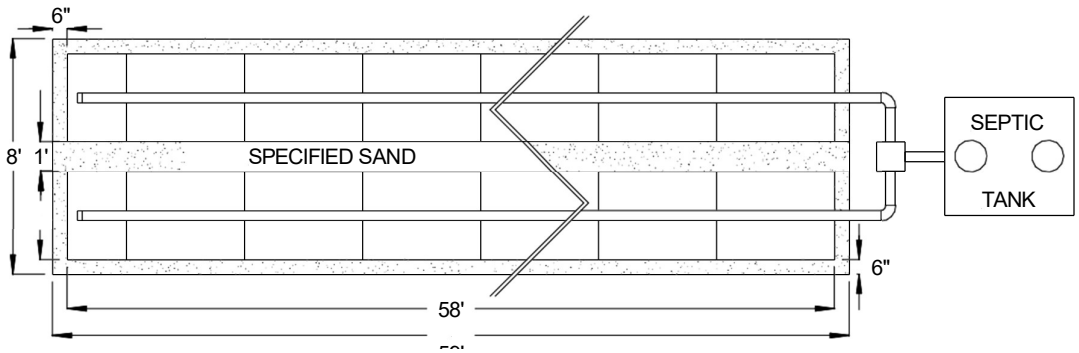
Field Size with Reduction = 450gpd ÷ 1.0 gdp/ft^2 =	450 ft^2
Number of units required = 450 ft^2 ÷ 16 ft^2 / module =	28.125 modules, round up to 29 modules

For this example, assume the number of rows equals two:

Bed Width – Module width (3ft) + Sand Sidewalls (6” + 6”) x Rows (2) =	8 ft
Bed Length – 29 modules ÷ 2 rows = 14.5, use	14 B43 & 1 B23 modules per row
Modules (14.5) x 4 lf/module + 1 ft (6” sand at each end of bed) =	59 ft
Bed area (width x length x rows) – 4 ft x 59 ft x 2 rows =	472 ft^2

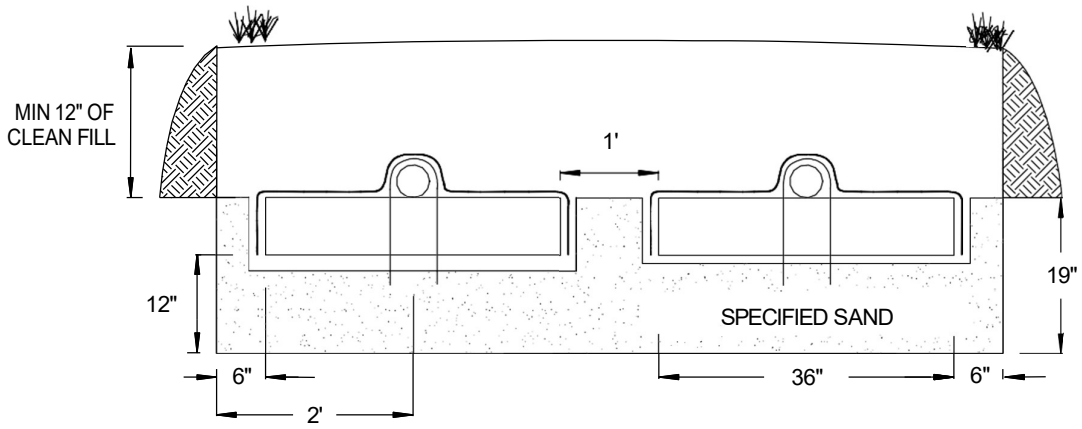
Bed Dimensions:	
Length =	59 ft
Width =	8 ft
Rows =	2

FIGURE 5A: PLAN VIEW – 450 GPD – BED SYSTEM – SLOPING SITE



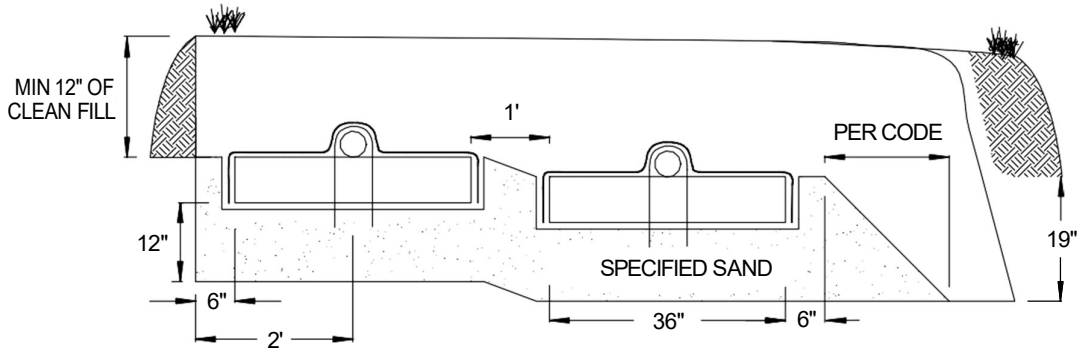
Design Flow 150 gpd x 3 Bedrooms = 450 gallons per day.
(14 B43 & 1 B23 Modules per Row)

FIGURE 5B: SECTION VIEW – 450 GPD – BED SYSTEM – LEVEL SITE



Design Flow 150 gpd x 3 Bedrooms = 450 gallons per day.
(14 B43 & 1 B23 Modules per Row)

FIGURE 5C: SECTION VIEW – 450 GPD – BED SYSTEM – SLOPING SITE



Design Flow 150 gpd x 3 Bedrooms = 450 gallons per day.
(14 B43 & 1 B23 Modules per Trench)

3.1 Bed Installation Sizing and Guidelines

Bed Installation Guidelines Additional guidance in State and Local regulations	
Determine the Number Modules	Determine the number of GSF Modules required using the bed sizing example.
Plan all Drainage Requirements	Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.
Excavating the Bed Area	Scarify the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the bed prior to placement of the Specified Sand to avoid soil compaction.
Placing Specified Sand Base	Place Specified Sand in two 6 inch lifts, compact each lift at a time. The compacted height below the GSF module must be level at 12 inches. A hand tamping tool or vibrating compactor is both acceptable.
Place GSF Modules	Place the GSF Modules, ***PAINTED STRIPE FACING UP***, end to end on top of the Specified Sand along their 4-foot length.
Distribution Pipes Gravity & Lift Pump/Gravity Systems	A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 5 & 7 o'clock position. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
Distribution Pipes Pressure Systems	A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 5 & 7 o'clock position. Insert a pressure pipe *(size per design and code)* into a standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 7. Each pressure lateral will have a drain hole at the 6 o'clock position. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
Place Geotextile Cover Fabric	***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the row, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by: • Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe. • Place shovel fulls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.
Placing Specified Sand after Cover Fabric is in place	Place 6 inches minimum of Specified Sand along both sides of the modules and a minimum of 6 inches of Specified Sand is placed at the beginning and end of each row.
Backfilling the System	Complete backfill with native soil to 12 - 18 inches over the GSF modules. Backfill exceeding 18 inches requires venting at the distal end of the bed. Fill must be clean, porous and devoid of rocks. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff. Finish grade to prevent surface ponding. Topsoil and seed to protect from erosion.

4.0 Pressure Mound Installation Sizing and Guidelines

4.1 PRESSURE MOUND REFERENCE: The following sizing and guidelines provide the dimensions of the distribution cell for your pressure mound. Consult the *Pressure Mound Systems, Technical Guidance for Site Suitability, Design, Construction and Operation and Maintenance, Michigan Department of Environmental Quality, June 2003* for more information on the construction of the pressure mound.

4.2 PRESSURE MOUND EXAMPLE:

House size –	4 bedrooms
Slope of site	4%
Soil Structure –	Loam/Sandy Clay Loam Moderately Blocky and Granular (2)
Design Flow – 150 gpd x 4 bedrooms =	600 gpd
Refer to Table 3, and find the soil loading rate.	0.5 gpd/ft^2
Refer to Table 3, and find the maximum hydraulic linear loading rate.	3.0 gpd/lf

FIGURE 6A: CROSS SECTION – PRESSURE MOUND SYSTEM

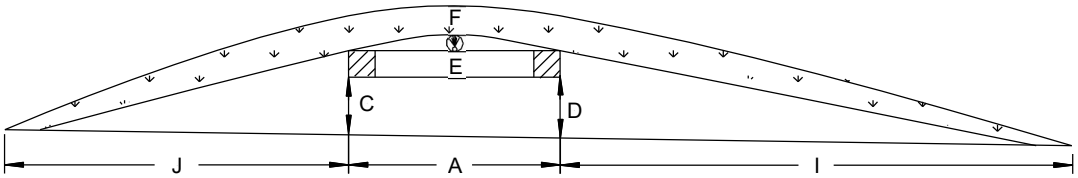
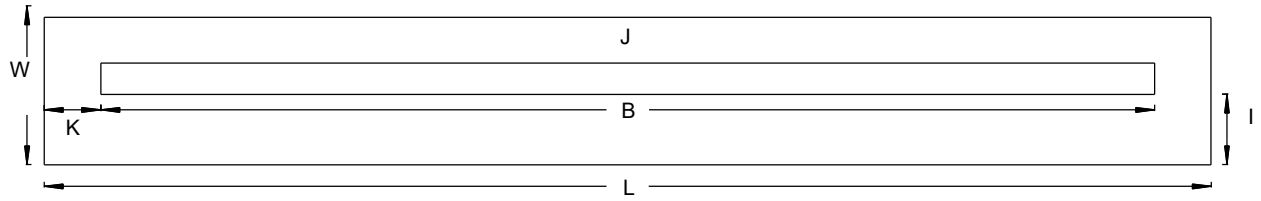


FIGURE 6B: PLAN VIEW – PRESSURE MOUND SYSTEM



A – Distribution cell width (accounts for sand) – **Minimum 4 ft for B43, Minimum 3 ft for A42**

B – Distribution cell length

C – Up slope fill depth under distribution cell – **Minimum 1 ft**

D – Downslope fill depth under distribution cell – **Minimum 1 ft**

E – Distribution cell depth – **Constant 7 in**

F – Depth of final cover – **Minimum 1 ft**

I – Distance from edge of distribution cell to downslope edge of fill

J – Distance from edge of distribution cell to up slope edge of fill

K – Distance from end of distribution cell to edge of fill

L – Overall mound fill length
W – Overall mound fill width

4.3 CALCULATE VARIABLES: The following equations are from the guidelines.

A – Distribution cell width = Linear Loading Rate ÷ Sand Fill Loading Rate
(State Rule w/ 50% Reduction = 2.0 gpd/ft^2)

Linear Loading Rate from Table 3 = 3.0 gpd/lf ÷ 2.0 gpd/ft^2 = **1.5 ft**

(***NOTE:*** For this example, the minimum width of distribution cell is **3 ft** when using A42 Modules.)

B – Distribution cell length = Design Flow ÷ Linear Loading Rate

600 ÷ 3.0 gpd/lf = **200 ft**

C – Up slope fill depth under distribution cell = **Minimum 1 ft**

(***NOTE:*** For this example, assume the depth of fill at the up slope edge of the distribution cell is **1.5 ft**.)

D – Downslope fill depth under distribution cell = **Minimum 1 ft**

C + Slope of site (Distribution cell width)

1.5 ft + (0.04 x 3 ft) = **1.62 ft**

E – Distribution cell depth – Constant 7 in., convert to feet – **0.583 ft**

F – Depth of final cover = **Minimum 1 ft**

(***NOTE:*** For the slope of the mound, we are using a **recommended 4:1 slope)**

I – Distance from edge of distribution cell to downslope edge of fill:
Downslope correction factor = 100 ÷ [100 – (side slope x % ground slope)]

100÷ [100 – (4 x 4)] = **1.19**

4 x (D + E + F) x Downslope correction factor
4 x (1.62 + 0.583 + 1) x 1.19 = **15.25 ft**

J – Distance from edge of distribution cell to up slope edge of fill

Up slope correction factor – 100 ÷ [100 + (side slope x % ground slope)]

100 ÷ [100 + (4 x 4)] = **0.86**

4 x (C + E + F) x Up slope correction factor
4 x (1.62 + 0.583 + 1) x 0.86 = **11.02 ft**

K – Distance from end of distribution cell to edge of fill
4 x [{(C + D)/2} + E +F]

4 x [(1.5 + 1.62)/2 + 0.583 + 1] = **12.57 ft**

L – Overall mound fill length
B + 2(K)

200 + 2(12.57) = **225.14 ft**

W – Overall mound fill width
A + I + J

3 + 15.25 + 11.02 = **29.27 ft**

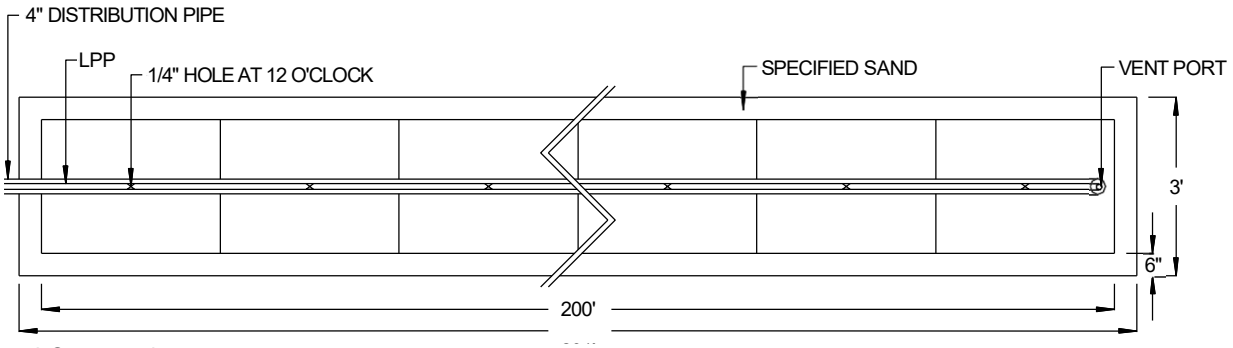
Distribution Cell Construction –

Width – 3 ft

Length – 200 ft

Modules in cell – 200 ft ÷ 4 lf per Modules = 50 A42 Modules

FIGURE 6C: PLAN VIEW – 450 GPD – DISTRIBUTION CELL MOUND SYSTEM



Mound Construction –

Width – 29.27 ft

Length – 225.14 ft

FIGURE 6D: SECTION VIEW – 450 GPD – MOUND SYSTEM

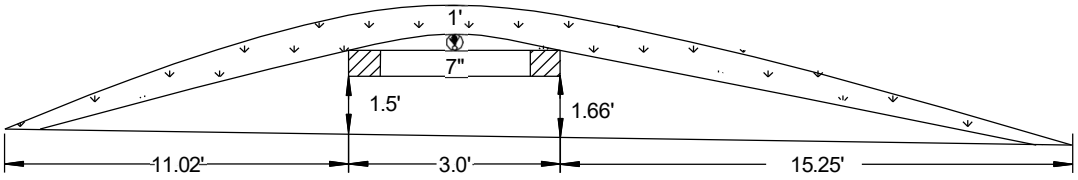
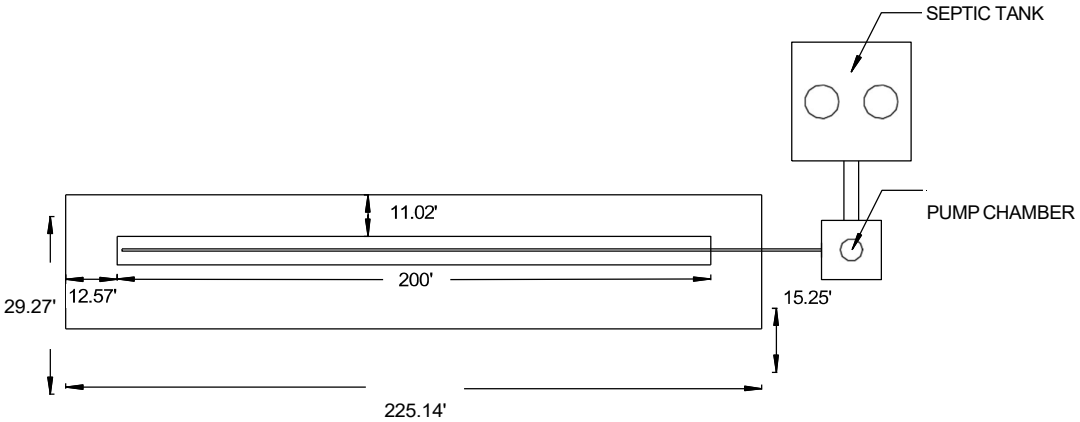


