MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

GUIDANCE MANUAL FOR THE LAND APPLICATION OF SEPTAGE WASTE




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- Cover page – updated photos; surface application, injection, storage facility and screening
- Cover page – EGLE Septage Waste Program address updated
- Ch. 4 – Updated Soil Textural Class Diagram
- Ch. 10 – Surface application language updated
- Ch. 10, Figure 10.1 – Photo updated for surface application example

Finding the Guidance Manual Online

You can find a copy of this Guidance Manual in the Michigan Department of Environment, Great Lakes, and Energy Septage Waste Program website at the following link: Michigan.gov/EGLESeptage. Under "Program Forms/Downloads" click Land Application Information – Click Guidance Manual for the Land Application of Septage Waste.

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Resources

- EGLE, Septage Waste Storage Facility (SWSF), Septage Program website: Michigan.gov/EGLESeptage
- Michigan State University Extension: MSUE.MSU.edu, 1-888-678-3464.
- United States Department of Agriculture and Natural Resource Conservation Service. Soil Survey. 1-517-324-5270.
- Michigan Department of Agriculture. 2005. Generally Accepted Agricultural and Management Practices (GAAMP) for Nutrient Utilization. Michigan Right-to-Farm 1981, PA 93.
- Water Well Viewer: Wellviewer.RSGIS.MSU.edu
- Other Online Resources.

ABBREVIATIONS

Agronomic Application Rate = AAR

Bushels per Acre = bu/ac

Feet or Foot = ft

Food Establishment Septage = FES

Gallons per acre per year = gal/ac/yr

Generally Accepted Agricultural and Management Practices = GAAMPs

Global Positioning System = GPS

Holding Tank Waste = HTW

Local Health Department = LHD

Michigan Compiled Laws = MCL

Michigan Department of Agriculture = MDA

Michigan Department of Environment, Great Lakes, and Energy = EGLE

Michigan Safe Drinking Water Act = MSDWA

Michigan State University Extension = MSUE

Natural Resources and Environmental Protection Act = NREPA

Natural Resources Conservation Service = NRCS

Part 117, Septage Waste Servicers = Part 117

Parts per million = ppm

Portable Tank Waste = PTW

Presidedress Soil Nitrate Test = PSNT

Pounds per acre = lbs/ac

Public Act = PA

Rate of Application = RA

Septage Waste Receiving Facility = SWRF

Septage Waste Storage Facility = SWSF

United States Department of Agriculture = USDA

United States Environmental Protection Agency = USEPA

Wastewater Treatment Plant = WWTP

Chapter 1

Introduction

Amendments to Part 117, Septage Waste Servicers (Part 117), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), became law on October 12, 2004, in Michigan[3].

These amendments have resulted in significant changes in the requirements related to land application of septage waste in Michigan.

1.1 Importance of Land Application of Septage Waste

The proper and acceptable method for disposal of septage waste is still a topic of intense discussion. There is competition for agricultural land to be used for residential development, land application of septage waste, biosolids, and animal manure. The rapid development and expansion of residential homes in areas considered rural that have onsite wastewater systems continue to generate septage waste that must be disposed. The high cost of constructing new wastewater treatment plants (WWTP) or expanding existing WWTPs to accept and treat septage is a known challenge. Providing an alternative means of septage disposal that is economical and protects the environment and public health has become imperative. Land application of septage, when done properly, is an alternative method of septage disposal.

Land application of septage is beneficial in a number of ways. Septage provides important macro and micro nutrients for crop growth and can condition the soil for good crop growth. Growing feed crops, such as forages, can be a benefit to the animal industry. When land applied at agronomic rates, septage can reduce the need for some of the chemical fertilizers that would normally be used. However, improper septage management on land could result in crop damage and potential damage to the environment.

Proper management of soils, crops, and septage is important in maximizing the beneficial aspects of septage and at the same time addressing public concern.

1.2 Objectives

This manual is intended to give guidance to licensed septage waste firms that land apply septage waste. It can also provide guidance for personnel of local health departments (LHD) and state regulatory agencies that provide compliance oversight and enforcement of Part 117.

This document provides basic information that is expected to assist the licensee or land manager about how to manage the soils, crops, and septage at land sites. The goals of good management are:

- Prevent or reduce the risk to public health.
- Prevent or reduce the potential for nutrient and pathogen contamination of groundwater and other surface waters.
- Provide nutrients to grow crops.
- Reduce the cost of septage disposal.

1.3 Land Application of Septage Waste and State and Federal Laws

This document is mostly based on Michigan's Part 117, Septage Waste Servicers law[3]. Some aspects of the federal 40 CFR Part 503 entitled "Standards for the Use of or Disposal of Sewage Sludge[5]" are discussed. Licensees that land apply septage waste are expected to meet both Part 117 and Part 503 requirements. Some references are made to Michigan Part 24, "Land Application of Biosolids[1]," and federal 40 CFR Part 257, "Criteria for Classification of Solid Waste Disposal Facilities and Practices[4]." The guidance document is not intended to be a substitute for reading, understanding, and implementing Part 117, Part 503, Part 24, or other applicable referenced laws. There are some items in this manual that may not be explicitly stated in the laws referenced above but are considered good and generally accepted management practices for land application of septage waste. The reader is also encouraged to

consult the “Generally Accepted Agricultural and Management Practices” (GAAMP)[2]. This document is a product of the Michigan Right to Farm Act, 1981, PA 93.

1.4 References

1. Michigan Biosolids Law. 1999. Part 24, Land Application of Biosolids. NREPA, 1994 PA 451, as amended, R 323.2410(8).

2. Michigan Department of Agriculture (MDA). 2005. GAAMPs for Nutrient Utilization. Michigan Right-to-Farm Act, 1981, PA 93.

3. Michigan Septage Law. Part 117, NREPA, Act 451 of PA 1994, as amended. Enacted 2004.

4. United States Environmental Protection Agency (USEPA). Federal Septage Law, CFR 40, Part 257.3 – 5. Criteria for Classification of Solid Waste Disposal Facilities and Practices.

5. USEPA. Federal Septage Law, CFR 40. Part 503 Standards for the Use or Disposal of Sewage Sludge. Effective 1993.

Chapter 2

Definitions [1, 2, 3]

Agricultural Land: Land on which a food crop, a feed crop, or a fiber crop is grown, including land used or suitable for use as a range or pasture, a sod farm, or a Christmas tree farm.

Authorized Land Site: A land application site that has been authorized by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to permit land application of septage waste.

Certified Local Health Department: A city, county, or district department of health certified under section 11716.

Cover Crop: A crop planted primarily for the purpose of protecting and improving soil between periods of crop production. Cover crops may not necessarily be grown for harvest.

Cropping Year: The period of time covering 365 days when septage application and management practices are implemented at a land site. The period is from January 1 to December 31 of the calendar year.

Department: The Department of Environment, Great Lakes, and Energy or its authorized agent.

Director: The Director of the Department of Environment, Great Lakes, and Energy or his or her designee.

Domestic Septage: Liquid or solid material removed from a septic tank, cesspool, portable toilet, type III marine sanitation device, or similar storage or treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar facility that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease interceptor, grease trap, or other appurtenance used to retain grease or other fatty substances contained in restaurant waste.

Domestic Sewage: Waste and wastewater from humans or household operations.

Domestic Treatment Plant Septage: Biosolids generated during the treatment of domestic sewage in a treatment works and transported to a receiving facility or managed in accordance with a residuals management program approved by the department.

Erosion: Detachment and movement of soil or rock by water, wind, ice, or gravity.

Eutrophication: Nutrient enrichment of lakes, ponds, and other bodies of water that stimulates the growth of aquatic organisms (e.g., algae and aquatic weeds), which leads to a deficiency of oxygen in the body of water.

Fallow Land: A land site that is plowed or unplowed but not seeded with actively growing planned crops or vegetation for a period of time.

Feed Crops: Crops produced primarily for consumption by animals.