FIGURE 6E: SECTION VIEW – 450 GPD – MOUND SYSTEM



4.4 Pressure Mound Installation Sizing and Guidelines

Pressure Mound Installation Guidelines Additional guidance in State and Local regulations	
Determine the Number Modules	Determine the number of GSF Modules required using the mound sizing example.
Excavating the Bed Area	Scarify the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the absorption area prior to placement of the Specified Sand to avoid soil compaction.
Placing Specified Sand Base	Place Specified Sand in two 6 inch lifts, compact each lift at a time. The compacted height below the GSF module must be level at 12 inches. A hand tamping tool or vibrating compactor is both acceptable.
Place GSF Modules	Place the GSF Modules, ***PAINTED STRIPE FACING UP***, end to end on top of the Specified Sand along their 4-foot length.
Distribution Pipes: • Lift Pump/Gravity • Siphons • Pressure	A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 5 & 7 o'clock position. Insert a pressure pipe *(size per design and code)* into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 7. Each pressure lateral will have a drain hole at the 6 o'clock position. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.
Pump Chamber to the GSF System	Refer to local regulations for guidance · Lift Pump/Gravity Guidance · Pressure Distribution Guidance · Pump Controls
Place Geotextile Cover Fabric	***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the trench, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by: • Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe. • Place shovel fulls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.
Backfilling the System	Complete backfill with native soil to 12 - 18 inches over the GSF modules. Backfill exceeding 18 inches requires venting at the distal end of the bed. Fill must be clean, porous and devoid of rocks. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Divert surface runoff. Finish grade to prevent surface ponding. Topsoil and seed to protect from erosion.

5.0 Dosing Distribution Guidance

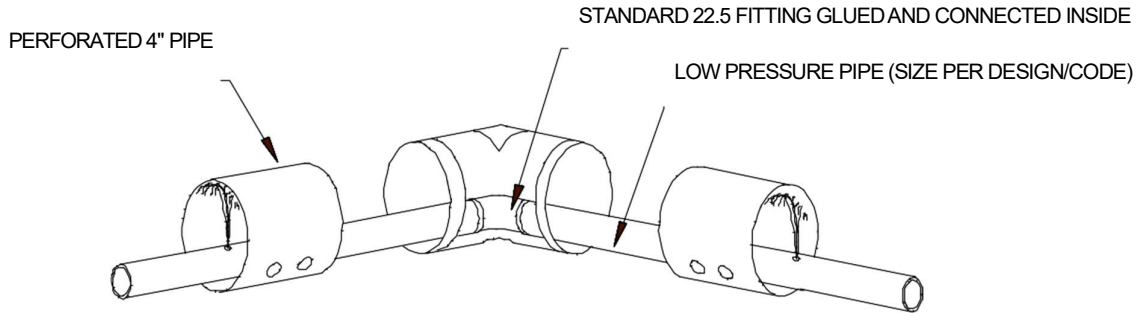
5.1 PUMP DISTRIBUTION BOX: Specify an oversized distribution box for pumped systems. Provide velocity reduction in the D-box with a tee or baffle. Set D-box invert 2 inches higher than invert of perforated pipe over GSF modules. If the absorption area is installed deeper than 18 inches, the system must be vented. See section 8.0 of this manual for detailed information on venting of systems.

5.2 DOSING DESIGN CRITERIA: Dosing volume must be set to deliver a maximum of 4 gallons per B43 Module and 3 gallons per A42 Module per dosing cycle with low head high volume pumps preferred. Higher flow rates and short dose cycle push the effluent down the line and thus disperse the effluent over a larger area. A valve on the force main is recommended to set the flow rate so that the orifices on the outlet pipes are submerged and the d- box does not overflow. Adjustment of the flow rate is likely needed if a row of modules are rested thus changing the number or outlets. Fewer outlets in the d-box force more effluent down each line and improve linear loading. Head loss and drain back volume must be considered in choosing the pump size and force main diameter.

6.0 Pressure Distribution Guidance

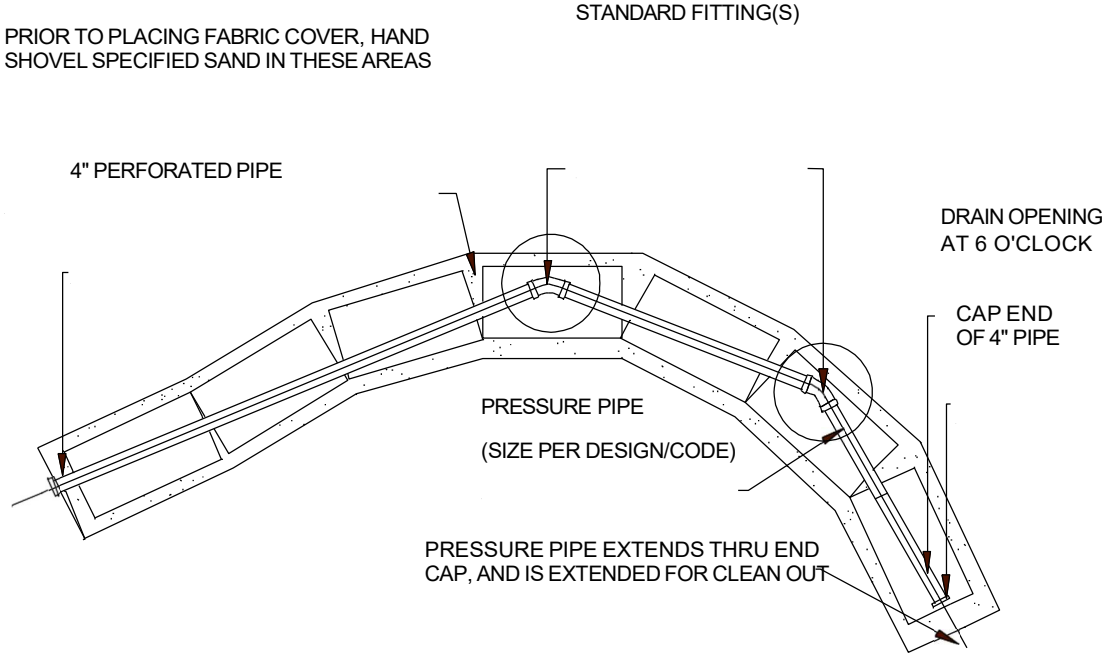
Standard procedures for design of pressure distribution networks apply to the GSF filter. Orifices shall be a minimum of 4-foot on center spacing so the orifices fall in the center of each module. A minimum orifice size of ¼ inch shall be maintained. A ¼ inch diameter drain hole is required at the 6 o'clock position of each pressure lateral for drainage purposes. The lateral pipe network *(size per design and code)* is placed within a standard 4-inch perforated pipe. The perforation in the 4-inch outer pipe are set at the 4 and 8 o'clock position, the drilled orifices on the pressure pipe are set to spray at the 12 o'clock position directly to the top of the 4-inch perforated pipe as shown below.

FIGURE 7: PRESSURE PIPE PLACEMENT



Pressure pipe placement when following contours or changes in trench direction.

FIGURE 8: CONTOURED TRENCH PRESSURE DISTRIBUTION



GSF Pressure Distribution trench placed on a contour or winding trenches to maintain horizontal separation distances may also be used in Dosed or Gravity system by removing the pressure pipe and using the 4-inch diameter perforated distribution pipe.

7.0 **Pump Controls**

Demand and Pressure Dosed controlled systems will include an electrical control system that has the alarm circuit independent of the pump circuit, controls and components that are listed by UL or equivalent, is located outside, within line of sight of the pump chamber and is secure from tampering and resistant to weather (minimum of NEMA 4). The control panel shall be equipped with cycle counters and elapsed time meters. Where a water supply water meter is available it may be possible to eliminate the counters or timers.

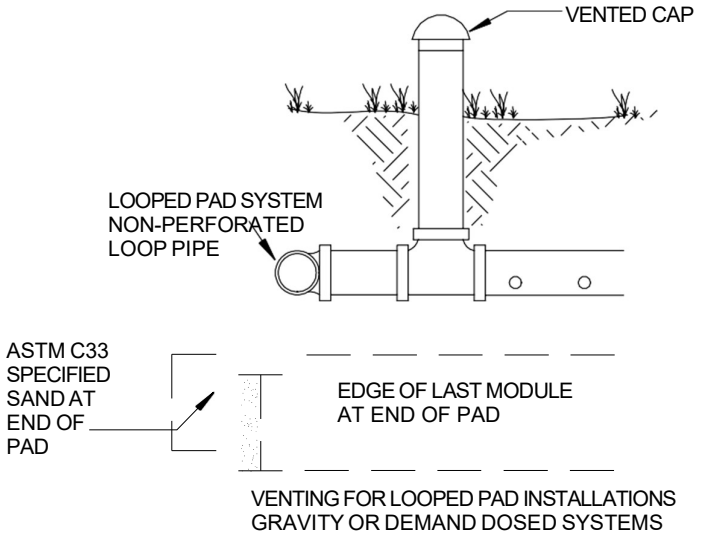
The control panel shall be equipped with both audible and visual high liquid level alarms installed in a conspicuous location. Float switches shall be mounted independent of the pump and force main so that they can be easily replaced and/or adjusted without removing the pump.

8.0 **System Ventilation**

8.1 SYSTEM VENTILATION: Air vents are required on all absorption systems located under impervious surfaces or systems **with *more than 18 inches of cover material*** as measured from the top of the GSF module to finished grade. This will ensure proper aeration of the modules and sand filter. The GSF PAD has aeration channels between the rows of GSF modules connecting to cuspations within the GSF modules. Under normal operating conditions, only a fraction of the filter is in use. The unused channels remain open for intermittent peak flows and the transfer of air. The extension of the distribution pipe to the vent provides adequate delivery of air into the GSF system, as shown in Figure 13.

Home plumbing operates under negative pressure due to hot water heating the pipes and reducing the density of air in the house vent. As hot air rises and exits the home, it must be replaced by air from the GSF. To maintain this airflow and fully aerate the GSF system, it is important that air vents are located only on the distal end of the GSF pipe network.

FIGURE 9: VENT FOR GRAVITY AND PRESSURE DOSED BED SYSTEMS



8.2 VENTILATION FOR PRESSURE AND DEMAND DOSED SYSTEMS: If a pressure or demand dosed system is specified with greater than 18 inches of cover, an additional 2-inch minimum air line must be extended from the GSF D-box back to a knockout or riser on the septic tank or pump chamber. This maintains the continuity of airflow from the field into the house plumbing.

FIGURE 10: AIR BY-PASS LINE PLAN VIEW FOR VENTING OF PUMPED SYSTEMS

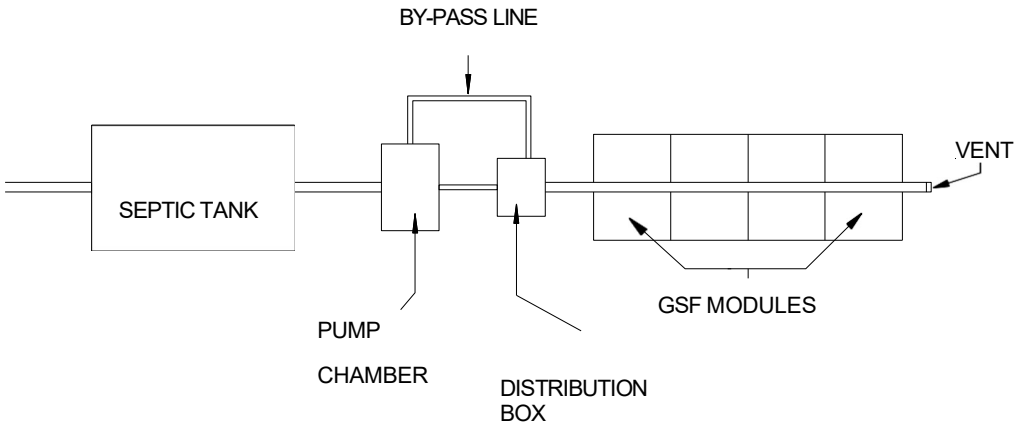
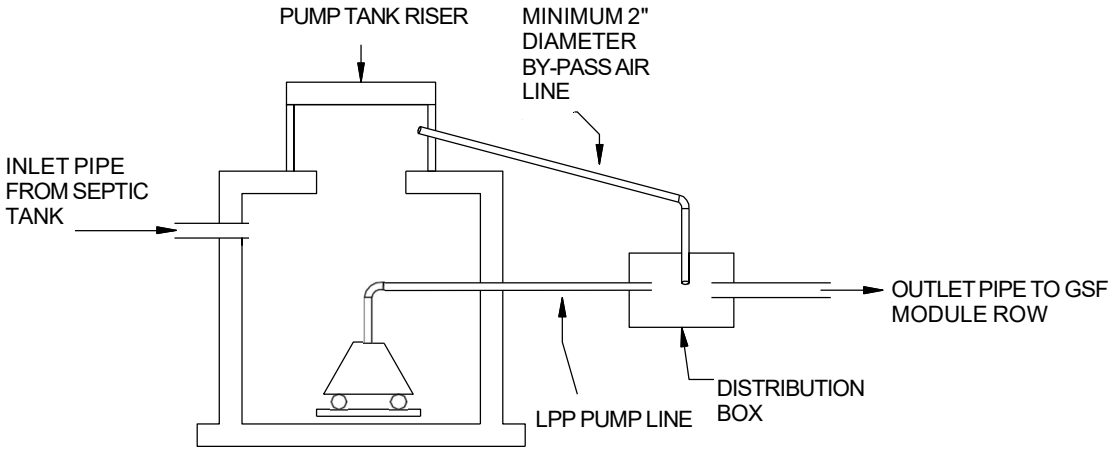
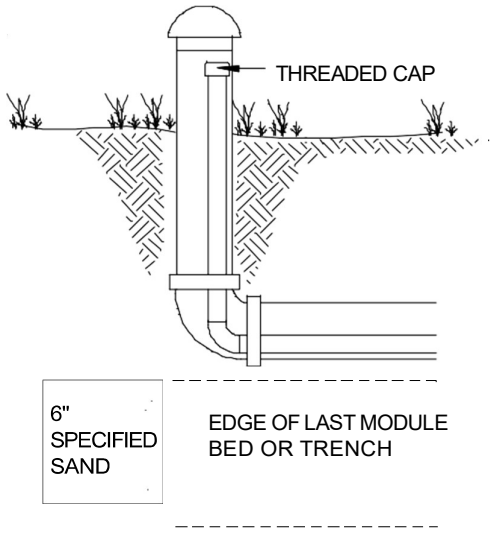


FIGURE 11: AIR BY-PASS LINE CROSS SECTION FOR VENTING OF PUMPED SYSTEM



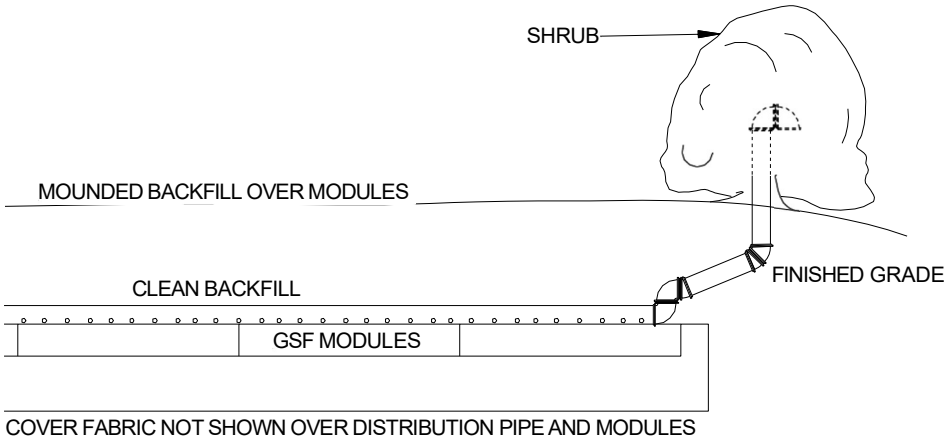
8.3 VENT PIPE FOR LOW PRESSURE DISTRIBUTION SYSTEMS: If the system is a low pressure distribution system with greater than 18 inches of cover, ensure that the LPP clean outs are located in the vent for easy access.

FIGURE 12: PRESSURE CLEAN OUT PRESSURE DOSED SYSTEMS



8.4 VENTILATION PLACEMENT: In a GSF system, the vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs, as shown in Figure 13. Corrugated pipe may be used. If using corrugated pipe, ensure that the pipe does not have any bends that will allow condensation to pond in the pipe. This may close off the vent line. The pipe must have an invert higher than the system so that it does not drain effluent.

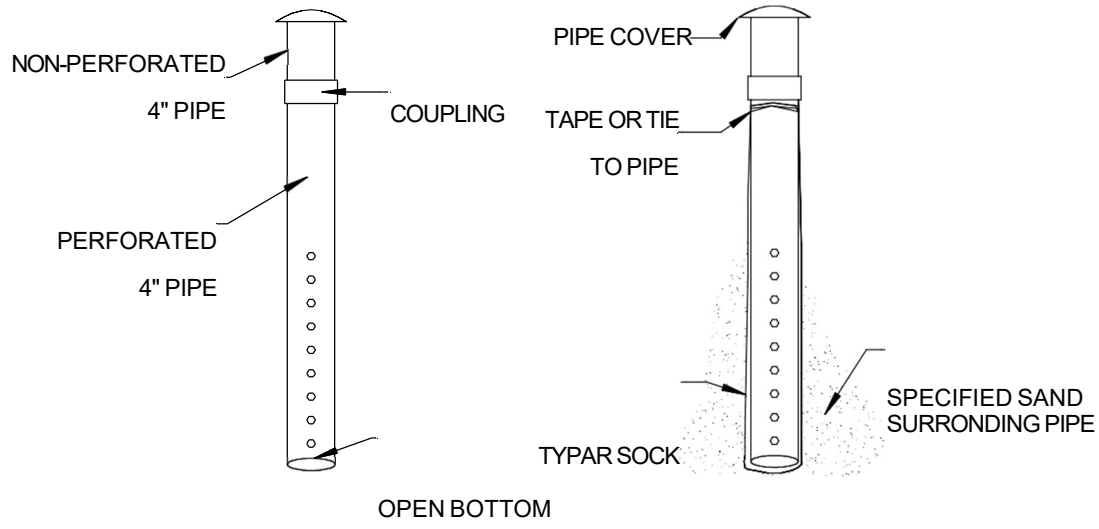
FIGURE 13: GSF WITH 4" VENT EXTENDED TO CONVENIENT LOCATION

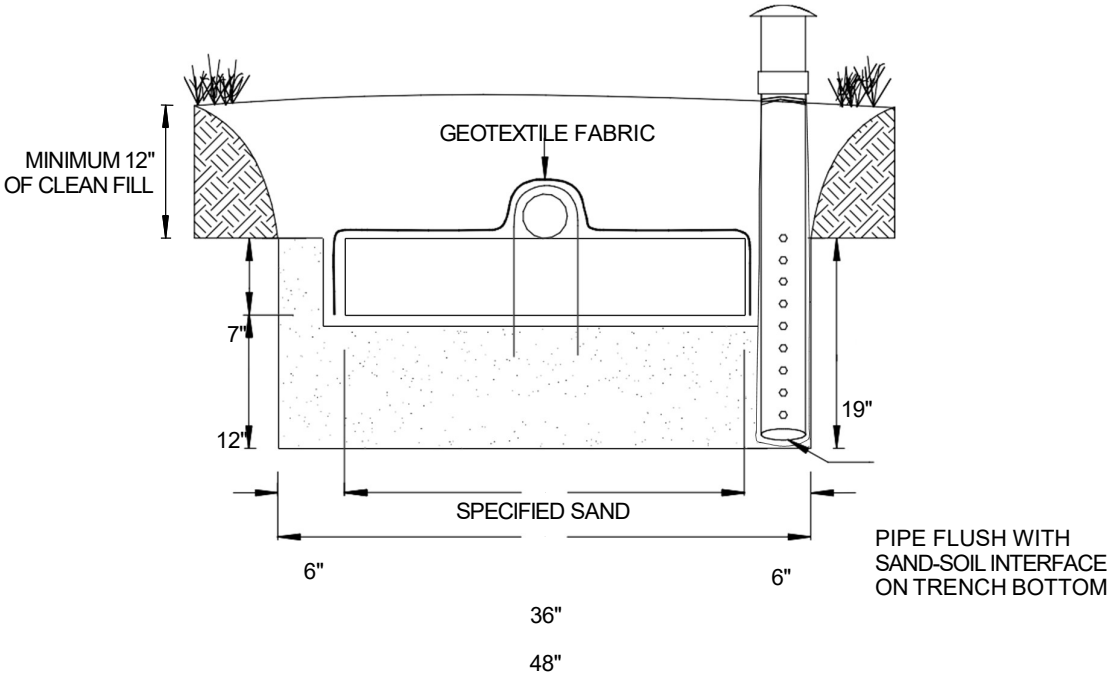


9.0 **Inspection/Monitoring Port**

The system shall include an Inspection/Monitoring Port designed and installed with access from the ground surface. It shall be open and slotted at the bottom and be void of sand or gravel to the infiltrative surface to allow visual monitoring of standing liquid in the trench. The figures below depict construction and placement of the Inspection/Monitoring Port. Positioning of the port in reference to the length of the trench is in accordance to your local regulations and specifications.

FIGURE 14: MONITORING WELL FOR SAND-SOIL INTERFACE





10.0 GSF Inspection Check List

Geotextile Sand Filter, (GSF) Checklist				
Facility Owner:				
Facility Address:				
Installation Date: (MDY)				
Previous Inspection Date: (MDY)				
Date of Inspection: (MDY)				
Residential Number of Bedrooms:				
Is this a Commercial Design? If yes what type:	Yes	No		
What is the estimated BOD5 and TSS strength?	BOD5	TSS	Comments	
Observation Port Location(s):	1		2	3
Inspection Data, (complete all fields)				
Is daily flow within the system design flow? If no, explain:	Yes	No		
Does the owner verify the system use as described above? If no, explain:	Yes	No		
Septic tank last inspection date:	Date			
Inspected by:				
Septic tank last pumped date:				
Is pumping recommended?	Yes	No		
Condition of the soil absorption system: Wet, Dry, Firm, Soft, Vegetative, or Other. If Other, explain:	W	D	S	F	V
Is there evidence of storm water flows or erosion over the septic system? If yes, explain:	Yes	No		

10.0 GSF Inspection Check List

Is there evidence of soil slump or compaction by traffic or other means in the vicinity of the soil absorption system? If yes, describe:	Yes	No	Comments
Is effluent visible through the observation port? If yes, describe the condition and the fluid level:	Yes	No	Comments
Is there a garbage disposal in the home?	Yes	No	Comments
Is a water softer connected to the system?	Yes	No	Comments
Are solids visible through the observation port? If yes, describe the condition and depth of solids:	Yes	No	Comments
Is there evidence of surcharging or effluent ponding in the D-Box? If yes, describe and measure:	Yes	No	Comments
Are the system vents in place?	Yes	No	Comments
Are they operational? If no, describe conditions and location:	Yes	No	
Describe any other pertinent issues:			

Inspected by:	
License Number:	
Date:	
Time:	
Print Name & Signature of Inspector:	
I certify I have inspected the system at the above address, completed this report, and the information reported is true, accurate, and complete.	

COMPANY HISTORY

Established in 1970, Eljen Corporation created the world's first prefabricated drainage system for foundation drainage and erosion control applications. In the mid-1980s, we introduced our Geotextile Sand Filter products for the passive advanced treatment of onsite wastewater in both residential and commercial applications. Today, Eljen is a global leader in providing innovative products and solutions for protecting our environment and public health.

COMPANY PHILOSOPHY

Eljen Corporation is committed to advancing the onsite industry through continuous development of innovative new products, delivering high quality products and services to our customers at the best price, and building lasting partnerships with our employees, suppliers, and customers.

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www.eljen.com

Printed in U.S.A. on recycled paper

Section 7:

Minimum Design Parameters – Advanced Enviro-Septic® (AES)

Description

The Advanced Enviro-Septic® (AES) Wastewater Treatment System utilizes a unique combination of components that work together to treat effluent and prevent suspended solids from sealing the underlying soil. Comprised of a patented corrugated, perforated plastic pipe with interior skimmer tables and cooling ridges, the large-diameter pipe retains solids while the Bio-Accelerator® fabric, coarse fibers, and geotextile fabric provide multiple bacterial surfaces to treat effluent prior to its contact with the receiving soils. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. The AES system is completely passive.

Conditions for Application Submittal

1. A Michigan Registered Sanitarian, Professional Engineer specializing in environmental or sanitary wastewater treatment, or licensed sewage system installer registered with LMAS to design the particular alternative on-site sewage treatment system proposed shall provide a detailed design plan for each specific application. Presby Environmental, Inc. certifies all AES designers and installers. Proof of certification is required.
2. Provide a scaled site plan detailing all aspects of the proposed work along with the LMAS District Health Department application form.
    a. Plans shall be at least 8 ½" X 11" in size and shall be legible, clear, and permanent copies.
    b. Plans shall include the name of the person who prepared the plan and shall be stamped if prepared by a Michigan Registered Sanitarian or Professional Engineer.
3. A *Submittal Checklist for Alternative On-Site Sewage Treatment System* is available per request for guidance.
4. Plans will not be reviewed until all required components described herein are submitted with the applicable fee.

Sewage Treatment Components

1. Site Preparation - Ultimate success or failure of a system also relies on clear

    communication along with the understanding of basic site preparation and construction principles. Critical issues include:

f. Proper procedures must be followed to protect the location area including required greenbelt area during and after construction. After establishing a suitable location for the initial and replacement area including greenbelt area, it should be suitably fenced or otherwise unmistakably identified to prevent further disturbance until actual construction can occur. Site planning resulting in a location for the system that is isolated from other anticipated home construction activities is encouraged.
g. Soil smearing and compaction, which can reduce infiltration capacity, will occur if soils are worked on when wet. Construction activities should be scheduled only when soils are sufficiently dry. Acceptable soil moisture content of the soils to a depth of one foot should be evaluated by rolling a sample of soil between the hands. If the soil can be rolled into a ¼ inch or smaller "wire" it is considered too wet and should be allowed to dry before preparing. If site is questionable then certification from Design Consultant shall be required.
h. Excessive vegetation should be removed from the area. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical "thumb" or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared. Avoid soil disturbance, relocation, or compaction. Avoid mechanical leveling or tampering of dislodged soil. Fill all voids created by stump removal with system sand.
i. The entire basal area of the mound should be suitably prepared by roughening in a ridge and furrow fashion with ridges following the contours. Methods that can be considered for roughening include chisel teeth fastened to the backhoe bucket, plowing with a multiple bottom agricultural chisel plow, or moldboard plow. Rototilling is not acceptable. Sand fill material should be applied immediately after roughening and prior to any subsequent precipitation.
j. Cleanliness of the sand fill should be checked prior to construction. Placement of fill material is to be accomplished from the end and upslope sides utilizing a tracked vehicle or equipment with adequate reach to minimize soil compaction. A minimum of 6 inches of fill material should be maintained below the tracks to minimize compaction. Wheeled vehicles should be prevented from travel over the mound basal area and downslope of the greenbelt area. Total depth of fill shall be established on a benchmark provided by the design consultant on the design plan.

2. Septic Tank

h. Tank requirements are established in Section 3-14.5 of the Code.
i. The minimum capacity for septic tanks for a 1, 2, or 3-bedroom dwelling shall be 1,000 gallons, except where in the opinion of the Department, increased capacities may be required. Each additional bedroom shall require an additional 250 gallons. Each garbage grinder shall require an additional 250 gallons.
j. Septic tanks shall be equipped with an approved effluent filter installed in the outlet baffle, or other approved location.

k. Septic tanks shall be equipped with a watertight access riser installed to grade to facilitate maintenance. Risers shall be installed with dual lids, leaving the concrete lid in place, or shall be equipped with other Department approved safety device to preclude accidental tank entry.
l. All septic tanks shall be installed to be level and to flow in accordance with the manufacturer's design intent.
m. All systems receiving sewage from a grinder pump shall be equipped with a minimum of two 1,000 gallon septic tanks. The first septic tank shall be installed in series to allow the settling of sewage discharged by the pump and shall be equipped with an outlet baffle.
n. Septic tanks and pump tanks shall be tested and certified to be watertight. Testing and certification must be performed on-site and in-place, by the tank manufacturer, design consultant, or licensed septic installer. Hydrostatic or vacuum test may be utilized to determine if the septic tank and/or pump tank are water tight. Certification shall be submitted prior to or during the final inspection performed by the Department.

10. Pump - See Section 2 of this manual for pump tank and pump design parameters.
11. Dispersal Area
    a. Infiltrative surface – the infiltrative surface of unsaturated soil to which treated effluent is discharged to shall be ≥ 24 inches above the limiting layer noted in the site evaluation report. Allowance granted for the 6 inches of specified sand (2NS) required below the AES pipe.
    b. The system shall be constructed per the AES Design Manual within this section.
    c. Effluent Distribution – pressure distribution throughout the dispersal system is not allowed per manufacturer specification. Pumped systems supply effluent to the system using a pump and D-box when site conditions do not allow for a gravity system.
    d. Taper – the slope surrounding the dispersal area. A taper shall be installed when the dispersal area is installed "on" or "above" the natural grade. The taper shall be constructed of clean sand with no excessive fines and shall be evenly graded from the top of the dispersal area to the natural soil surface with a slope of 4:1 or flatter if within a maintained lawn. Final grading of the area should divert water drainage away from the system.

Operation and Maintenance

Passive treatment systems do not require a maintenance and monitoring agreement, however they do require minimal maintenance as is standard for conventional onsite systems, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will ensure system longevity. The premise shall be used for the purpose intended when permitted. Any modification in usage of the premise shall be reported to the Department for evaluation. As a condition of operating approval, LMAS staff may conduct random site inspections.

1. Septic Tank and Effluent Filter

    a. Inspect the septic tank at least once every 2 years under normal usage.