Fiber Crops: Crops such as flax and cotton.

Field: (see Site)

Food Crops: Crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

Food Establishment Septage: Material pumped from a grease interceptor, grease trap, or other appurtenance used to retain grease or other fatty substances contained in restaurant wastes, and which is blended into a uniform mixture, consisting of not more than 1 part of that restaurant-derived material per 3 parts of domestic septage, prior to land application or disposed of at a receiving facility.

Governmental Unit: A county, township, municipality, or regional authority.

Groundwater: Water below the land surface in the saturated zone.

Incorporation: The mechanical mixing of surface-applied septage waste with the soil.

Injection: The pressurized placement of septage waste below the surface of soil.

Isolation Distance: The horizontal distance from the perimeter of EGLE authorized septage application land site and a particular object (e.g., drinking water well, home, road, property line, etc.) being considered.

Land Application: A systematic and planned disposal of septage waste by surface or injection methods in a given field.

Land Manager: The person who applies septage waste, grows and/or harvests the crop(s) at the department authorized land site. There may be more than one person involved in the process.

Land (or field) Rotation: A planned system of site management where septage is applied on a specific authorized area of land during a cropping year. This is followed by a time period of no septage application and growing a crop on that specific area during the next cropping year.

Land Site Management: The sum total of all tillage (mechanical manipulation) operations, cropping practices, application of septage waste, fertilizer, and lime and/or other treatments applied to the soil.

Lime (or Alkali) Stabilization: This is a method of pathogen and vector attraction reduction involving the mixing of lime and septage.

Location: (see Site)

Mineral Soil: Soil with soil organic matter less than 20 percent. Most soils used by land appliers fall into this category.

Mottling: Spots or blotches of different colors or shades of colors interspersed with the dominant color that occurs in the subsoil of a soil profile, indicating a seasonal high water table.

New Land Site: A land site that is not currently permitted for which land application of septage waste is proposed.

Organic Soil: Soil with organic matter equal to or greater than 20 percent.

Pasture: Land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

Pathogen: A disease-causing agent. Pathogen includes, but is not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

Planned Crop or Vegetation: This is a specific type of crop or vegetation proposed by the licensee to be grown at the land site as part of a nutrient management plan.

Ponding: The presence of septage waste liquid on soil surface after one hour of application if injection is the method used and after 6 hours if surface application is the method used.

Portable Toilet: A moveable receptacle designed to hold human waste temporarily in a sanitary manner.

Public Contact Site: Land with high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

Runoff: Rainwater, leachate, septage waste, or other liquid that flows overland on any part of a land surface and runs off the land surface.

Runoff Controls: These are management practices developed and implemented at the septage waste land application site designed to reduce potential runoff from the site.

Screened or Ground Septage: Septage, as defined in the law, that has been screened through a screen of not greater than ½-inch mesh or slats separated by a gap of not greater than 3/8-inch before land application. Septage may be processed through a sewage grinder designed to not pass solids larger than ½-inch in diameter.

Septage Applicator Vehicle: The equipment that applies septage to the land site by surface application or injection.

Septage Waste: The fluid mixture of untreated and partially treated sewage solids, liquids, and sludge of human or domestic origin that is removed from a wastewater system. Septage waste consists only of

food establishment septage, domestic septage, domestic treatment plant septage, sanitary sewer cleanout septage, or any combination of these.

Where the word "septage" alone is used in this guidance manual, "septage waste" is implied.

Septage Waste Storage Facility: A structure that receives septage waste for storage but not for treatment.

Service or Servicing: Cleaning, removing, transporting, or disposing, by application to land or otherwise, of septage waste.

Site: A location or locations on a parcel or tract, as those terms are defined in section 102 of the land division act, 1967 PA 288, MCL 560.102, proposed or used for the disposal of septage waste on land.

Site Permit: A permit issued under section 11709 authorizing the application of septage waste to a site.

Soil (or Land) Degradation: The decline in soil quality such that it is not capable of supporting good plant growth.

Soil Fertility: The status of a soil with respect to the amount and availability of nutrients to plants for plant growth.

Soil Horizon: A layer of soil, approximately parallel to the soil surface, differing in properties and characteristics from adjacent layers below or above.

Soil Map: A map showing the distribution of soil types or other soil mapping units in relation to prominent physical and cultural features of the earth's surface.

Soil Profile: A vertical section of the soil through all its horizons and extending into the parent material.

Soil Series: There is at least one dominant soil series at each land site. Soil series consists of soils that have similar horizons. The soil horizons are similar in color, texture, structure, consistence, and composition (mineral and organic).

Soil Structure: The arrangement of primary soil particles into secondary particles, units, or peds. The secondary units are classified on the basis of size, shape, and degree of distinctness into classes, types, and grades respectively.

Soil Survey (County): This is a publication of the Natural Resources Conservation Service.

Soil Fertility Test: The laboratory analysis of a soil sample to determine soil pH and the amount and forms of plant-available nutrients using specific methods. Soil fertility testing is used to have a basis for knowing how much lime and nutrients to add to a soil to achieve maximum or optimum crop production. Soil test results are typically provided in a soil test report, along with nutrient and lime recommendations.

Soil Textural Class: Grouping into soil textural units based on the soil texture, e.g., sandy loam.

Soil Texture: The relative proportions of sand, silt, and clay. It also refers to the fineness or coarseness of the soil.

Surface Water: Means any of the following:

- The Great Lakes and their connecting waterways.
- Inland Lakes (greater than 5 acres).
- Rivers.
- Streams.
- Impoundments and perennial open drains.
- Ponds and wetlands. Wetlands may not have perennial standing water. Setbacks must be maintained from all perennial ponds and wetlands unless a site-specific variance is requested in accordance with Section 11720 of Part 117.

Stover: The materials that are left after harvest. For instance, corn stover consists of stalks and leaves that remain in the field after corn has been harvested.

Tank: An enclosed container placed on a septage waste vehicle to carry or transport septage waste.

Type I Public Water Supply, Type IIa Public Water Supply, Type IIb Public Water Supply, and Type III Public Water Supply: Those terms, respectively, as described in R 325.10502 of the Michigan Administrative Code.

Type III Marine Sanitation Device: That term as defined in 33 CFR 159.3, which means a device that is designed to prevent the overboard discharge of treated or untreated sewage or any waste derived from sewage

Vehicle Calibration: A systematic standardization of a vehicle to determine the quantity of material disposed over a given area. In land application of septage, vehicle calibration involves the standardization of the vehicle to give the quantity of septage applied per acre.

Water Table: The upper surface of groundwater or that level below which the soil is saturated with water.

Water Table (Seasonal High): The highest level that the water table reaches during the year. That level fluctuates throughout the year due to the season, rainfall, topography, and other factors.

Wetlands: Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Winter Months: Winter months are defined as December 21 to March 21.

2.1 References

1. Brady, Nyle C. and Weil, Ray R. 2002. The Nature and Properties of Soils. 13th Ed. Prentice Hall, Upper Saddle River, New Jersey 07458.

2. Michigan Septage Law. Part 117, NREPA. Enacted 2004.

3. USEPA. Federal Septage Law, CFR 40. Part 503 Standards for the Use or Disposal of Sewage Sludge. Effective 1993.

Chapter 3

Land Site Characteristics, Identification, and Evaluation

3.1 Land Site Selection and Characteristics

The licensee is responsible for selecting the land site that will be used for septage waste disposal. EGLE is responsible for having the selected land site inspected and authorized for septage disposal if the site is found to be suitable.

Prior to submitting the land application form with applicable fee in order to secure a land site for septage disposal, a licensee should conduct a **preliminary site evaluation on his/her own**, taking into consideration factors such as:

- Type of soils.
- Type of crops to be planted.
- Soil test for phosphorus.
- Slope of the land.
- Depth to water table.
- Isolation distances from disposal area.
- Previous land use.
- Remoteness of the site.
- Accessibility to the site.
- Location of the potential land site with reference to the service area of a Septage Waste Receiving Facility (SWRF).
- Distance from major septage business clients.
- Predominant wind direction.
- Other factors.