    The tank shall be emptied of sludge and floating material by a licensed

septage hauler at a recommended frequency of 3-5 years

b. After pumping, inspect the integrity of the septic tank to ensure that no groundwater is entering it. Check the inlet and outlet and repair if needed.

c. Effluent filters require on-going maintenance due to their tendency to clog and cut off oxygen to the system. The effluent filter shall be cleaned at every septic tank pump out and inspected every 6-12 months. Follow filter manufacturer's maintenance instructions.

e. Owner must keep copies of the pump-out invoice and they shall provide maintenance as required by the AES manufacturer.

f. The use of enzymes or any septic system additives is prohibited.

2. Pumped Systems

a. Inspect at least once a year to assure adequate operation of pump, floats, control panel, and alarm.

3. Infiltration Area

a. It is important that the system site remain free of shrubs, trees, and other woody vegetation. Roots can infiltrate and cause damage or clogging of system components.

b. Make sure the infiltration area is free of motorized vehicle traffic, is seeded, and that all water is diverted to avoid overloading.

c. If the system has a vent, make sure it is not obstructed.

d. Check and immediately report any odor or sign of water breakouts around the system.

Noncompliance

1. The owner is responsible for the proper operation and performance of the system. If additional monitoring is required, the owner shall be responsible for all costs associated with the monitoring and/or system repair.

2. In the event that any part of the system is found to be in noncompliance with the requirements in which it was permitted, the following actions must be taken at the owner's expense:

a. The distributor shall inspect the system (with LMAS staff person present) to determine any deficiencies.

b. If LMAS deems necessary, effluent samples shall be taken to determine system compliance.

c. Use of the system may need to be discontinued if the system is found to be non-repairable, is non-compliant with the permit, or results in an imminent health hazard. If compliance with the conditions in which the AES and/or associated components was permitted under cannot be achieved, or if the Department determines that the Code
has been violated, a notice of violation will be issued to the owner.

Limitation of Responsibility

1. Plan approval by LMAS may not be construed as an assumption of any responsibility for the design of the alternative on-site sewage treatment system and associated components.

2. LMAS does not hold itself liable for any defects in design and/or construction, or for any damages that may result from a specific installation.

Final Inspections and Approval to Use System

1. A final inspection shall be conducted by LMAS in accordance with Section 3-11.3 of the Code. During this inspection, LMAS will approve or deny covering the system. Approval to use the system will not be granted until all required information has been received:

    a. Request for a final inspection of the alternative on-site sewage treatment system by the contractor, installer, or property owner shall serve as notice to the Department that the system is installed according to the permit and associated design plans. Final inspection conducted by the Department shall identify any items of noncompliance.

    b. No portion of the system shall be covered and the system shall not be placed into service prior to final inspection and approval. The property owner is responsible for maintenance and monitoring of the system following approval from the Department unless a contract agreement is in place between the property owner and a qualified maintenance provider.

    c. Any other information requested by LMAS such as watertight tank test results and pump installation certification.

2. After all required information has been submitted, LMAS shall issue a final drawing/operating approval to the applicant.

Revocation of Permit

1. The Department may revoke any plan approval under this Section when one or more of the following conditions exists:

    a. The location of the system(s) specified in the design is altered.

    b. There is an increase in the scope of the project prior to, during, or following construction.

    c. LMAS acquires new information indicating that any agency rules or regulations are violated before, during, or after construction.

    d. LMAS has reasonable cause to believe that an intentional misrepresentation has occurred.

Disclaimer

1. The Department reserves the right to require special restrictions, in rare circumstances, in addition to those listed herein to ensure that an adequate sewage disposal system is installed. These restrictions may be determined on a site-specific basis.

ADVANCED ENVIRO-SEPTIC[MD]

Design and Installation Manual for Advanced Enviro-Septic® (AES) Wastewater Systems

For more detailed design and installation information on AES, please contact Infiltrator Water Technologies at (800) 221-4436 or Presby Environmental, Inc. at (800) 473-5298.

www.infiltratorwater.com • www.presbyeco.com

LMAS District Michigan

INFILTRATOR® water technologies

Table of Contents

April 2022

The purpose of this manual is to provide the minimum specifications for design and installation of the Advanced Enviro-Septic System (AES) System in LMAS District Michigan. All local ordinances, requirements, and procedures must be followed. Each revised version of this manual supersedes the previous version.

The systems presented in this document are common configurations and are provided for illustrative purposes. They are not intended to restrict the use of other configurations.

The information in this Manual is subject to change without notice. We recommend that you check your state's page on our website on a regular basis for updated information. Your suggestions and comments are welcome. Please contact us at:

Presby Environmental, Inc.

143 Airport Road

Whitefield, NH 03598

Phone: 1-800-473-5298 Fax: (603) 837-9864

Website: www.presbyenvironmental.com

The products and methods depicted in this Manual are protected by one or more patents.

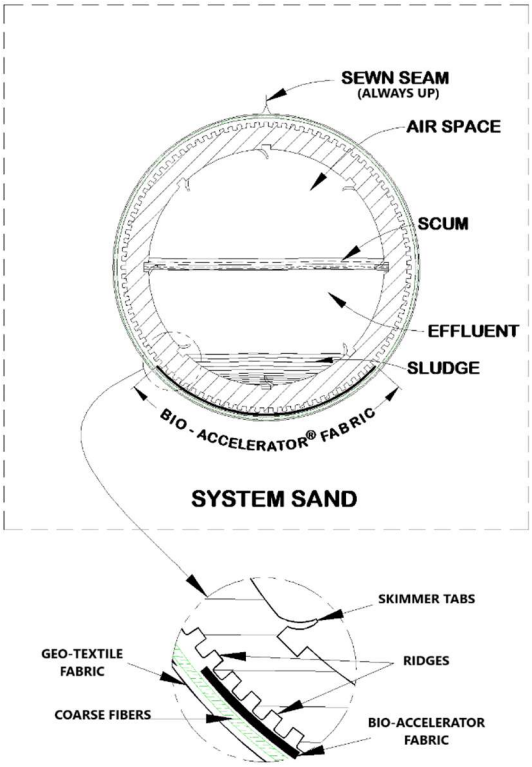
Advanced Enviro-Septic® is a registered trademark of Presby Environmental Inc.

IMPORTANT NOTICE: This Manual is intended ONLY for use in designing and installing Presby Environmental's Advanced Enviro-Septic® Wastewater Treatment Systems. The processes and design criteria contained herein are based solely on our experience with and testing of Advanced Enviro-Septic®. Substitution of any product is prohibited.

1.0 INTRODUCTION

1.1 Background

The Advanced Enviro-Septic® (AES) Wastewater Treatment System utilizes a unique combination of components that work together to treat effluent and prevent suspended solids from sealing the underlying soil. Comprised of a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges, the large-diameter pipe retains solids while the Bio-Accelerator® fabric, coarse fibers, and geo-textile fabric provide multiple bacterial surfaces to treat effluent prior to its contact with the receiving soils. The continual cycling of effluent (the rising and falling of liquid inside the pipe) enhances bacterial growth. The AES system is completely passive, and yet provides increased aeration and a greater bacterial treatment area than traditional systems. The result is a system that is more efficient, lasts longer, and has a virtually no negative environmental impact.



Additional system benefits include:

- installs easily and quickly
- adapts easily to residential, commercial, and difficult sites
- prevents formation of organic material at the receiving soil interface
- safely recharges groundwater

Environmental Standards and Technical Support

All AES systems shall be designed and installed in compliance with the procedures and specifications detailed in this Manual and in the product's local approval. In the event of contradictions between this Manual and local rules, PEI should be contacted for technical assistance at (800) 473-5298.

Certification Requirements

Designers and installers who have not previously attended a PEI certification course are required to obtain certification. Certification is obtained by attending a certification course presented by PEI or its sanctioned representative or by viewing tutorial videos on our website and then successfully passing a short assessment test. PEI recommends professionals involved in the inspection or review of AES systems also become PEI certified.

1.2 Michigan-Specific Information

The AES system is certified by NSF International as complying with NSF/ANSI 40 for the production of Class I effluent. The AES system may be designed and installed in Michigan in trench or bed configurations as detailed in this manual.

This manual is intended to provide system design, installation, and use information to the users in Michigan, including system designers, local health officials, system installers, and system owners. Illustrations presented in this manual are common configurations and are not intended to restrict the use of other configurations. If design, installation, operation, or maintenance specifications are not specifically addressed in this manual, the manufacturer should be contacted for guidance.

1.0 INTRODUCTION

System Sizing

AES system design specification and instructions are detailed on pages 5-17 of this manual. Recommended sizing criteria for the basal area footprint in the AES system is provided in Table A on page 5. Note that local regulations may dictate other sizing criteria.

1.3 System Components

AES Pipe

- nominal exterior diameter of 12 in
- holding capacity of 5.8 gallons per foot
- 10 ft length of AES pipe is flexible enough to bend up to 90° and can be cut to any length
- made with a significant amount recycled material

Offset Adapter - A 12 in plastic fitting with a single inlet hole oriented in the 12 o'clock position and designed to accept a 4 in sewer line, raised connection or vent pipe.

Double Offset Adapter - A 12 in plastic fitting with two 4 in holes designed to accept a 4 in inlet pipe, raised connection, vent or vent manifold, and/or bottom drain, depending upon the requirements of the design configuration.

Coupling - A plastic fitting used to create a connection between two pieces of AES pipe.

System Sand - The system sand that surrounds the AES pipes is an essential component of the system. It is critical that the correct type and amount of system sand is used during construction. System sand shall be coarse to very coarse, clean, granular sand, free of organic matter meeting MDOT 2NS sand specifications. System sand is placed a minimum of 3 in above and 6 in below, between, and around the outer perimeter of the AES pipes.

System Sand Bed Height Dimension

The height of an AES sand bed measures 21 in minimum (not including cover material):

- minimum of 6 in of system sand below the AES pipe;
- 12 in diameter of the pipe;
- minimum of 3 in of system sand above the AES pipe; and
- when a system sand extension is required it shall be a minimum of 6 in thick.

System Sand Acceptable Alternative - ASTM C-33 (concrete sand), natural or manufactured sand, with not more than 3% passing the #200 sieve (verified by washing the sample per the requirements of ASTM C-117 as noted in the ASTM C-33 specification) may be used as an acceptable alternate material for use as system sand.

Sand Fill – Sand fill may be used to raise the elevation of the system in order to meet the required separation distance from the SHWT or restrictive feature. Sand fill must have a permeability the same as the soil below or faster. No organic material or stones larger than 3 in are allowed in the sand fill. System sand may be used in place of sand fill.

Clean Fill – Clean fill is soil or sand used in side-slope tapers. Onsite material (soils excavated from the site) may be used as clean fill as long as it does not contain organic material or stones larger than 3 in. System sand or sand fill may also be used as clean fill.

2.0 SYSTEM DESIGN

1.1 Sizing

Table A: System Sand Bed Area and Bed Configuration Requirements for Subsurface Bed Systems

Texture Class of Native Soil	Estimated Permeability Rate		Sewage Application Rate (gpd/ft^2)
	Inches/Hour	Minutes/Inch	
Coarse Sand, Gravel, Gravelly Sand	>20	<3	Not Suitable
Stratified Sand and Gravel, Medium Sand	20-6.0	3-10	1.5
Fine Sand, Loamy Sand	6.0-3.0	11-20	1.0
Sandy Loam, Loam	3.0-2.0	21-30	0.8
Silty Loam, Sandy Clay Loam	2.0-1.35	31-45	0.6
Clay Loam, Silty Clay Loam	Not Suitable		
Silty Clay			

Table B: System Sand Bed Area and Bed Configuration Requirements for Above-Grade Bed Systems

Texture Class of Native Soil	Estimated Permeability Rate		Sewage Application Rate (gpd/ft^2)
	Inches/Hour	Minutes/Inch	
Coarse Sand, Gravel, Gravelly Sand	>20	<3	Not Suitable
Stratified Sand and Gravel, Medium Sand	20-6.0	3-10	1.5
Fine Sand, Loamy Sand	6.0-3.0	11-20	1.0
Sandy Loam, Loam	3.0-2.0	21-30	0.8
Silty Loam, Sandy Clay Loam	2.0-1.35	31-45	0.6
Clay Loam, Silty Clay Loam	Not Suitable		
Silty Clay			

Table C: AES Pipe Requirements

System Type	**AES Pipe Loading Rate**
Residential System	70 ft/br
Commercial (Non-Residential) System	2.14 gpd/ft

Assumes residential strength effluent. Contact Presby Environmental for technical assistance with high strength wastewater.

1.2 Design Procedure and Examples

Step #1: *Determine System Sand Bed Area Required*

From Table A or B: find the soil's application rate using the assigned soil texture and structure and calculate the minimum system sand bed area (SSBA): divide the daily design flow (gpd) by the application rate.

Step #2: *Calculate the Minimum Amount of AES Pipe Needed*

From Table C: Calculate the minimum amount of AES pipe needed: use 70 ft/br for residential systems or 2.14 gpd/ft for commercial/non-residential systems treating residential strength effluent – contact Technical Support for high strength wastewater.

Step #3: *Calculate the Number of Serial Sections Needed*

Calculate the minimum number of serial sections required (does not apply to parallel configuration): divide the daily design flow by 750 gpd (round up to nearest whole number).

Step #4: *Determine Row Length and Quantity Needed*

Select a row length suitable for the site and calculate the number of rows (round up to a whole number). The number of rows must be evenly divisible by the number of serial sections required (add rows as necessary – does not apply to parallel layouts).

Step #5: *Determine Pipe Layout Width (PLW)*

Calculate the PLW (the distance of the width of the pipes from outside edge to outside edge) using a 1.5 ft minimum center-to-center row spacing (larger spacing allowed). PLW = [(# of rows – 1) x spacing (1.5 ft)] + 1 ft.

Step #6: *Determine Minimum System Sand Bed Width (SSBW)*

Calculate the minimum SSBW by dividing the SSBA from Step #1 by the selected row length from Step #4 + 1 ft (allows 6 inches of sand beyond the ends of the rows).

Step #7: *Verify Final Bed Width Requirements*

Verify the minimum SSBW from Step #6 will cover all the rows in the bed:

a) Level beds and beds sloping less than 5%: If the minimum SSBW is less than the (PLW + 1 ft), use (PLW + 1 ft) as the new minimum SSBW.
b) Beds sloping > 5%: If the minimum SSBW is less than the (PLW + 3.5 ft), use (PLW + 3.5 ft) as the new minimum SSBW. Adding 3.5 ft to the pipe layout width accounts for a 2.5 ft system sand extension on the down slope side of the field.

Step #8: *Calculate System Sand Extensions (SSEs):*

a) Level beds: SSE are placed on each side of AES pipes = [SSBW – (PLW + 1)] ÷ 2. There will be no SSE's if the SSBW = (PLW +1 ft).
b) Sloping Beds: SSE placed entirely on the down slope side of the bed = SSBW – (PLW + 1) and must be at least 2.5 ft (3 ft from the edge of the AES pipe) for beds sloping greater than 5%.

Design Example #1

Single family residence, 3- bedrooms (450 gpd), soil type of medium sand, level site, in-ground bed using serial distribution layout.

Step #1: *Determine System Sand Bed Area Required*

2.0 SYSTEM DESIGN

Soil's application rate from Table A for medium sand = 1.5 gpd/ft²; SSBA → 450 gpd ÷ 1.5 gpd/ft² = 300.0 ft² minimum.