See 3.4.1 for details.

3.1.1 Slope

The slope of the land site is important. The purpose is to ensure that septage applied on the land remains at the application site and is not carried away to adjoining properties or other bodies of water due to storm water run off or melting snow. As shown in Table 3-1, the maximum slope is 6 percent when surface applying septage waste. When using subsurface injection for applying septage, the land's slope shall not exceed 12 percent. Soil maps categorize slopes. If you want to get slope information of your land site, check the soil map of your county.

Table 3-1. Slope Consideration.

Slope (%)	Surface Application	Injection
0 - 6	Permitted	Permitted
6.1 - 12	Not Permitted	Permitted
More than 12	Not Permitted	Not permitted

3.1.2 Water Table

There are a number of methods commonly used to evaluate the presence of and depth to the water table. These methods include, among others, redoximorphic features that may also be referred to as mottling, monitoring devices, direct observation of saturated groundwater, and dominant soil color. The method used should reflect the conditions at the site during times of application of septage waste. A combination of at least two methods may be necessary at certain locations in providing a more reliable determination of the water table conditions at the site. For instance, if the depth to the water table is not certain due to the characteristics of the soils at that site, additional methods such as monitoring devices may be used to confirm observations. If monitoring devices are used, it is important to know the direction of flow of the groundwater. The monitoring devices should be installed and monitored by the inspecting

agency. Furthermore, they should be installed at the appropriate time of the year that would make their use meaningful. See Appendix N for a suggested groundwater elevation monitoring well.

If the land site will be used for septage waste application during late fall through spring seasons, it is recommended that seasonal high water table be used as a guide to determine the suitability of the site. However, if septage waste will be land applied only during summer and early fall seasons, the presence of a saturated condition can be used to determine the suitability of the site.

If the surface application method is used, the depth to the water table should be measured from the potentially lowest depth of septage waste after incorporation with the soil. If an injection method is used, the depth to the water table should be measured from the potential lowest depth of the septage waste after injection. It is important to have at least 30 inches of nonsaturated soil from where septage waste is applied to the water table at any time of the year.

3.1.3 Isolation Distances

The following isolation distances shall be observed where septage is land applied. The isolation distance shall be equal to or exceed what is listed below in Table 3-2.

Table 3-2. Isolation Distances.

Features	Method of Application	
	Surface	Injection
Type I public water supply wells	2,000 feet	2,000 feet
Type IIa public water supply wells	2,000 feet	2,000 feet
Type IIb public water supply wells	800 feet	800 feet
Type III public water supply wells	800 feet	150 feet
Private drinking water wells	800 feet	150 feet
Other water wells	800 feet	150 feet
Homes or commercial buildings	800 feet	150 feet
Surface water	500 feet	150 feet
Roads or property lines	200 feet	150 feet

Definitions of types of water wells can be found in the Michigan Safe Drinking Water Act, 1976 PA 399, as amended (MSDWA), and the administrative rules below.

R 325.10502 Classification of public water supplies[1].

Rule 502. (1) For purposes of implementing the act, public water supplies are classified by the department into 3 types as follows:

(a) Type I: All community supplies are classified as type I public water supplies.

(b) Type II: All noncommunity supplies are classified as type II public water supplies.

(c) Type III: All water supplies which are not type I or type II public water supplies shall be classified as type III public water supplies.

(2) Type II public water supplies are further classified by the department as follows:

(a) Type IIa: Type IIa public water supplies are type II public water supplies with an average daily water production for the maximum month equal to or greater than 20,000 gallons per day.

(b) Type IIb: Type IIb public water supplies are type II public water supplies with an average daily water production for the maximum month of less than 20,000 gallons per day.

(3) When a supplier of water is unable to determine average daily water production, the department may use other criteria based on similar public water supplies to make a determination of classification for purposes of subrule (2).

History: 1954 ACS 94, Eff. Jan. 12, 1978; 1979 AC.

3.2 Land Site Identification and Description – New Land Site Requirements

An application for a new land site must be supported by detailed information as described in this section. This information is applicable to a person who wants to be licensed and the person who is already licensed and wants a new land site for the disposal of septage waste.

See **Appendix L** for new land site checklist.

New Land Site Definition: See Chapter 2 for definition of new land site.

3.2.1 Application Process Items to be Submitted

When the person has selected the site, the person shall provide information that describes and identifies the land site as part of the application process for inspection and approval.

The following information shall be provided when applying for a new land disposal site or when your license expires and is renewed every 5 years:

3.2.2 Map identifying from a County Land Atlas and Plat Book

You may work with your Clerk/Register of Deed, LHD, and other governmental or public agencies to access the information needed to complete your application.

3.2.3 Latitude and Longitude

Latitude: Measurement in degrees north or south from the equator.

Longitude: Measurement in degrees east or west of the earth's surface, as an arc of the equator. They are both used to locate a specific point on the globe including land application sites.

3.2.4 Name and Address of Land Owner

3.2.5 Name and Address of Land Manager, if Different than the Owner

3.2.6 Other Information - Maps (Aerial, Vicinity, Topographic, Soil)

Aerial Map

A map of the land site that is taken from the air. A vicinity map may also be an aerial map. See "Resources" at the beginning of the manual or the web.

Vicinity Map

A map that identifies the location of the site location with respect to existing public and/or private roads. This may also be an aerial map. It could be information from a plat book with the site clearly identified.

Topographic Map

A map that shows the relief (high and low points) of the soil surface at the land site, including slopes. See soil maps for the county where the land site is located.

Soil Map

It is a map showing the distribution of soil types or other mapping units. Provide a copy of available soil maps and the description of the soil, soil profile, and the depth to the groundwater table for the land site intended for use as outlined in the United States Department of Agriculture (USDA), Natural Resource Conservation Service, Soil Survey issued for that particular county.

Other Soils Information

Where soil maps are not available, at least one soil test pit or auger boring, sunk at the center of an area that represents about 5 acres, shall be used to describe the soil characteristics and identify the soil textural class. The soil description should be prepared by a competent person that has knowledge of soils.

3.2.7 Soil Fertility Test
(See Section 13.1 of this guidance document for details).

3.2.8 Land Site Plan
A plan drawn to scale (not less than 1 inch: 200 feet) showing the location of the septage application area in relation to:

- Homes or commercial buildings (150 ft/800 ft).
- Private drinking water wells and other wells (150 ft/800 ft).
- Surface water (150 ft/500 ft).
- Property lines (150 ft/200 ft).
- Roads (150/200 ft).

See Appendix M for an example of a land site plan.

Also indicate the location of the following:

- Drainage field tiles if any.
- Storage tanks or proposed screening tanks for septage waste.
- Easements or right-of-way.
- Surrounding land use, e.g. farms, residential homes, etc.
- Soil test pits and/or auger borings.
- Boundaries of each field (See Section 3.3.3 of this manual).
- Access roads.
- All areas within the land site that are available for septage application (See Sec. 3.2.9).
- Arrow pointing to the "north" direction.

3.2.9 Land Site Area
Indicate the size of each field and the total number of acres for all fields at the land site that will be used for septage disposal. It is important that the entire area available for septage application be evaluated for authorization the first time evaluation is conducted. This is due to the fact that a new site evaluation with applicable fees may be needed if the licensee extends the septage area in subsequent years beyond the previously evaluated area. The extended part that was not previously evaluated may be considered a new-use evaluation.

3.2.10 Public Access Restriction:
During a cropping year when septage waste is being actively land applied, restrict public access to the site by posting legible signs such as "No Trespassing," "Septage Application Site," or similar wordings, with letters not less than 2 inches high and placed at all vehicle access points. The remoteness of the site and/or fencing may be considered as ways of restricting public access to active disposal sites but these will be handled on a case by case basis.

3.2.11 Location of Proposed Land Site and SWRF
A proposed land site may not be authorized for septage waste application if it is within a service area of a SWRF. Check the Septage Program website at: Michigan.gov/EGLESeptage for the SWRF(s) near the proposed land site. Check the operating plan of the SWRF to know whether it has a service area. Determine whether your proposed land site is within or outside the service area of the SWRF. Some units of local government (township/county) have enacted ordinances banning or restricting the land application of septage waste.

3.2.12 Historical Site Use
Historical use includes, but is not limited to, manure application, biosolids application, crop rotation, and minimum or zero tillage systems. It is important to know from the land owner what kind of historical land use the land site has been subjected to in the past. Knowledge of historical site use can assist in

planning and implementing good management for optimum crop growth. Optimum crop growth is vital for efficiently "mining" the nutrients applied from septage.

The following checklist may be used as a guide:

(Check all that apply)

- ☐ Site is currently or was recently (2 years or less) under forest.
- ☐ Farm with manure application.
- ☐ Farm with biosolids application.
- ☐ Farm with regular crop rotation.
- ☐ Farm with zero tillage.
- ☐ Other _____

3.3 Land Site Identification Number (Site ID), Field Identification Label (Field ID) and Acreage

3.3.1 Site Identification Number (ID) and Number of Land Sites

Each land site, when authorized by EGLE, is assigned a numerical identification number (e.g., 1, 2, 3, etc.) This number shall be used in all correspondence involving the land site including, but not limited to, inspections (annual, reinspection, new), cropping plans and complaints. This information can be accessed on the EGLE Septage Program website.

Maximum Number: There is no maximum number of land sites a licensee can use. The licensee can have as many land sites as can be effectively managed, provided they are EGLE authorized.

Minimum Number: For a licensee who intends to land apply, the minimum number is one.

3.3.2 Field Identification Label, Number of Fields, and Number of Acres

If there is more than one field within a land site, the licensee shall use alphabetical letters (A, B, C, etc.) to identify each field. Once identified, these letters will be maintained and used in all correspondence including, but not limited to, inspections (annual, reinspection), cropping plans and complaints. The licensee shall inform EGLE in writing in a timely manner when field identification labels change or if additional labels are assigned to additional fields within a land site.

Maximum Number: There is no maximum number of fields within a land site.

Minimum Number: The minimum number of fields is two (2) within a land site, where the licensee has only one land site. This will enable the licensee to rotate between the fields from one cropping year to the next cropping year. If the licensee has more than one land site, the minimum number may be one (1) field.

Minimum Number of Acres: The number of acres depends on the volume of septage waste that will be disposed at the authorized land site. For effective management of the land site, including the ability to turn the septage waste applicator truck properly at the disposal location, a minimum of five (5) acres is recommended for each field.

3.3.3 Field Boundary Identification

Identify boundary of the land site or field by marking corners of the land site or field, unless already identified or marked naturally with tree lines, other vegetation, fence-rows, or roads. Examples of other

suitable boundary markers include flags and orange cones. Recording the location of the corners by longitude and latitude using a Global Positioning Systems (GPS) unit is highly recommended.

3.3.4 Land Site Address

Where a permanent address to a land site is available, it will be used to identify the site in all correspondence involving the site. Where a permanent site address is **not** available, an approximate/temporary site address will be used in all correspondence involving the site.

3.4 Land Site Application, Site Evaluation, Approval, and Authorization Process

The overall process leading to the permitting of a land site places distinct responsibilities on the licensee or new applicant, authorized LHD, and EGLE. This process is more fully discussed in this section.

3.4.1 Application – Licensee/New Applicant Responsibilities[2]

Step 1: Preliminary site evaluation - Check the land site on your own to determine whether this site could be authorized for land application of septage waste before you go to the next step. Use criteria in Section 3.1 as a guide. You may seek assistance from the LHD, Extension Office, EGLE and/or private consultant. The LHD is not mandated by EGLE to do the preliminary site evaluation for you.

Step 2: Complete the application form EQP5837 (Initial Application for Site Permit to Land Apply Septage Waste), if the licensee determines that this land site could be authorized.

Step 3: Attach all the required documents listed under 3.2.2 to 3.2.12. <u>This is the application packet with documents.</u>

Step 4: If payment is required, attach applicable fees by money order or check.

Step 5: Send the application packet to the EGLE address given below:

Department of Environment, Great Lakes, and Energy
Cashier's Office – 33000 45730 9087
P.O. Box 30657
Lansing, Michigan 48909-8157

Step 6: At the same time the application packet is sent to EGLE (Step 5 above), the licensee shall send notice of the application that includes the items listed under Sec. 3.2.2 to 3.2.5 to the following departments or agencies:

- ❖ Certified LHD* that has jurisdiction.
- ❖ The clerk of the city or township where the site is located.
- ❖ Land owners whose land or parcel is contiguous to the proposed disposal site or would be contiguous except for the presence of a highway, road, or street.
- ❖ Land owners whose lot or parcel is within 150 feet (if disposed by injection) or within 800 feet (if disposed by surface application).

** Note: In addition to the notice of application, the LHD will also get more detailed information about the site as contained in the application packet stated in step 3 above.*

3.4.2 LHD Responsibilities

Detailed responsibilities are outlined and described in the contract document titled "Agreement with Local Health Departments Appendix E." This document can be accessed from the EGLE Septage Program website at Michigan.gov/EGLESeptage under Local Health Department Information. This involves LHDs that participate in the Septage Program. In counties not under contract, EGLE provides these functions directly.

Step 1: The LHD, on receipt of the application packet from EGLE, will review the contents of the application packet to determine whether the application packet initially reviewed by EGLE for completeness is in fact complete.

Step 2: The LHD will contact the licensee and schedule an inspection of the land site(s). If questions arise from the application packet sent by EGLE to the LHD, the LHD will contact EGLE as soon as possible for clarification and then initiate action for inspection. It is important that the LHD and EGLE document contacts with each other about issues arising from the application packet for a timely and efficient response.

Step 3: Conduct a site inspection/evaluation after reviewing all items in the application packet.

- ❖ Complete the new land site inspection checklist.
- ❖ Document the observations in the inspection checklist if there is enough space. The LHD is strongly encouraged to use extra sheets to document observations.
- ❖ For soils, use soil test pits and/or auger borings to determine soil characteristics (e.g., soil textural class, soil color, water table, etc.). Use the method that would provide the best information for the type of soils with which you are working.

Step 4: After completing the site inspection/evaluation, the LHD will make a recommendation about approving or not approving the land site.

Step 5: The LHD sends the land site inspection checklist, field notes including site plan and other inspection notes to EGLE in a timely manner (30 days or less from the date of receipt of the application packet from EGLE as in Step 1).

3.4.3 EGLE Responsibilities

Details of EGLE's responsibilities are stated in the contract document titled "Agreement with Local Health Departments Appendix E." This information can be accessed in the EGLE Septage Program website.

Step 1: EGLE Septage Program staff will review the new land site application from the licensee/new applicant for completeness.

Step 2: If the application is determined to be complete, a copy of the application packet will be sent to the LHD under contract to implement the program at the local, county, or district level for site inspection.

However, if the application is deemed incomplete, the licensee/new applicant will be informed by letter, phone call, fax, or a combination of the three from EGLE requesting the missing information. Further action may not be taken with regard to processing until all relevant information is received.

Step 3: Upon receipt of the land site inspection documents from the LHD, EGLE will review the documents for completeness of the inspection and documentation.

Step 4: If complete, EGLE will authorize the use of the land site for septage waste application, in a timely manner (30 days or less from the date of receipt of the complete inspection documents from the LHD).

However, if the site inspection documents from the LHD are determined to be incomplete, EGLE will contact the LHD to provide complete site inspection documents as soon as possible.

EGLE will inform the licensee/new applicant in writing and copy the LHD whether the land site is authorized or denied.