Step #2: *Calculate the Minimum Amount of AES Pipe Needed*

AES pipe required using 70 ft/br from Table C → 70 ft/br x 3 br = 210 ft minimum

2.0 SYSTEM DESIGN

Step #3: *Calculate the Number of Serial Sections Needed*

Serial sections required → 450 gpd ÷ 750 gpd/section = 0.6 (round up to 1)

Step #4: *Determine Row Length and Quantity Needed*

Using a row length of 70 ft requires three rows → (210 ft ÷ 70 ft = 3 rows)

Step #5: *Determine Pipe Layout Width (PLW)*

Calculate the PLW (the distance of the width of the pipes from outside edge to outside edge) using a 1.5 ft minimum center-to-center row spacing (larger spacing allowed). PLW = [(# of rows – 1) x spacing (1.5 ft)] + 1 ft. PLW = [(3 rows – 1) x spacing (1.5 ft)] + 1 ft = 4 ft.

Step #6: *Determine Minimum System Sand Bed Width (SSBW)*

Minimum SSBW → 300.0 ft² ÷ (70 ft + 1 ft) = 4.23 ft. (Round up to 5 ft.)

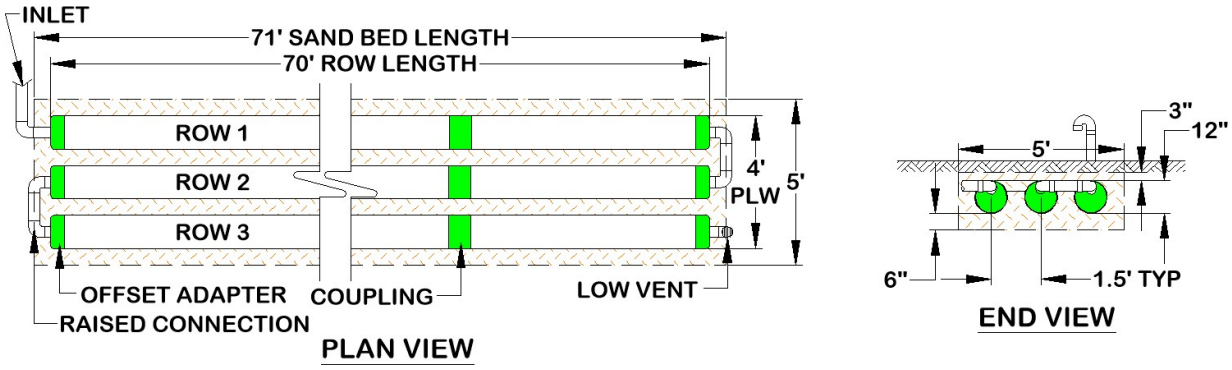
Step #7: *Verify Final Bed Width Requirements*

a) Level beds and beds sloping less than 5%: 5 ft minimum SSBW from Step 6 is equal to the PLW from Step 5 + 1 ft for perimeter sand; use 5 ft as the minimum SSBW.
b) Beds sloping > 5%: Not applicable as bed slopes less than 5 %.

Step #8: *Calculate System Sand Extensions (SSEs):*

a) Level beds: There will be no SSE's as the SSBW = (PLW +1 ft).
b) Sloping Beds: Not applicable as bed is level.

Illustration of Example #1, Basic Serial Distribution



Design Example #2

Commercial system treating residential strength effluent (800 gpd). Soil type of medium sand, 7% sloping site, designed as an elevated system to meet required vertical separation using combination serial distribution layout.

Step #1: *Determine System Sand Bed Area Required*

Soil's application rate from Table B for medium sand = 1.5 gpd/ft²; SSBA → 800 gpd ÷ 1.5 gpd/ft² =

533.3 ft² minimum.

Step #2: *Calculate the Minimum Amount of AES Pipe Needed*

AES pipe required using 2.14 gpd per lf = 800 ÷ 2.14 = 373.83. Round up to 380 lf for ease of construction.

Step #3: *Calculate the Number of Serial Sections Needed*

2.0 SYSTEM DESIGN

Serial sections required → 800 gpd ÷ 750 gpd/section = 1. (round up to 2). System will use combination serial distribution containing equal serial sections. Note: System must be designed using an even number of pipe rows per section.

Step #4: *Determine Row Length and Quantity Needed*

Using a row length of 95 ft requires 4 rows → (380 ft ÷ 95 ft = 4 rows which will provide 2 rows per section).

2.0 SYSTEM DESIGN

Step #5: *Determine Pipe Layout Width (PLW)*

Calculate the PLW (the distance of the width of the pipes from outside edge to outside edge) using a 1.5 ft minimum center-to-center row spacing (larger spacing allowed). PLW = [(# of rows – 1) x spacing (1.5 ft)] + 1 ft. PLW = [(4 rows – 1) x spacing (1.5 ft)] + 1 ft = 5.5 ft.

Step #6: *Determine Minimum System Sand Bed Width (SSBW)*

Minimum SSBW → 533.3 ft² ÷ (95 ft + 1 ft) = 5.56 ft.

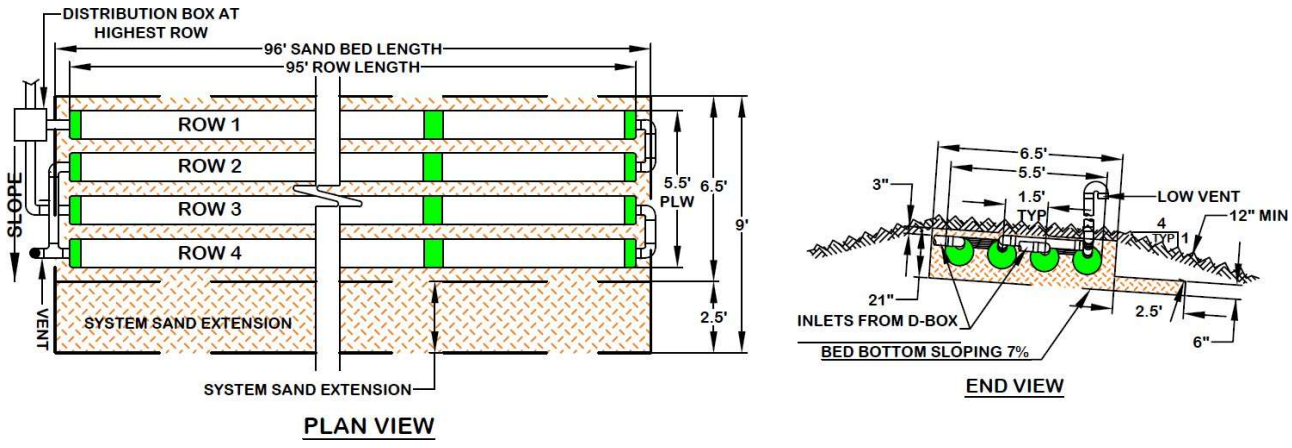
Step #7: *Verify Final Bed Width Requirements*

a) Level beds: Not applicable as bed slopes with site at 7%.
b) Beds sloping > 5%: The minimum SSBW from Step #6 is 5.56 ft which is less than the PLW of 5.5 ft + 3.5 ft. Use 9 ft as the new minimum SSBW. Adding 3.5 ft to the pipe layout width accounts for a 2.5 ft system sand extension on the down slope side of the field.

Step #8: *Calculate System Sand Extensions (SSEs):*

a) Level beds: Not applicable as bed slopes with site at 7%.
b) Sloping Beds: SSE placed entirely on the down slope side of the bed = 9 – (5.5 PLW + 1) = 2.5 (3 ft from the edge of the AES pipe).

Illustration of Example #2, Combination Serial Distribution:



1.3 Design Specifications

The AES system shall be designed in accordance with this Manual and local rules. Systems can be installed using either bed or trench design utilizing any of the design configurations outlined in this Manual.

Daily Design Flow

Residential daily design flow for AES systems is calculated in accordance with local rules. Systems servicing more than two residences shall use the commercial specifications detailed in the sizing tables. The minimum daily design flow shall be one bedroom for any single-family residential system and 300 gpd for any commercial system.

Septic Tank

2.0 SYSTEM DESIGN

The AES system is designed to treat effluent that has received “primary treatment” in a standard septic tank. Septic tanks shall be sized according to local rules.

2.0 SYSTEM DESIGN

Water Purification Systems

- Water purification systems and water softeners should not discharge into any AES system.
- If there is no alternative means of disposing of this backwash other than in the system, the system will need to be "oversized." Calculate the total amount of backwash in gpd, multiply by 2, and add this amount to the daily design flow when determining the field and septic tank sizing.
- Water purification systems and water softeners require regular routine maintenance; consult and follow the manufacturer's maintenance recommendations.

Pressure Distribution

The use of pressure distribution lines in AES systems is prohibited. Pumps may be utilized when necessary only to gain elevation and to feed a distribution box which then distributes effluent by gravity to the AES field. Siphon dosing is permitted; adequate venting is required in a siphon-dosed system or pumped system, which may require an additional high vent (referred to as "differential venting").

Observation Ports

The AES system can accommodate observation ports if required.

Effluent (Wastewater) Strength

The AES pipe requirement for bed or trench systems is based on residential strength effluent, which has received primary treatment in a septic tank. Designing a system that will treat higher strength wastes requires additional AES pipe. In these situations, our Technical Advisors shall be consulted for recommendations at (800) 473-5298.

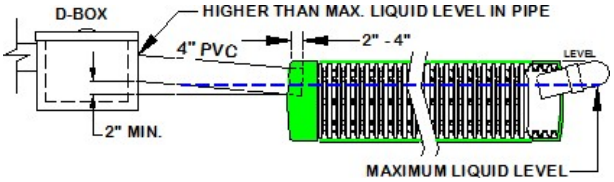
Effluent Filters

- If used, effluent filters shall be maintained on at least an annual basis. Follow manufacturer's instructions regarding required inspections, cleaning and maintenance of the effluent filter.
- Effluent filters must allow the free passage of air to ensure the proper functioning of the system.
- Charcoal filters in vent stacks (for odor control) are not recommended by PEI. They can block air flow and potentially shorten system life.

Flow Equalizers Required

All distribution boxes (D-box) used to divide effluent flow require flow equalizers in their outlets. A flow equalizer is an adjustable plastic insert installed in the outlet holes of a D-box to equalize effluent distribution to each outlet whenever flow is divided. Each bed or section of combination serial distribution is limited to a maximum of 15 gallons per minute (gpm), due to the flow constraints of the equalizers. Example: pumping to a combination system with 3 sections (using 3 D-box outlets). The maximum delivery rate is (3 x 15) = 45 gpm. Always provide a means of velocity reduction when needed. All systems with combination serial distribution or multiple bed distribution shall use flow equalizers in each D-box outlet.

Two Inch Rule



The outlet of a septic tank or D-box shall be set at least 2 in above the highest inlet of the AES row, with the connecting pipe slope not less than 1% (approximately $^1/_8$ in per foot). Illustration of 2 in rule:

AES Pipe Requirement

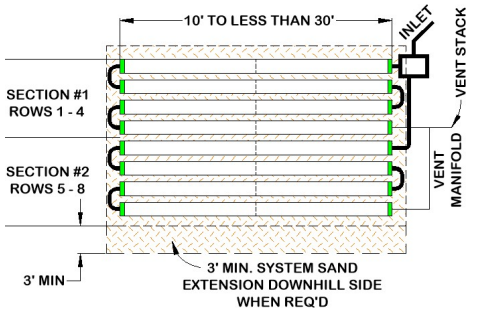
2.0 SYSTEM DESIGN

AES systems use the bed sizing tables, pipe and installation requirements noted in this Manual.

- Residential systems: 70 ft per br.
- Non-Residential/Commercial systems comprised of residential strength effluent: 2.14 gpd per ft.

2.0 SYSTEM DESIGN

Row Requirements



- All beds shall have at least 2 rows.
- Maximum row length for any system is 100 ft of pipe.
- Recommended minimum row length is 30 ft of pipe.
  - A combination (or D-box) distribution system shall be used if any row length is less than 30 ft.
  - A minimum of two D-box outlets must be used and the field must be vented.
- Minimum center-to-center spacing is 1.5 ft for all systems. Spacing may be increased at the discretion of the system designer or as needed to meet the required SSBA.
- Sewn seam must be oriented in the 12 o'clock position. This correctly orients the Bio-Accelerator® fabric in the 6 o'clock position.
- For level beds the AES rows shall be centered in the middle of the system sand bed area and any system sand extensions divided evenly on both sides.
- For sloping beds: the elevations for each AES row must be provided on the drawing. All rows shall be grouped 6 in from the up-slope edge of the system sand bed area (SSBA) with any system sand extensions placed entirely on the downslope side. Systems sloping greater than 5% require a 2.5 ft system sand extension on the downslope side of the bed (3 ft when measured from the pipe).
- Each row must be laid level to within +/- ½ in (total of 1 in) of the specified elevation and preferably should be parallel to the contour of the site.
- It is most convenient if row lengths are designed in exact 10 ft increments to accommodate the length of the AES pipe as manufactured. However, AES pipe lengths can be cut to any length.

System Sand Extensions

System sand extensions are placed on the down slope side of sloping systems and equally divided on each side of level systems. The system sand extension is measured from the tall portion of the system sand bed. In systems sloping more than 5%, a 2.5 ft minimum system sand extension is required. The system sand extension area is a minimum of 6 in deep.

Sloping Sites and Sloping Mound Systems

- The percentage of slope in all system drawings refers to the slope of the system, not the existing terrain ("site slope") and refers to the slope of the bed itself ("system slope").
- The system slope and the site slope do not have to be the same.
- Maximum site slope is 12% and maximum system slope is 12%.

Separation Distances (Horizontal)

All horizontal separation distances are dictated by local regulations. Horizontal separation distances (setbacks) shall be measured from the outside aspect of the system sand adjacent to the outermost pipe row or system sand extension if applicable.

Separation Distances (Vertical)

Vertical separation distances shall be 24 inches from the bottom of the AES conduit to the limiting layer.

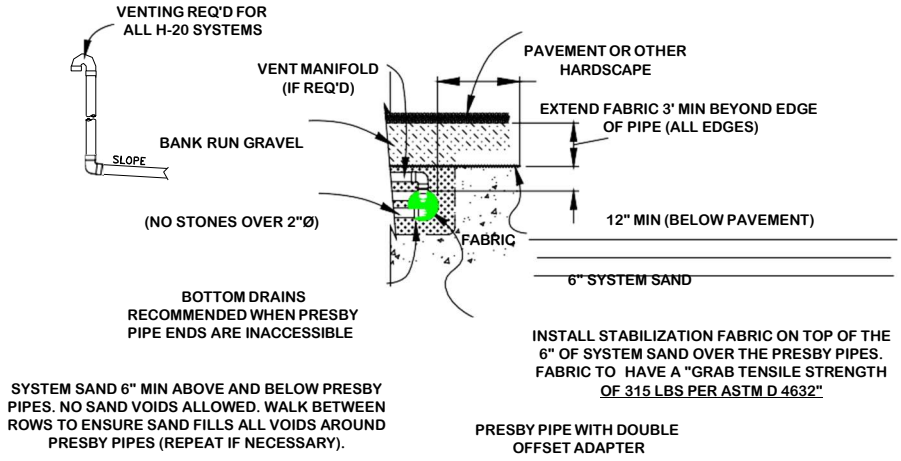
Barrier Materials over System Sand

No barrier materials (hay, straw, tarps, etc.) are to be placed between the system sand and cover material. The only exception is the placement of the specified fabric to achieve H-20 loading requirements.

2.0 SYSTEM DESIGN

H-20 Loading

If a system is to be installed below an area that will be subjected to vehicular traffic, it must be designed and constructed as depicted in order to protect the system from compaction and/or damage. Note that a layer of stabilization fabric is added between the 6 in system sand and the cover material. All H-20 systems require venting.