3.5 References

1. EGLE. MSDWA and the Administrative Rules.

2. Michigan Septage Law. Part 117, NREPA. Enacted 2004.

Chapter 4

Introduction to Soils and Crops

4.1 Soils

Understanding basic soil science is important because septage is added to soils and soils treat septage. The degree and efficiency of septage treatment by the soil will depend on the nature and properties of the soil and several other factors.

4.1.1 Soil Texture

Soil texture refers to the relative amounts of sand, silt, and clay present in a soil. Soil texture is probably the most important soil property because it determines the amount of surface area exposed by soil particles and largely governs the amount and size of soil pores. These properties will largely determine a soil's fertility (plant nutrient availability), water holding capacity, and water movement (infiltration, percolation, leaching), which in turn influences crop growth, erosion, and septage waste management.

4.1.2 Soil Textural Class

Soils with similar amounts of sand, silt, and clay are grouped into twelve textural classes, as shown in Figure 4-1.

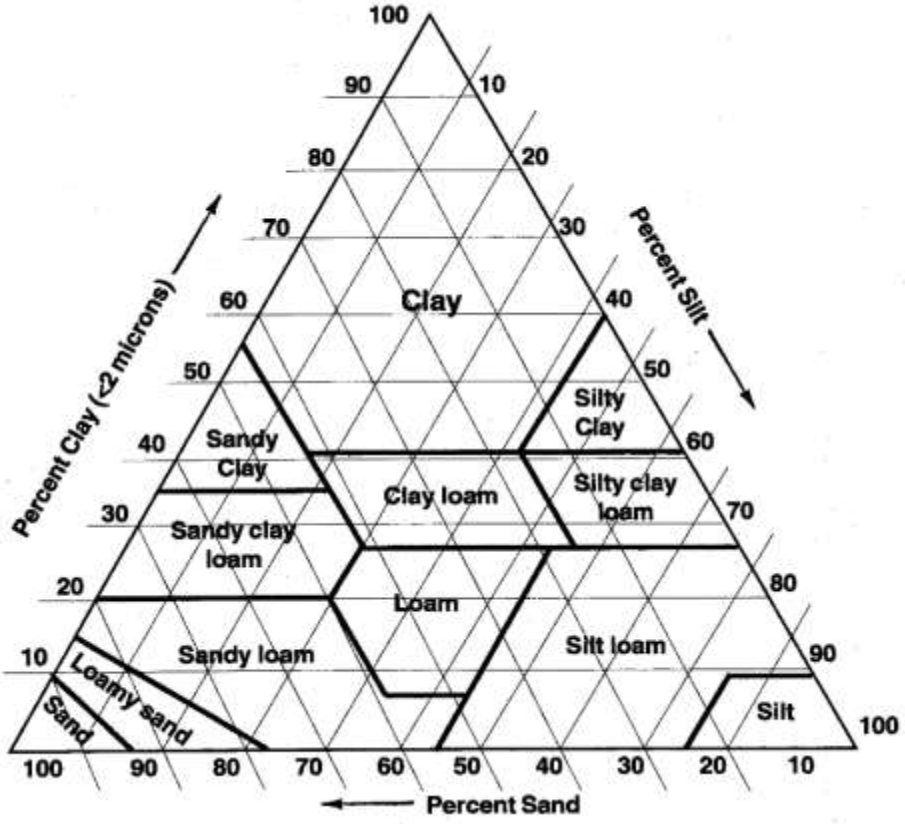


Figure 4-1. Soil Textural Class Diagram.

4.1.3 How to Know the Dominant Soil Textural Class at Your Land Site

Check the soil survey of the county. It contains information about the soil series of your land site. Soil series consists of soils that have similar horizons that are similar in color, texture, consistence, and composition. The soil survey gives information about how to manage the different soils found in a county and is produced by the Natural Resources Conservation Service[2].

Recommended Steps: The three major ways of determining the dominant soil textural class at septage application fields are the following:

- Laboratory Analysis: In this method, the licensee takes soil samples from each major soil horizon of a soil profile. The soil samples are analyzed in the soil testing laboratory to determine the percent of sand, silt, and clay. Using Figure 4-1, the soil textural class can be determined for each horizon, and then the dominant soil textural class of all the horizons can be determined. Where it may be impossible or impractical to determine the soil textural class for deeper soil horizons, the soil textural class of the top horizon (0 to 10 inches) may suffice as the dominant textural class for septage application purposes.

- Soil Survey Map: The soil textural class can be known by consulting the county soil survey map. Soil survey of a county is usually available in national, state, and local government offices or Michigan State University Extension (MSUE) Offices. This document contains information not only about the dominant soil type and soil textural class but also about how to best manage the soils at your septage application land site.

- Feel Method: Soil textural class can also be determined by the feel method. This is a practical determination of the soil in the field by working a little quantity of soil between the fingers with a little moisture. This method is usually described in introductory soil science books like Brady and Weil[1] and takes some practice and experience to make correct soil texture determination.

4.1.4 Soil Groups and Septage Application

There is a broad range of soils in the soil textural classes that are suitable for septage disposal. The following groups of soil textural classes are provided as a guide in the choice and use of land sites for land application of septage.

Table 4-1. Soil Groups.

Soil Group	Soil Textural Class	Comments
1	Sandy clay loam, clay loam, silty clay loam, loam, sandy loam, silt loam, and silt	Soils in this group provide the best choice compared to soils in Groups 2 and 3. There are some soils in this category that will also provide some challenges, such as silt, silty clay loams, and clay loams, similar to Group 3.
2	Loamy sands and sands	Soils in this group are not able to hold or retain enough moisture for good crop growth especially during the summer months. The other challenge is keeping the nitrogen in the septage within the root zone. Due to their permeability, nitrogen in soil solution has a greater tendency to move quickly below the root zone and contaminate groundwater, especially if excessive amounts are applied.
3	Sandy clay, silty clay, and clay	Managing soils in this group will also provide some real challenges especially during the wet and dry periods of the year. During the dry periods, achieving proper incorporation after surface application will be a challenge due to the dense nature of the soil. It is difficult to achieve good incorporation. During the wet period or when septage is applied, the soils are very sticky and tires of trucks frequently get stuck, and it is difficult to achieve good soil turnover. Water and nutrients are held very tight by the soil particles and do not readily release them for crop growth. These soils are generally not recommended for septage application due to the difficulty in tilling (incorporating and injecting) unless a special comprehensive soil management plan is submitted and approved before use.

4.2 Crops

Understanding the differences between crops is important because crops assist in removing the nutrients from the soil where septage is land applied. Moreover, the rate of septage applied depends on a number of factors including the type and yield of the crop and the quantities of nutrients removed from the soil by harvested crops.

4.2.1 Types

A variety of crops can be planted at septage disposal sites. These crops include grain crops, forage crops, and legume crops.

Grain crops include corn, barley, wheat, oats, rye, and sorghum.

Forage crops include alfalfa, birdsfoot trefoil, clover, orchard grass, ryegrass, sorghum and Sudan grass, bromegrass, tall fescue, and timothy.

Legume crops include alfalfa, birdsfoot trefoil, clover, soybeans, and vetch.

These are common crops in Michigan. The list given above is not comprehensive. There are several other crops in each of the categories listed above that can be planted.

4.2.2 Crop Selection Factors

The following factors should be considered in selecting crops for the land site. These include among others:

- Crop use – What the harvested crop will be used for, e.g., feed, food crop, pasture crop, or cover crop.
- Crop adaptability – Whether the crop can survive and grow well in that environment.
- Crop management – Whether licensee or the land manger is willing and able to manage the crop from planting to harvest.
- Phosphorus management – Whether the soil phosphorus level in the field is high and the licensee intends to plant crops that will assist in phosphorus reduction.

4.3 References

1. Brady, Nyle C. and Weil, Ray R. 2002. The Nature and Properties of Soils. 13th Ed. Prentice Hall, Upper Saddle River, New Jersey 07458.

2. United States Department of Agriculture and Natural Resources Conservation Service. Soil Survey. Contact Address: State Conservationist 3001 Coolidge Road, Suite 250, East Lansing, Michigan 48823-6350. Phone 517-324-5270, Fax 517-324-5171.

Chapter 5

Nutrient Management Plan of Land Application of Septage Waste

5.1 Nutrient Management Plan of Septage Waste Application

An effective nutrient management plan takes into consideration the following:

- Identifying the crops and the quantities of major nutrients (nitrogen, phosphorus, and potassium) required by the crops to be grown.
- Type and amount of the crop nutrients supplied from various sources such as septage waste, previous crops, chemical fertilizers, and animal manure.
- Realistic yield goals for the crops to be grown.
- Results of soil, plant, animal manure, or septage waste testing.
- MSU nutrient recommendations for crops to be grown or calculated nutrient removal for crops to be grown.
- Hydraulic loading rates for soils receiving septage waste that will not cause nutrient leaching.
- Practices developed to minimize loss of nutrients and maximize crop yields.

5.2 Soil Nutrients and Septage Waste

Plants or crops need at least 17 chemical elements to grow and be healthy, and these 17 elements are considered to be “essential nutrients.” Three essential plant nutrients (carbon, oxygen, and hydrogen) make up about 95 percent of plant dry matter. These three nutrients are obtained from water (H_2O) and the air as carbon dioxide (CO_2) and oxygen (O_2). The other 14 essential plant nutrients come principally from the soil.

Three of these 14 nutrients, nitrogen, phosphorus, and potassium, are called major or primary nutrients and are needed in relatively large amounts by crops. Varying amounts of these three nutrients are usually included in fertilizer, or nutrient recommendations for crops, depending on what the crop is and what the expected yield is. Generally, some amount of these three nutrients must be added, because the plant-available amounts in the soil are not enough to meet the crop’s needs. For some soil/plant situations in Michigan, nutrient recommendations may also be given for other essential plant nutrients besides nitrogen, phosphorus, and potassium, when soils cannot provide adequate amounts to meet a crop’s need.

For the three major plant nutrients, septage can provide nitrogen and phosphorus but very little, if any, potassium. Since most potassium discharged into a septic system is soluble, it is carried with effluent leaving the septic tank to the on-site sewage disposal system, so very little potassium remains in the tank as septage. Therefore, the two major nutrients discussed in this manual are nitrogen and phosphorus. When septage is applied to land, these two nutrients should be managed to ensure that adequate quantities are available for optimal crop growth but that excess amounts are not added that can negatively impact water quality.

5.3 Importance of Nitrogen

Nitrogen is one of the essential plant elements and is important in plant development. Nitrogen is part of many essential plant components, especially amino acids, which are the building blocks of proteins.

Nitrogen deficiency results in poor plant growth. Poor plant growth results in less nutrients being taken up by plants, which in turn may reduce the need of septage that can be applied to the land site.

On the other hand, nitrogen in excess of plant requirements can lead to potential leaching of nitrate nitrogen below the root zone to contaminate groundwater. Nitrogen is taken up in soil solution mainly in the form of nitrate and ammonium ions.

The uniform application of septage waste at an agronomic rate helps to provide optimum but not excess nitrogen, which will reduce the introduction of excessive nitrate nitrogen into groundwater. Typically, nitrogen added to soils will be converted to nitrate nitrogen by bacteria. High concentrations of nitrates can leach to groundwater. Nitrates in drinking water can cause health problems, especially for infants[1, 3].

5.3.1 Nitrogen Level in Soil and Nitrogen Soil Test

Inquiries have been made by septage waste haulers why nitrate nitrogen levels are not reported in the standard soil test reports. In Michigan, there is a nitrate-nitrogen test called the presidedress soil nitrate test (PSNT) that can be used for field corn or sugarbeets. Soil samples must be collected between May 15 to July 15, and results are used for making a sidedress application of nitrogen. Most soil testing laboratories do not test nitrate as part of a routine or basic soil test. This is mostly due to the fact that nitrate concentrations in soils are very dynamic and can change very quickly, making this test potentially unreliable for determining how much nitrogen may be available to crops.

Note: If you decide to request the soil laboratory to run a PSNT test, make sure you follow the directions as to how and when to sample the soil and how to handle the soil sample prior to submission to the laboratory for analysis. The PSNT test is not recommended.

5.3.2 Sources of Nitrogen in Soils

Some common sources of nitrogen at land application sites include:

- Septage.
- Biosolids* from WWTPs.
- Chemical fertilizers.
- Legumes.
- Manure**.
- Plant residues.

* Do not apply biosolids to a land site currently authorized and used for the land applications of septage waste in the same cropping year[2]. Land application of biosolids to an EGLE authorized site would require approval from the department.

** It is not recommended that manure be applied to an authorized land site where septage is land applied in the same cropping year. However, where manure is applied to such a land site, or will be applied, a comprehensive nutrient management plan is to be developed and submitted to EGLE that accounts for the nutrient contribution from manure.

5.4 Importance of Phosphorus

Phosphorus is the other essential plant element discussed in this manual. Phosphorus is a key component of adenosine triphosphate (ATP), which is considered the energy source for many plant processes. It is also an essential component of deoxyribonucleic acid (DNA), a key part in genetics (hereditary) and ribonucleic acid (RNA), an important player in protein synthesis.

5.4.1 Phosphorus Deficiency and Excess

Phosphorus deficiency results in stunted plant growth and poor seed development. Over application of phosphorus can lead to accumulation of total and available phosphorus in the soil. Excess phosphorus in soil can potentially increase its solubility and mobility leading to its migration or movement to lakes, streams, rivers, and other bodies of surface water. Phosphorus in surface waters can contribute to eutrophication (accelerating growth of algae and aquatic weeds).

5.4.2 Sources of Phosphorus in Soils

Common sources of phosphorus in soils at land application sites include:

- Domestic septage waste.
- Biosolids from WWTPs.
- Chemical fertilizers.
- Manure.
- Plant residues.

5.4.3 Soil Phosphorus Test at Septage Waste Application Sites

The maximum allowable concentration of phosphorus in soils at septage waste application land sites is 300 lb P/ac (or 150 ppm P) using the Bray P1 method, or 340 lb P/ac (or 170 ppm P) using Mehlich method[2], Part 117.

Septage shall not be allowed to be land applied when the phosphorus level in soil at the land site has exceeded the maximum allowable concentration.

Conversion Factor: Phosphorus in soil test reports is usually reported in pounds per acre (lb/ac) or parts per million (ppm)

It is possible to convert from one unit to the other as shown below.

Parts per million (ppm) to Pounds per acre (lb/ac)
ppm x 2 = lb/ac
Example: 98 ppm Phosphorus = 98 x 2 = 196 lb/ac

5.4.4 Phosphorus Uptake and Loss

Crop uptake of phosphorus has been reported to be 18 to 53 lb/ac/year depending on crop type and yield[4].

Other Conversions:	lb/ac x 1.12 = kg/ha	ppm (wet) = mg/L
	kg/ac x 0.893 = lb/ac	
	lb P_2O_5 = lb P x 2.29	lb K_2O = lb K x 1.20
Explanations:	kg/ha (kilograms per hectare)	mg/L (milligrams per liter)
	P_2O_5 (phosphorus pentoxide)	K_2O (potassium oxide)
	P (phosphorus)	K (potassium)

Phosphorus Loss

In general, phosphorus can be lost from the soil[1], which includes soils at land sites from one or a combination of the following:

- In dissolved surface runoff water (0.01 to 2.68 lb/ac).
- In eroded soil particles (mineral and organic) (0.09 to 8.93 lb/ac).
- Crop uptake (4.47 to 44.65 lb/ac).
- Other chemical processes.

5.4.5 Managing High Soil Phosphorus Levels at Land Sites

What to do when soil phosphorus test level is “High.”

The following steps will assist in managing the phosphorus levels in soils at land application sites.

Check the Phosphorus Level

Determine the soil phosphorus test level at your land site by conducting soil tests. Make sure that soil samples are properly taken. Refer to Appendix K about how to take soil samples. Take more than one composite sample if soil variability at the site is present.