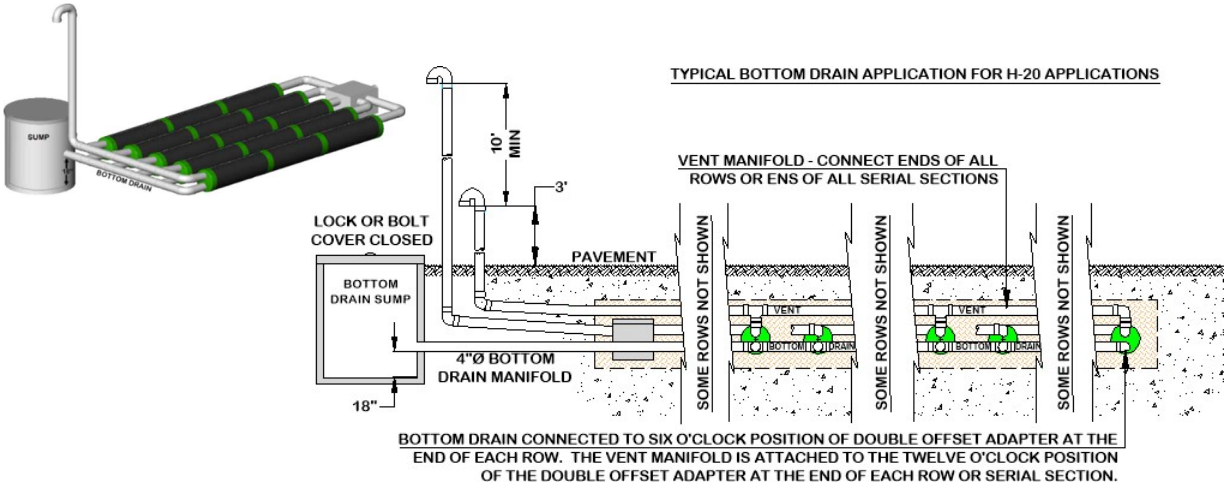
NOTE:

THE ONLY SOIL COMPACTION THAT SHOULD TAKE PLACE IS AT THE POINT OF PREPARATION FOR PAVEMENT.

Bottom Drain

A bottom drain is a line connected to the hole in the 6 o'clock position of a double offset adapter at the end of each row which drains to a sump and is utilized to lower the water level in a saturated system or to facilitate system rejuvenation. There must be 18 in from the bottom of the sump to the bottom of the drain. The sump should be brought above the final grade and have a locking or mechanically fastened cover. The bottom drain may be located on either end of the AES rows.

Illustrations of a bottom drain:



1.4 System Configurations

Elevated Bed Systems (Mounds)

2.0 SYSTEM DESIGN

Elevated beds are designed for sites with soil, depth to groundwater or restrictive feature constraints that do not allow for in-ground bed systems. An elevated bed system is a soil absorption field with any part of the system above original grade. Side-slope tapering is used to blend the raised portion of the system with the existing grade. Elevated bed systems require 6 in fill extensions on each side (measured from the pipe), after which side-slope tapering is to be a maximum of 4 horizontal feet for each 1 ft of vertical drop until it meets existing grade. In systems sloping greater than 5%, there must be a minimum of 2.5 ft of system sand extension (3 ft measured from

the pipe) beyond the last down-slope row of pipe. There must be a minimum of 12 in of cover material over the ends of all system sand extensions (if present).

Illustration of an elevated level bed:

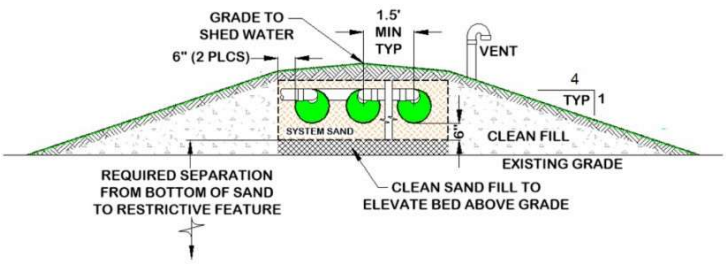
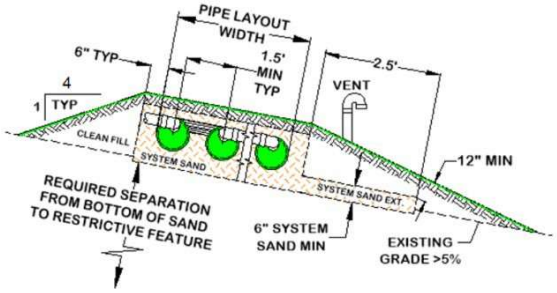
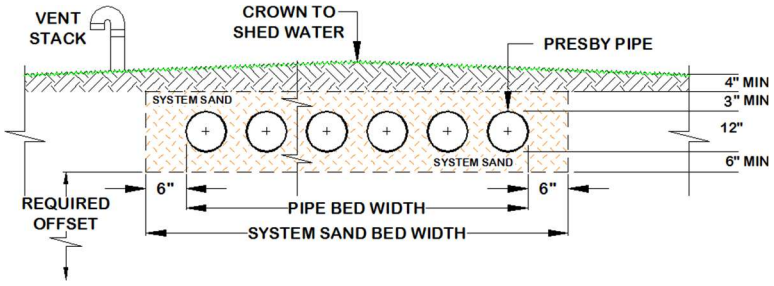


Illustration of an elevated sloping bed:



In-Ground Bed Systems

Systems are installed below existing grade for sites with no soil restrictive features to limit placement. In-ground systems that slope over 5% require a 2.5 ft system sand extension on the downhill side of the field. In-ground on level site:



Trench Systems

AES pipe may be installed in trench configurations on level or sloping terrain and may utilize serial, combination, butterfly, or parallel distribution. A minimum of 3 in of system sand is required above and 6 in below, between, and around the perimeter of the AES pipe. Consult state rules for acceptable trench width and/or required trench separation.

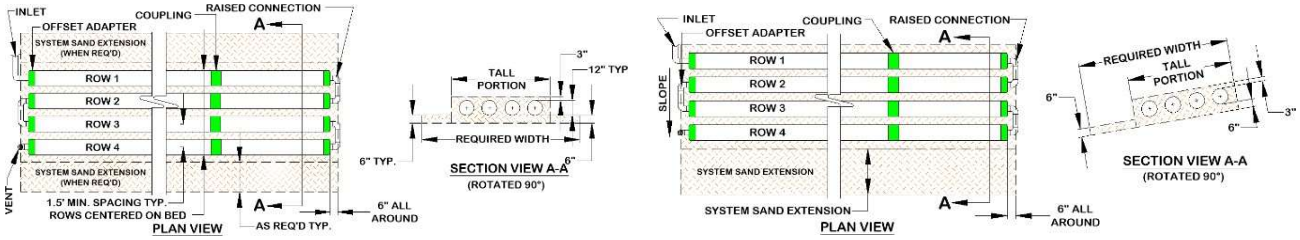
Basic Serial Distribution (Single Level)

AES rows are connected in series at the ends with raised connections, using offset adapters.

- Used for single beds of 750 gpd or less and multiple beds where each bed receives 750 gpd or less.
- Incorporates rows in serial distribution in a single bed.
- Rows shall meet requirements outlined in the design criteria above.
- Gravity fed basic serial systems may be fed directly from the septic tank.
- Bed may be constructed with unusual shapes to avoid site obstacles or meet setback requirements.

Illustration of basic serial systems bed designs:

2.0 SYSTEM DESIGN

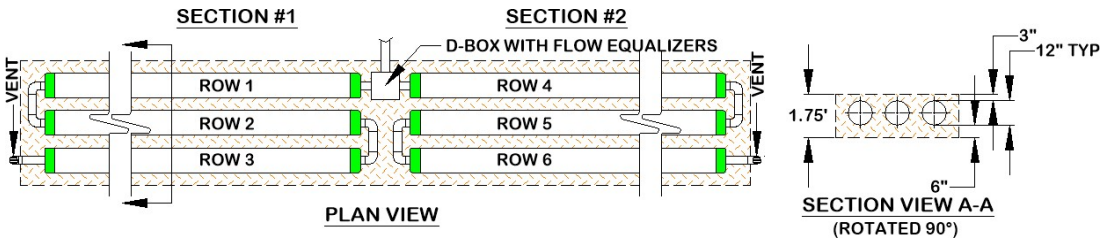


2.0 SYSTEM DESIGN

Butterfly Configuration

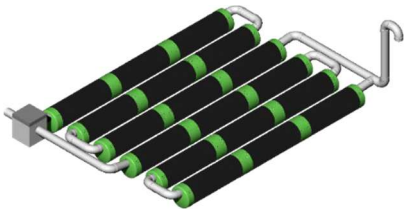
- A “butterfly configuration,” is considered a single bed system with two or more sections extending in opposite directions from the D-box along the contour.
- Butterfly configurations are generally used to accommodate bed lengths longer than the maximum row length of 100 ft.
- Beds can contain any number of serial sections.
- Rows shall meet requirements outlined in the design criteria above.

Illustration of a butterfly configuration bed design:



Combination Serial Distribution

Combination serial distribution within one bed, or multiple beds, is required for systems with daily design flows greater than 750 gpd. Effluent flow is divided evenly to each section using a D-box with flow equalizers.

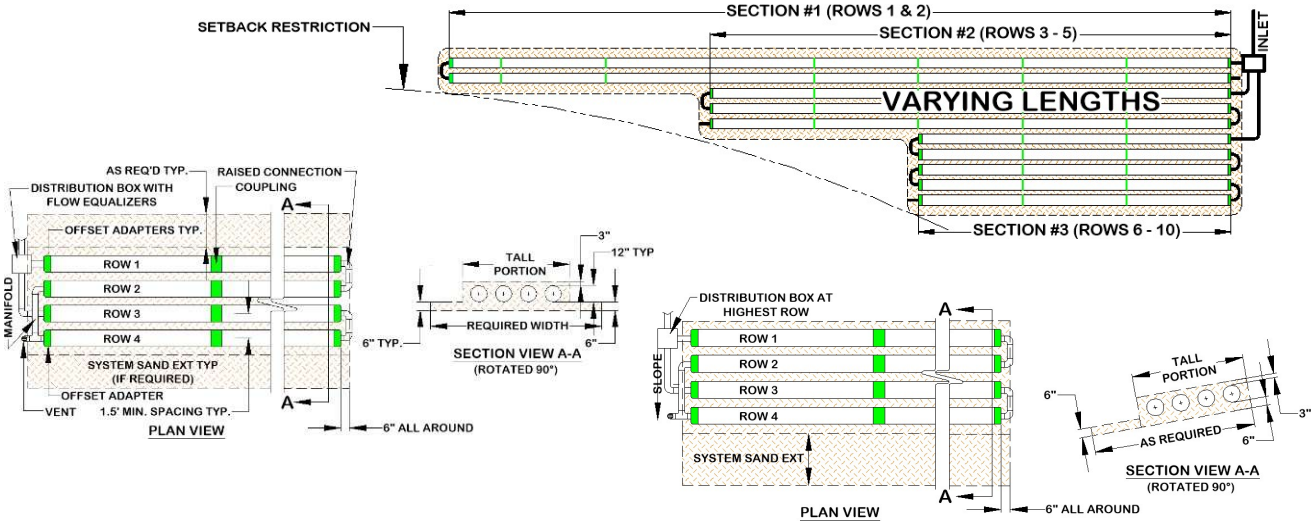


- Consists of two or more serial sections (with a maximum loading of 750 gpd/section) installed in a single bed each section receiving an equal amount of effluent from a D-box with flow equalizers.
- Each section consists of a series of AES rows connected at the ends with raised connections, using offset adapters and PVC sewer and drainpipe.
- There is no limit on the number of sections within a bed.
- Each section shall have the same linear feet of pipe determined by dividing the total minimum linear feet required in the system by the number of sections required.
- A section may exceed the minimum linear feet required.
- When the vent manifold is on the same side as the serial section inlets, the manifold runs over the top of these inlets.

Rows must meet requirements outlined in the design criteria above except rows within a section may vary in length to accommodate site constraints as shown below.

Illustrations of combination serial systems:

2.0 SYSTEM DESIGN

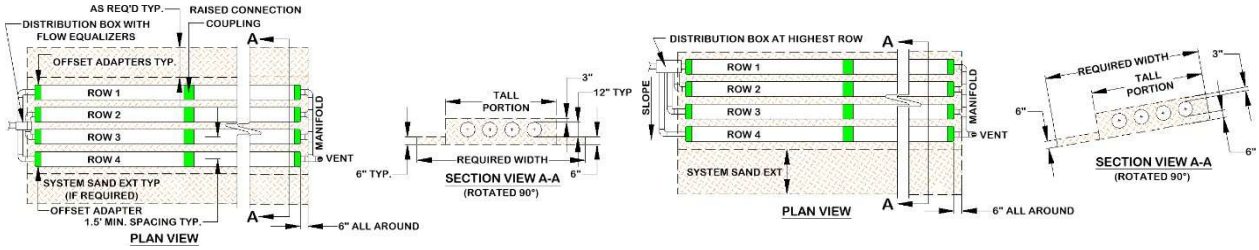


2.0 SYSTEM DESIGN

D-box (Parallel) Distribution

- All rows in this configuration must be the same length.
- Flow equalizers must be used in the D-box.
- Use a manifold to connect the ends of all rows. Manifold shall be sloped toward AES pipes.
- D-box placement shall be installed on level, firmly compacted soil.
- All rows shall be laid level end-to-end.
- A 2 in min. drop is required between the D-box outlets and the AES pipe inlets.
- Rows shall meet requirements outlined in the design criteria above.

Illustrations for D-box (parallel) distribution bed design:



Multiple Bed Distribution

Incorporates two or more beds, each bed receiving an equal amount of effluent from a D-box. Multiple beds may be oriented along the contour of the site or along the slope of the site.

- Each bed shall have the same minimum linear feet of pipe. The minimum linear feet of pipe per bed is determined by dividing the total linear feet required in the system by the number of beds.
- Rows within a bed may vary in length to accommodate site constraints, except with D-box configuration which requires all rows to be the same length.
- End-to-end configurations are preferred to side-to-side configurations.
- Bed separation distance is measured from the edge of the SSBA and is dependent on state requirements.

Illustration of End-to-End multiple beds:

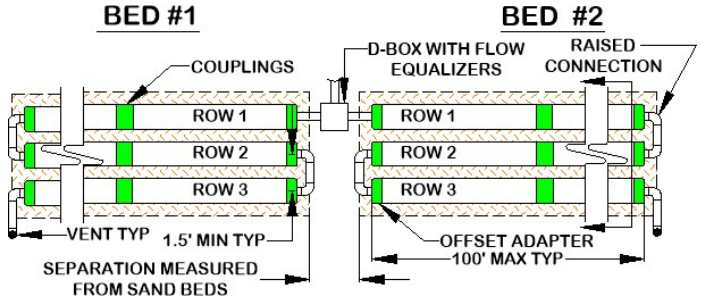
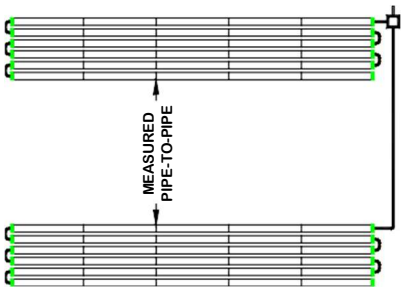


Illustration of Side-to-Side multiple beds:

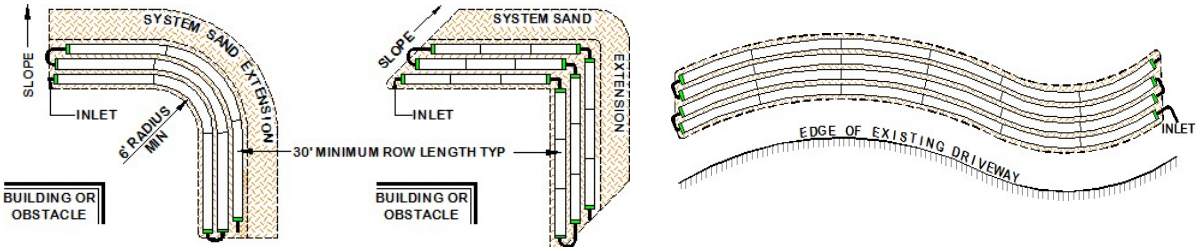


Angled and Curving Beds

Angled and curving beds are used to avoid obstacles and work well around structures, setbacks, and slopes. Multiple curves can be used within a system to accommodate various contours of the site.