Phosphorus Nutrient Plan Readjustment

When the soil phosphorus test level as shown in the soil test report is in the high range, but still less than 300 lb P/ac (150 ppm P), nutrient management should focus on phosphorus instead of nitrogen. The application of additional phosphorus sources from septage waste and/or chemical fertilizers should be significantly reduced or discontinued. Design and implement a nutrient management system that will assist in reducing the phosphorus level in the soil. Consider an alternate method of calculating the agronomic application rate based on phosphorus rather than nitrogen. See Sections 6.9 and 6.10 for additional information.

Furthermore, crops that are good phosphorus removers from soil such as alfalfa, bromegrass, orchard grass, timothy, or sorghum-Sudan grass should be grown to help remove phosphorus from the soil. In general, the largest nutrient removals are achieved using legumes and perennial grasses that are cut frequently in their early stages of growth[4]. Some haulers in Michigan have reported that they noticed remarkable decline in phosphorus levels in some of their high yielding corn fields when grown and harvested for silage.

Factors Affecting the Reduction of Soil Phosphorus Test Levels in Soils

The degree and rate of soil phosphorus test reduction depends on a number of factors including, but not exclusive to:

- Soil pH.
- Type of soil.
- Type of crop.
- Health of crop.
- Amount of phosphorus that can be removed by crop harvest.
- Nutrient balance of essential macro and micro nutrients.
- Management (how the crops and soils are treated).

Consult Appendix I for additional information about field crops and their ability to remove phosphorus in soil.

For additional information about nutrient removal, consult reference 5.

Phosphorus Monitoring and Evaluation

When your soil phosphorus test levels are high, it is recommended that you test the soil and evaluate the phosphorus status annually. High phosphorus level in soil cannot be reduced overnight. It may take several years to notice a significant decline in the soil phosphorus test level. For this reason, it is important not to over-apply septage or supplemental fertilizer at your land site.

5.5 References

1. Brady, Nyle C. and Weil, Ray R. 2002. The Nature and Properties of Soils. 13th Ed. Prentice Hall, Upper Saddle River, New Jersey 07458.

2. Michigan Biosolids Law. 1999. Part 24, Land Application of Biosolids. NREPA, R 323.2410(8).

3. Nugent, Mike, Michael A. Kamrin, Lois Wolfson and Frank M. D'Itri. 1993. Nitrate – A Drinking Water Concern. MSUE Bulletin WQ-19

4. USEPA. 1981. Process Design Manual. Land Treatment of Municipal Wastewater. EPA-625-1-81-013.

5. Warncke, D, J. Dahl, L. Jacobs and C. Laboski. 2004. Nutrient Recommendations for Field Crops in Michigan. MSUE Bulletin E-2904.

Chapter 6

Agronomic Application Rate of Septage Waste

6.1 Definition of Agronomic Application Rate (AAR)

The agronomic application rate (AAR) is the annual amount of septage waste that supplies the nitrogen needs of the crop or vegetation for optimal growth without leaving excess nitrogen that may leach below the root zone to pollute groundwater or move by surface runoff to pollute surface waters. The key concept is to manage the nutrients, crops, and soils to achieve the desired goal.

6.2. AAR Based on Nitrogen and Phosphorus

AARs are based on the nitrogen and phosphorus removal from the harvested portion of the crop and nitrogen recommendations in soil fertility test reports.

The AAR is based on nitrogen because nitrogen is usually the limiting element in crop production compared to phosphorus. The nitrogen applied to soil from the septage waste will be available to the existing crop, over which it is applied, or to the next crop. The amount of nitrogen available to the crop depends on a number of factors such as amount and form of nitrogen applied, soil temperature, soil moisture, soil type, disposal method, and other factors. These factors assist in determining the rate at which organic nitrogen in the septage waste is converted to inorganic forms that can be taken up by the crop. They also assist in determining how much nitrogen, in the form of ammonia, is lost to the atmosphere. When septage waste is land applied based on nitrogen, it tends to provide more phosphorus than the crop requirement. This may eventually lead to phosphorus accumulation in the soil. Therefore there is no need to consider supplemental phosphorus addition from other sources such as fertilizers and manure. Proper phosphorus management involves growing high phosphorus removing crops in the rotation with other crops for two to three years. For additional information about AAR of biosolids, animal manure, and septage waste, check these references [1, 2, 3, 4, 9].

6.3 Nutrient Removal by Crops

Crops remove nutrients such as nitrogen and phosphorus from the soil for their growth and development. The extent of nutrient removal depends on a number of factors such as:

- Amount of plant-available nutrient in the soil.
- Stage of growth and maturity of crop.
- Environmental conditions like moisture, temperature, soil pH, length of growing season, etc.
- Type, variety, and yield of crop.
- Efficiency of crop harvest.

AAR Based on Nitrogen Removal

The following factors are considered in determining the AAR for a particular crop:

- Type of crop or vegetation.
- Expected yield of the crop.
- Nitrogen content of septage.
- Nitrogen from other sources such as chemical fertilizers and from previous historical site use such as animal manure or previous legume crop.
- Nitrogen requirement of the crop.

6.3.1 Type of Crop

Crops need nutrients for good growth and yield. The amount of septage to be land applied depends on the type of crop because crops have different nutrient requirements.

6.3.2 Expected Yield of Crop

The greater the expected yield, the greater the amount of nutrients needed to support the yield. Since septage supplies nutrients, one should expect that the amount of septage applied per acre will increase as the nutrient requirement increases. Using inflated crop yields with the aim of applying more septage waste for land sites that can historically support lower crop yields can lead to proving more nutrients than

the crop requirement. Historical 3- to 5-year certified or properly documented yield data can be used in calculating what yield to expect, so a reasonable AAR can be calculated. You can get the yield data for counties in Michigan from the following sources and from other sources:

- National Agricultural Statistics Service (NASS)[5] – USDA. You can access the website with the following address: QuickStats.NASS.USDA.gov. This address provides average yield data for counties for which data is available. An example is given in Table 6-1. This is only an example.

Table 6-1. Example of Yield Data from a County in Michigan

U.S. & All States County Data - Crops									
Commodity	**Practice**	**Year**	**State**	**County**	**District**	**Planted All Purposes**	**Harvested**	**Yield**	**Production**
Corn For Grain	Total For Crop	2003	Michigan	Allegan	70	82,000 acres	74,600 acres	122 bushel	9,100,000 bushel
Corn For Grain	Total For Crop	2004	Michigan	Allegan	70	83,000 acres	70,300 acres	150 bushel	10,550,000 bushel
Corn For Grain	Total For Crop	2005	Michigan	Allegan	70	85,000 acres	73,000 acres	146 bushel	10,680,000 bushel
Corn For Grain	Total For Crop	2006	Michigan	Allegan	70	85,000 acres	72,200 acres	143 bushel	10,300,000 bushel

- Farmer's Record: If a farmer is able to provide accurate crop production records (3 to 5 years) for the specific septage waste disposal site, these records can be a good source for determining the "expected yield." The limitation is that records may not be readily available.

6.3.3 Nitrogen Content of Septage

The nitrogen content of 0.0026 lb N/gal in septage used in calculations of AAR in this guidance manual was established by USEPA[6, 7, 8, 9].

6.3.4 Nitrogen from Other Sources

Other sources of nitrogen, such as chemical fertilizers and previous crops, should be credited against nitrogen recommendations before the AAR is calculated. The amount of septage that shall be land applied depends on the amount of nitrogen contributed from the other sources. Nitrogen contributions from previous crops in a rotation are shown in Table 6-2. Nitrogen legume crop credits from the most current issue of the MSUE bulletin[10] can be used to help calculate the AAR.