- Rows are angled by bending pipes up to 90 degrees or through the use of offset adapters
- Rows shall meet requirements outlined in the design criteria above.

Illustrations of angled and curving beds:

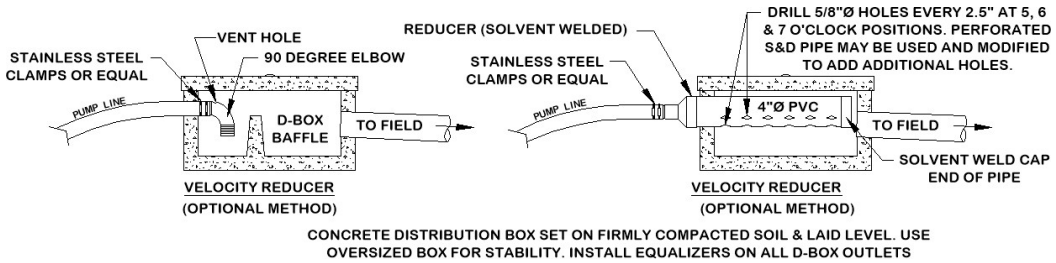


1.5 Pump Systems

Pumped systems supply effluent to the system using a pump and D-box when site conditions do not allow for a gravity system. Dosing siphons are also an acceptable means of delivering effluent to the system.

- Pump dosing should be designed for a minimum of 6 cycles per day; 6-8 cycles per day are recommended.
- If possible, the dosing cycle should provide one hour of drying time between doses.
- Pump systems must have a high-water alarm float or sensor installed inside the pump chamber. Follow state, local and national code requirements.
- Pumped systems with basic serial distribution are limited to a maximum dose rate of 40 gpm and do not require the use of a flow equalizer on the D-box outlet.
- All pump systems require differential venting.
- All pumped systems require a D-box with baffles, a velocity reducing tee or other means to be used for velocity reduction.
- All systems with combination serial distribution or multiple bed distribution shall use flow equalizers in each D-box outlet with each flow equalizer limited to 15 gpm, due to the flow constraints of the equalizers.
    - *Example: pumping to a combination system with 3 sections (using 3 D-box outlets). The maximum delivery rate is (3 x 15) = 45 gpm. Higher flow rates can be accommodated by connecting multiple D-box outlets to each line.*
- The rate at which effluent enters the AES pipe shall be controlled. Excessive effluent velocity can disrupt solids that settle in the pipes.
    - Effluent shall never be pumped directly into AES pipes.
    - A D-box or tank shall be installed between the pumping chamber and the AES pipe to reduce effluent velocity.
    - Force mains shall discharge into a D-box (or equivalent) with velocity reducer such as a baffle, 90° bend, tee or equivalent.
- Velocity reducers are also needed for gravity systems when there is excessive slope between the septic tank and the AES system.

Two methods of velocity reduction:



1.6 Venting

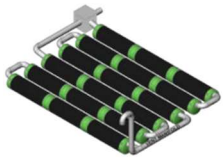
An adequate air supply is essential to the proper functioning of AES systems. Venting is always required. All systems shall utilize differential venting.

General Rules

- Differential venting is the use of high and low vents in a system.
- In a gravity system, the roof stack acts as the high vent.
- High and low vent openings shall be separated by a minimum of 10 vertical ft.
- If possible, the high and low vents should be of the same capacity.
- Roof vent diameter must be a minimum of 3 in, 4 in diameter is recommended. If the roof vent is less than 3 in, an additional high vent is recommended.
- Vent openings shall be located to ensure the unobstructed flow of air through the entire system.
- The low vent inlet shall be a minimum of 1 ft above final grade or anticipated snow level. Vents extending more than 3 ft above grade must be anchored.
- Sch. 40 or SDR 35 PVC (or equivalent) should be used for all vent stacks.
- One 4 in vent is required for every 1,000 ft of AES pipe.
- A single 6 in vent may be installed in place of up to three 4 in vents.
- If a vent manifold is used, it shall be at least the same diameter as the vent(s).
- Vent piping should slope downward toward the system to prevent moisture from collecting in the pipe and blocking the passage of air.
- Remote venting may be utilized to minimize the visibility of vent stacks.
- When venting multiple beds, it is preferred that each bed be vented separately rather than connecting bed vents together. Multiple vents can be remotely located to the same location if desired.

Vent Manifolds

A vent manifold may be incorporated to connect the ends of a number of sections or rows of AES pipe to a single vent opening. Slope the lines connecting the manifold to the AES pipes to drain condensation.

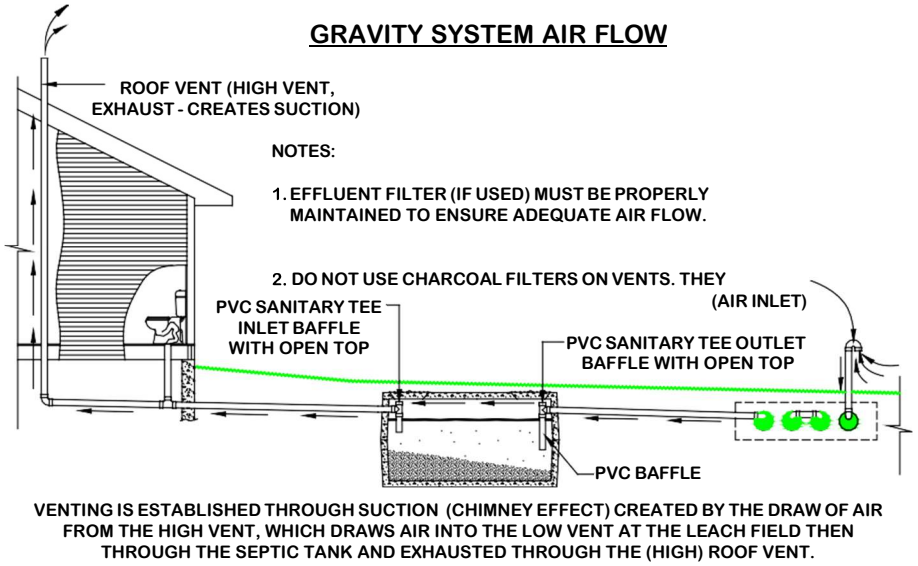


Gravity Systems Vent Location

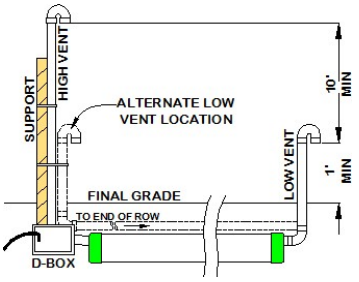
- A low vent is installed at the end of the last row of each section or the end of the last row in a basic serial bed, or at the end of each row in a D-box distribution configuration system. A vent manifold may be used to connect the ends of multiple sections or rows.
- The house (roof) vent functions as the high vent as long as there are no restrictions or other vents between the low vent and the house (roof) vent.
- When the house (roof) vent functions as the high vent, there shall be a minimum of a 10 ft vertical differential between the low and high (roof) vent openings.

2.0 SYSTEM DESIGN

Illustration of gravity system air flow:



Pump System Vent Locations



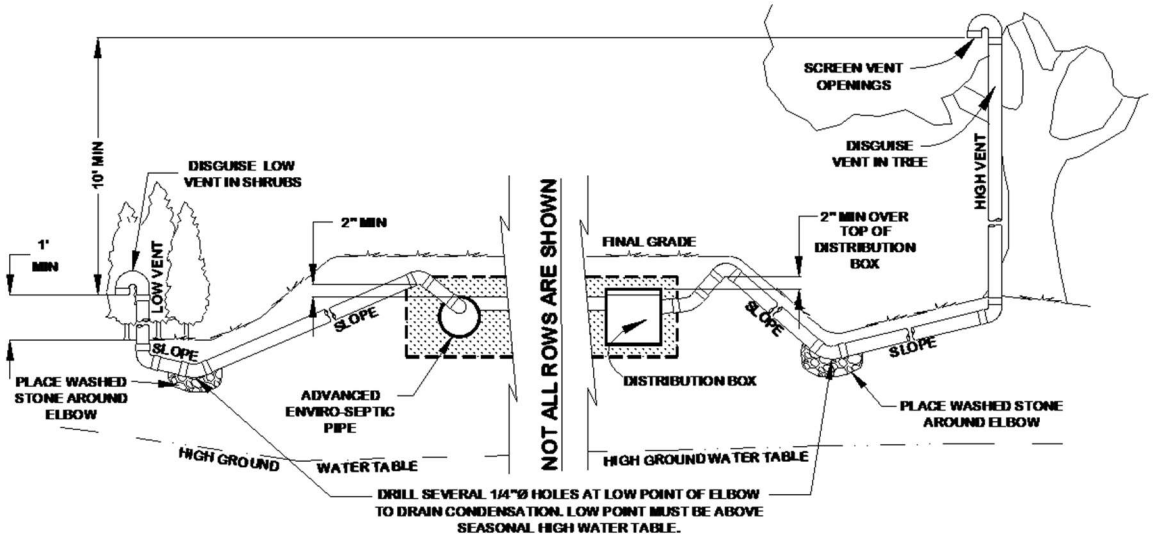
- A low vent is installed through an offset adapter at the end of each section, basic serial bed or attached to a vent manifold.
- A high vent is attached to an unused D-box outlet.
- The low and high vents may be swapped, provided the D-box is insulated against freezing in cold climates.
- For options to relocate the high vent, see Remote Venting.
- For options to eliminate the high vent, see Bypass Venting.

Remote Venting

If site conditions do not allow the vent pipe to slope toward the system, or the owner chooses to utilize remote venting for aesthetic reasons (causing the vent pipe not to slope toward the system), the low point of the vent line must be drilled creating several ¼ in holes to allow drainage of condensation. This procedure may only be used if the vent pipe connecting to the system has:

- A high point that is above the highest point of all AES pipes or the D-box (2 in minimum for each); and,

A low point opened for drainage which is above the SHWT (see diagram below).

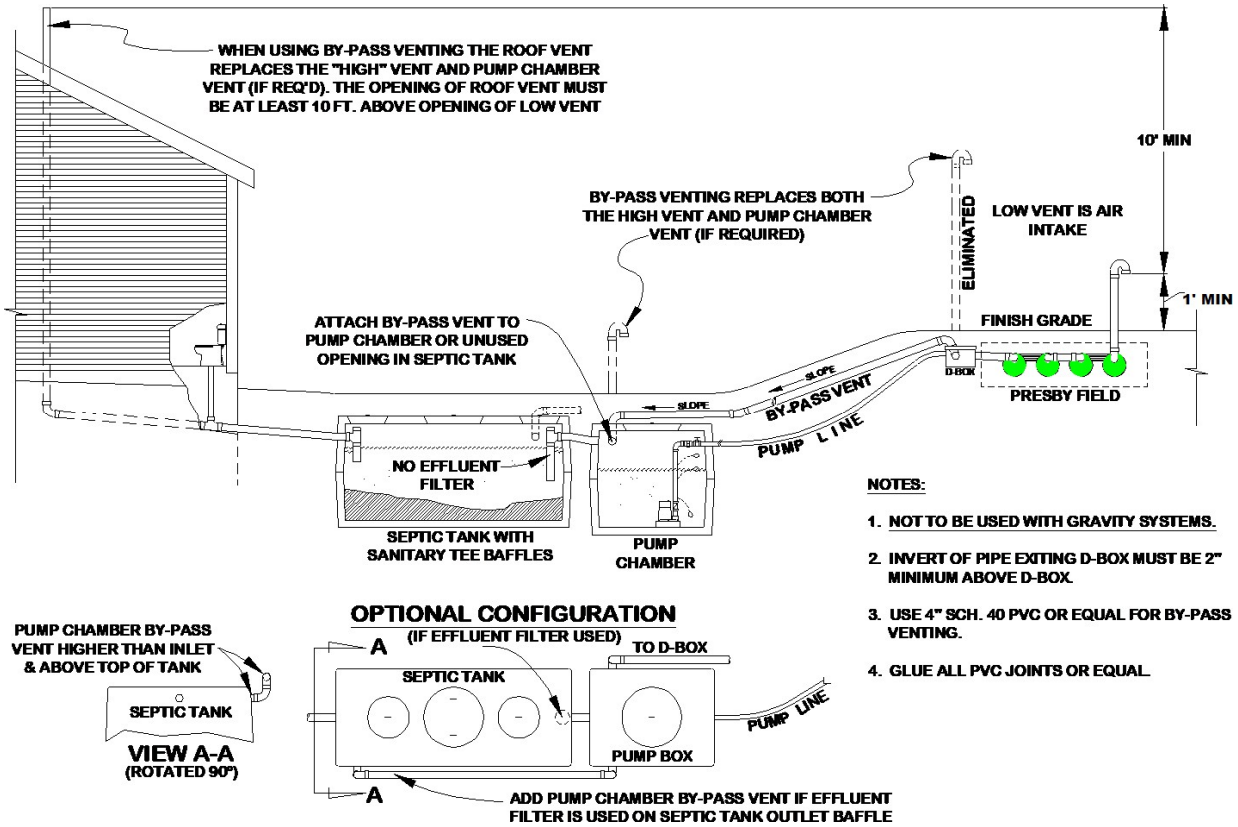


2.0 SYSTEM DESIGN

By-Pass Venting

When a field is fed using pumping or dosing, it is necessary to provide air flow through the system by using either an independent high vent at the field or "by-pass venting." For by-pass venting, the system is plumbed by attaching Sch. 40 or SDR 35 PVC from the D-box back to the septic tank or pump chamber if no effluent filter is present. This process "by-passes" the pump line and allows air to flow from the low vent to the roof vent which functions as the high vent. The bypass vent line invert must rise 2 in above the D-box before dropping to pump chamber or septic tank.

Illustration of by-pass venting:



1.7 Site Selection

Determining Site Suitability

Refer to state or local rules regarding site suitability requirements.

Topographic Position Requirement

AES systems shall not be located where surface or ground waters will converge, causing surface water flow to become concentrated or restricted within the soil absorption field. The system shall be located in an area that does not concentrate water, both surface and subsurface. If allowed by state and local authorities, altering the terrain upslope of a system may alleviate this requirement if the waters are sufficiently altered to redirect flows away from the field.

- Locate systems on convex, hill, slope or level locations. Avoid swales, low areas, or toe-of-slope areas that may not provide sufficient drainage away from the system.
- No onsite system may be located on concave slopes that concentrate surface or ground water flows unless up-slope terrain is sufficiently altered or interceptor drains are used to redirect water away from the system.

2.0 SYSTEM DESIGN

- Systems should not be located where lawn irrigation, roof drains, or natural flows increase water loading to the soils around the system.
- Divert surface water away from the system. Interceptor drains, if used, must be upslope of the AES system and a minimum of 10 ft away from all AES pipe.
- Systems should not be located where structures such as curbs, walls or foundations might adversely restrict the soil's ability to transport water away from the system.
- Systems should be located to allow access for septic tank maintenance and to at least one end of all AES rows.
- Avoid locating systems in rocky or wooded areas that require additional site work, since this may alter the soil's ability to accept water.
- No trees or shrubs should be located within 10 ft of the system to prevent root infiltration.

AES as a Replacement System

If an AES system is being installed in the same location where another onsite system has previously been installed:

- Remove the existing components and contaminated sand and soil.
- If the soils under and around the system have not been compromised, it is permissible to install the AES system in the same excavated location using new system sand.

Note: Permits may be required for system replacement.

3.0 INSTALLATION

3.1 Installation Requirements

Component Handling

- Keep mud, grease, oil, etc. away from all components. Avoid dragging pipe through wet or muddy areas. Store pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.
- The outer fabric of the AES pipe is ultra-violet stabilized; however, this protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp if stored outdoors.

Site Preparation Prior to Excavation

1. Locate and stake out the system sand bed, extension areas and soil material cover extensions on the site according to the approved plan.
2. Install sediment/erosion control barriers prior to beginning excavation to protect the system from surface water flows during construction.
3. Do not stockpile materials or equipment within the portion of the site receiving system sand.

Critical Reminder to Prevent Soil Compaction

It is critical to keep excavators, backhoes, and other equipment off the excavated or tilled surface of a bed. Before installing the system sand, excavation equipment should be operated around the bed perimeter; not on the bed itself. It is especially important to avoid using construction equipment down slope of the system to prevent soil compaction.

When to Excavate

- Do not work wet or frozen soils. If a fragment of soil from about 9 in. below the surface can easily be rolled into a wire, the soil moisture content is too high for construction.
- Do not excavate the system area immediately after, during or before precipitation.

Tree Stumps

Before tilling, remove all grass, leaves, sticks, brush and other organic matter or debris from the excavated system site. Remove all tree stumps and the central root system below grade by using a backhoe or excavator with a mechanical “thumb” or similar extrication equipment, lifting or leveraging stump in a manner that minimizes soil disturbance. It is not necessary for the soil of the system site to be smooth when the site is prepared.

- Avoid soil disturbance, relocation, or compaction.
- Avoid mechanical leveling or tamping of dislodged soil.
- Fill all voids created by stump or root removal with system sand.

Raking and Tilling Procedures

All areas receiving system sand, sand fill, side-slope tapering and fill extensions shall be raked or tilled to remove the organic layer (grass, leaves, forest litter, etc.). When needed to meet vertical separation distances, the topsoil may be left in-place and tilled. If a backhoe/excavator is used to till the site, fit it with chisel teeth and till the site. The backhoe/excavator shall remain outside of the proposed system sand area and all areas that will be impacted by side-slope tapering. While tilling, remove all stones larger than 3 in, stumps roots, grass, brush and other organic matter or debris from the excavated system site.

- For in-ground bed systems, excavate the system bed as necessary below original grade. Using an excavator or backhoe, tilt the bucket teeth perpendicular to the bed and use the teeth to rake furrows 2 in – 6 in deep into the bottom of the entire area receiving system sand or sand fill.
- For elevated bed systems, remove all organics in the footprint of the dispersal area prior to installing system sand. Next, use an excavator or backhoe to rake furrows 2 in – 6 in deep into the receiving area.

Note: It is not necessary for the soil of the system site to be smooth when the site is prepared.

3.0 INSTALLATION

Install System Sand and/or Sand Fill Immediately After Excavation

- To protect the tilled area from damage by precipitation, system sand should be installed immediately after tilling.
- Work off either end or the uphill side of the system to avoid compacting soil.
- Keep at least 6 in of sand between the vehicle tracks and the tilled soil of the site if equipment must work on receiving soil.
- Track construction equipment should not travel over the installed system area until at least 12 in of cover material is placed over the AES pipes.
- Heavy equipment with tires shall never enter the receiving area due to likely wheel compaction of underlying soil structures.

Distribution Box Installation

It is essential that the D-box remain level after installation in order to ensure even distribution to all rows within the system. To prevent movement, D-box shall be set on a layer of level compacted soil, sand, pea gravel base or a concrete footing. Take care when backfilling that the D-box remains level.

Row Installation Sequence

1. Install a minimum of 6 in of system sand to the elevation where the bottom of AES pipes will be and install the sand for side-slope tapering to allow machinery movement around the perimeter of the system. Rake the system sand where the AES pipes will be installed so it is as level as possible before placing pipes on the system sand. This will make it easier to level the pipe rows.
2. Locate AES rows horizontally.
3. Locate AES rows vertically using a laser level or transit. Lift or lower the pipes at couplings using a hand shovel and adding or removing system sand, as necessary.
4. Drop system sand along each row of couplings being careful to avoid moving the rows.
5. Add or remove system sand along rows to level. The rows may be raised by pushing additional system sand below the pipes. A hand shovel may be scraped along the system sand below the pipes to remove a small amount if needed.
6. Re-check horizontal and vertical locations. Re-check that pipes are level to within 1 in end-to-end.
7. Add system sand between and around the AES pipes, leaving the uppermost surface of the pipe exposed to allow for system inspection (if required by local approving authority).

Level Row Tolerances

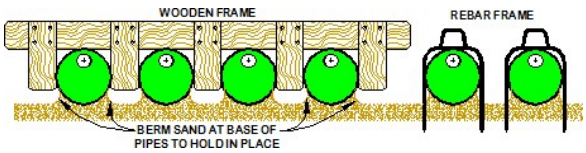
Use a laser level or transit to install rows level. Variations beyond 1 in (±½ in) may affect system performance and are not acceptable.

Correct Alignment of AES Bio-Accelerator® Fabric

The Bio-Accelerator (white geo-textile fabric) is to be positioned centered along the bottom of the pipe rows (sewn seam up).

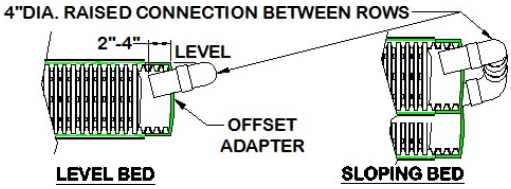
Row Spacers

System sand may be used to keep pipe in place while covering, but simple tools may also be constructed for this purpose. Two examples are shown. One is made from rebar, the other from wood. Caution: Remove all tools used as row spacers before final covering.



Connect Rows Using Raised Connections

Raised connections consist of offset adapters, 4 in PVC sewer and drainpipe, and 90° elbows. They enable greater liquid storage capacity and increase the bacterial surfaces being developed. Use raised connections to connect the rows of basic serial and combination serial configurations. Raised connections extend 2 in to 4 in into pipe and are installed on an angle

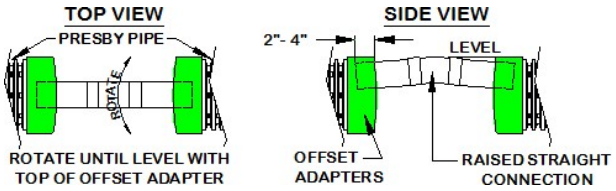


3.0 INSTALLATION

(As shown in the drawing to the right). If the ends are not at least 2 in into the pipe, they may become dislodged during backfilling. If the ends extend more than 4 in into the pipe, this may cut off the flow of oxygen to the system. The top of the raised connections should be level with the top of the AES pipe as shown. All PVC joints should be glued or mechanically fastened.

Raised Straight Connection

A raised straight connection is a PVC sewer & drain pipe configuration which is used to connect AES rows that are placed end to end along the same contour. Raised straight connections extend 2 in to 4 in into pipe and are installed on an angle (as shown in the drawings to the right). All PVC joints should be glued or mechanically fastened.



Backfilling Rows

1. Spread system sand between the rows.
2. Confirm pipe rows are positioned with Bio-Accelerator along the bottom (sewn seam up).
3. Straddle each row of pipe and walk heel-to-toe its entire length, ensuring that system sand fills all void spaces beneath the AES pipe.
4. Finish spreading system sand to the top of the rows and leave them exposed for inspection purposes.
5. Confirm that all rows of pipe are level to within 1 in end-to-end.
6. After inspection (if required) proceed to backfilling and final grading.

Backfilling and Final Grading

1. Spread system sand to a minimum of 3 in over the pipe and a minimum of 6 in on all four sides of the bed beyond the AES pipes.
2. Spread a minimum of 4 in of suitable earth cover (topsoil or loam) free of organics, stones over 4 in and building debris, having a texture similar to the soil at the site, without causing compaction.
3. To prevent erosion, soil cover above the system shall be planted with native, shallow-rooted vegetation such as grass, wildflowers and certain perennials or ground covers. No trees or shrubs should be located within 10 ft of the system perimeter to prevent roots from growing into and damaging the system.

Fill Extensions Requirements

All systems with any portion of the system sand bed above original grade require 6 in fill extensions on each side beyond the outside edge of all AES pipes and then tapering to meet existing grade at a maximum slope of 4:1.

There must be a minimum of 12 in of cover material over the ends of all system sand extensions (if present).

4.0 REJUVENATION AND EXPANSION

4.1 Bacteria Rejuvenation and Expansion

Why Would System Bacteria Rejuvenation Be Needed?

Bacteria rejuvenation is the return of bacteria to an aerobic state. Flooding, improper venting, alteration or improper depth of soil material cover, use of incorrect sand, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to converting bacteria in any system from an aerobic to an anaerobic state. This conversion severely limits the bacteria's ability to effectively treat effluent, as well as limits liquids from passing through. A unique feature of the AES system is its ability to be rejuvenated in place.

How to Rejuvenate System Bacteria

System bacteria are "rejuvenated" when they return to an aerobic state. By using the following procedure, this can be accomplished in most AES systems without costly removal and replacement.

1. Contact PEI before attempting rejuvenation for technical assistance.
2. Determine and rectify the problem(s) causing the bacteria conversion.
3. Have system and septic tank pumped by a registered septage pumper.
4. Drain the system by excavating at least one end of all the rows and removing the offset adapters.
5. If foreign matter has entered the system, flush the pipes.
6. Safeguard the open excavation.
7. Guarantee a passage of air through the system.
8. Allow all rows to dry for 72 hours minimum. The system sand should return to its natural color.
9. Re-assemble the system to its original design configuration. As long as there is no physical damage to the AES components, the original components may be reused.

System Expansion

AES systems are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections. All system expansions shall comply with state and local regulations. Permits may be required prior to system expansion.

Reusable Components

AES pipe and components are not biodegradable and may be reused. In cases of improper installation, it may be possible to excavate, clean, and reinstall all system components.

System Replacement

If an AES system requires replacement…

- Remove the existing components and contaminated sand
- If the soils under and around the system have not been compromised, replace in the same excavated location with new system sand.
- If components are not damaged, they may be cleaned and reused.

Note: Permits may be required for system replacement.

5.0 OPERATION AND MAINTENANCE

5.1 Operation and Maintenance

Proper Use

AES systems do not require a maintenance and monitoring agreement, however they do require minimal maintenance as is standard for conventional onsite systems, provided the system is not subjected to abuse. An awareness of proper use and routine maintenance will guarantee system longevity. We encourage all system owners and service providers to obtain and review a copy of our Owner's Manual, available from our website www.presbyeco.com or via mail upon request to (800) 473-5298 or info@presbyeco.com.

System Abuse Conditions

The following conditions constitute system abuse:

- Liquid in high volume (excessive number of occupants and use of water in a short period of time, leaking fixtures, whirlpool tubs, hot tubs, water softening equipment or additional water discharging fixtures if not specified in system design).
- Solids in high volume (excessive number of occupants, paper products, personal hygiene products, garbage disposals or water softening equipment if not specified in system design).
- Antibiotics and medicines in high concentrations.
- Cleaning products in high concentrations.
- Fertilizers or other caustic chemicals in any amount.
- Petroleum products in any amount.
- Latex and oil paints.
- System suffocation (compacted soils, barrier materials, etc.) without proper venting.

Note: PEI does not recommend the use of septic system additives.

System Maintenance/Pumping of the Septic Tank

- Inspect the septic tank at least once every two years under normal usage.
- Pump the tank when surface scum and bottom sludge occupy one-fourth or more of the liquid depth of the tank.
- If a garbage disposal is used, the septic tank will likely require more frequent pumping.
- After pumping, inspect the septic tank for integrity to ensure that no groundwater is entering it. Also check the integrity of the tank inlet and outlet baffles and repair if needed.
- Inspect the system to ensure that vents are in place and free of obstructions.
- Effluent filters require ongoing maintenance due to their tendency to clog and cut off oxygen to the system. Follow filter manufacturer's maintenance instructions and inspect filters frequently.

Site Maintenance

It is important that the system site remain free of shrubs, trees, and other woody vegetation, including the entire SSBA, and areas impacted by side slope tapering and perimeter drains (if used). Roots can infiltrate and cause damage or clogging of system components. If a perimeter drain is used, it is important to make sure that the outfall pipes are screened to prevent animal activity. Also check outfall pipes regularly to ensure that they are not obstructed in any way.

6.0 WARRANTY

6.1 PRESBY ENVIRONMENTAL, INC. STANDARD LIMITED WARRANTY

(a) The structural integrity of each unit, endcap and other accessory manufactured by Presby Environmental, Inc. (collectively referred to as "Units"), when installed and operated in an onsite wastewater system in accordance with Presby Environmental's installation instructions, is warranted to the original purchaser ("Holder") against defective materials and workmanship for one year from the date upon which a septic permit is issued for the septic system containing the Units; provided, however, that if a septic permit is not required for the septic system by applicable law, the one (1) year warranty period will begin upon the date that installation of the septic system commences. In order to exercise its warranty rights, Holder must notify Presby Environmental in writing at its corporate headquarters in Whitefield, New Hampshire within fifteen (15) days of the alleged defect. Presby Environmental will supply replacement Units for those Units determined by Presby Environmental to be defective and covered by this Limited Warranty. Presby Environmental's liability specifically excludes the cost of removal and/or installation of the Units.

(b) THE LIMITED WARRANTY AND REMEDIES IN SUBPARAGRAPH (a) ARE EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE UNITS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

(c) This Limited Warranty shall be void if any part of the Presby Environmental system (unit, endcap or other accessory) is manufactured by anyone other than Presby Environmental. The Limited Warranty does not extend to incidental, consequential, special or indirect damages. Presby Environmental shall not be liable for penalties or liquidated damages, including loss of production and profits, labor and materials, overhead costs, or other losses or expenses incurred by the Holder or any third party. Specifically excluded from Limited Warranty coverage are damage to the Units due to ordinary wear and tear, alteration, accident, misuse, abuse or neglect of the Units; the Units being subjected to vehicle traffic or other conditions which are not permitted by the installation instructions; failure to maintain the minimum ground covers set forth in the installation instructions; the placement of improper materials into the system containing the Units; failure of the Units or the septic system due to improper siting or improper sizing, excessive water usage, improper grease disposal, or improper operation; or any other event not caused by Presby Environmental. This Limited Warranty shall be void if the Holder fails to comply with all of the terms set forth in this Limited Warranty.

Further, in no event shall Presby Environmental be responsible for any loss or damage to the Holder, the Units, or any third party resulting from installation or shipment, or from any product liability claims of Holder or any third party. For this Limited Warranty to apply, the Units must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Presby Environmental's installation instructions.

(d) No representative of Presby Environmental has the authority to change this Limited Warranty in any manner whatsoever, or to extend this Limited Warranty. No warranty applies to any party other than the original Holder.

The above represents the standard Limited Warranty offered by Presby Environmental. A limited number of states and counties have different warranty requirements. Any purchaser of Units should contact Presby Environmental's corporate headquarters in Whitefield, New Hampshire, prior to such purchase, to obtain a copy of the applicable warranty, and should carefully read that warranty prior to the purchase of Units.