Table 6-2. Nitrogen Credit for N-responsive Crops Grown in Rotation with these Crops[10]

Previous Crop	N Credit (lb/N/A)
Alfalfa, established	40 + (% stand*)
Alfalfa, seeding	40 + 0.5 (% stand)
Clover, established	40 + 0.5 (% stand)
Clover, seeding	20 + 0.5 (% stand)
Trefoil, established	40 + 0.5 (% stand)
Barley + legume	30 + 0.5 (% stand)
Oats + legume	30 + 0.5 (% stand)
Wheat + legume	30 + 0.5 (% stand)
Dry edible beans	20
Soybeans	30
Grass hay	40

* Percent (%) stand = the percent of the total vegetative cover occupied by legume plants; estimate the percentage visually or count the number of legume plants per square foot. One plant/sq ft = 20% stand; 2 plants/sq ft = 40%, etc., up to 5-6 plants/sq ft = 100% stand.

6.3.5 Nitrogen Requirement

The nitrogen requirement is the amount of nitrogen required by a crop for optimum growth in 365 days or in the natural lifecycle of the crop, whichever is applicable in your region.

Calculating the Nitrogen Requirement

The nitrogen requirement of a crop can be determined by either of two ways:

- Nutrient removal per unit yield of crop:
  Nitrogen Requirement (lb N/ac) = Expected Yield x (Nutrient Removal/unit yield)

- Soil test recommendations:
  Nitrogen requirement (lb N/ac) = Soil Test Report under nutrient recommendations

The crop nutrient removal and nutrient recommendation concepts are discussed below.

6.4 Methods for Determining the AAR Options

Several methods for determining the AAR are presented below in Sections 6.5 – 6.13.

Question - What plan do I use?

Answer - The plan you use depends on whether:

- You want to use the basic AAR, Option A.
  Basic AAR (Option A) is recommended for most haulers. See Section 6.5 below and Appendix C. However, if the predominant septage waste you land apply or intend to land apply is Portable Toilet Tank Waste (PTW) or Holding Tank Waste (HTW). Check Sections 6.12 and 6.13 for additional information about adjustments of the AAR from the rates given in Basic Option A.

- You want to perform calculations as stated in Section 6.6.

  If the predominant septage waste is PTW or HTW, check Sections 6.12 and 6.13 for additional information about adjustments of the AAR from the rates calculated.

- The level of soil phosphorus as shown in the soil test report is high and close to the maximum allowable limit. See Table 6-3 in Section 6.10.

6.5 Basic AAR - Option A

This is a basic option where a licensee or land manager uses the recommended precalculated AAR depending on the crop type. These recommendations are based on criteria such as:

- Crop type.
- Crop removal[10].
- Nitrogen recommendations[10].
- Nitrogen content in septage waste as reported in Section 6.3.3.
- Average crop yields in a typical mineral soil.

AARs from Option A assume septage waste as the only source of nitrogen for the crop and no additional application of nitrogen from other sources of nutrients. These are rates typically designed for soils at land sites within Soil Group 1(SG 1) as stated in Sec.4.1.4 but may be used at land sites with soils in other Soil Groups. **The table for Option A is shown in Appendix C.**

Items to be Submitted as part of your Cropping Plan for Review for Basic AAR - Option A.

- Completed Cropping Plan (Land Site Management).
- Soil test report (annual) for each field in each land site where septage waste has been or will be land applied within 12 months.
- Basic site plan showing fields within a land site for current cropping year.
- Other.

6.6 Advanced AAR - Option B

Option B is considered to be a more advanced option than Option A. This option can be used by licensees or land managers who want to land apply septage at rates greater than the rates recommended in Option A.

Worked examples, calculation worksheet and explanation of this option are available in Appendix D and E. In this option, the AAR is not precalculated. The land manager calculates:

- Nitrogen requirement as shown in Section 6.3.5.
- AAR based on the formula stated in Sections 6.7 and 6.8.

Items to be Submitted as part of your Cropping Plan for Review for Option B.

To use this option, provide all essential items listed below in this section.

- Completed Cropping Plan (Land Site Management Calendar).
- Soil test report (annual) for each field in each land site where septage waste has been or will be land applied within 12 months.
- Agronomic Application Rate Calculations.
- Expected Crop Yield (Three to 5-year certified or properly documented records of crop yields at each land site/field).
- Other nitrogen sources such as chemical fertilizers or manure, if applicable.
- Basic site plan showing fields within a land site for current cropping year.
- Nitrogen content in septage waste as reported in Section 6.3.3. Septage waste analysis may be required in some circumstances.
- Other as deemed essential by reviewer.

6.7 Calculating AAR Based on Nitrogen Removal

Based on the concept that the nitrogen removal in the harvested portion of the crop per unit yield, multiplied by the expected yield of the crop, provides a reasonable estimate of the amount of nitrogen required by the crop for normal growth and development. The amount of nitrogen and other plant nutrients such as phosphorus and potassium applied to the soil from septage waste and other nitrogen sources should provide the nutrients needed by the crop.

You can get crop removal information from Michigan State University Extension Service. “Nutrient Recommendations for Field Crops in Michigan,” Extension Bulletin E-2904. (Appendix I)[10]. Use the most current publication.

Example:
Calculating AAR based on nitrogen removal.

Crop = Corn (grain)
Expected (or realistic) crop yield = 110 bu/ac
Nitrogen removal = 0.9 lb N /bu (Appendix I) [10]
Nitrogen requirement = 110 bu/ac x 0.9 lb N/bu = 99 lb N/ac (Assumes zero N contribution from other N sources)
Nitrogen content in septage waste = 0.0026 lb N/gal (USEPA, 1993)[6, 7]
Agronomic application rate (gallons/ac/yr) = Nitrogen requirement of the crop / Nitrogen content of septage

= 99 lb N/ac / 0.0026 lb N/gal
= 38,000 gallons/acre/year (rounded)

6.8 Calculating AAR Based on Nitrogen Recommendations in Soil Test Reports
The AAR can also be calculated based on the nitrogen recommendations for the crop. These nutrient recommendations are given in some soil fertility test reports. Nutrient recommendations reported in the soil test report are based on several factors including, but not limited to, the amount of nitrogen already in the soil, type of crop, expected yield, previous crop, and whether or not manure has been applied or will be applied. For nitrogen recommendations to be useful, it is important to provide accurate and complete information on the soil information sheet. The information sheet should be submitted with the soil sample to the laboratory. Information about nutrient recommendations for some Michigan field crops is available in the MSUE Bulletin E-2904[10]. Some soil testing laboratories provide nutrient recommendations as part of the soil test service, but other laboratories only provide nutrient recommendations upon request by the customer.

To Use Nutrient Recommendations on a Soil Test Report

- Get nutrient recommendations from soil test report. The nitrogen requirement is usually reported under nutrient recommendations in the soil test report. This should be based on a realistic yield. Realistic yield information should be submitted to the laboratory at the time the soil sample is submitted for analysis. Recommendations based on inflated crop yield values may not be accepted.
- Use the nitrogen content value (see Section 6.3.3) to calculate the AAR.
- If other sources of nitrogen are applied or will be applied, deduct the amount of nitrogen in those sources from the nitrogen requirement before calculating the AAR.

Example
Calculating AAR based on nutrient recommendations from soil test reports

Crop = Wheat
Expected yield = 65 bu/ac
Assumed nitrogen content in septage waste = 0.0026 lb N/gal
Nitrogen requirement (recommendation from soil test report) = 50 lbs N/ac
Agronomic application rate (gallons/ac/yr) = Nitrogen requirement / Nitrogen content of septage waste

= 65 lb N/ac / 0.0026 lb N/gal
= 25,000 gallons/acre/year

6.9 AAR Based on Phosphorus
AAR can also be based on phosphorus. The AAR Application rate based on phosphorus will likely be different from the AAR based on nitrogen, because the amount of phosphorus and nitrogen required and used by the crop will be different. Phosphorus-based AAR is particularly important for fields that have

high soil phosphorus test levels and fields that have high risk soil phosphorus loss or fields close to surface waters.

Example:
Calculating AAR Based on phosphorus removal

Crop = Corn (grain)
Expected (or realistic yield) crop yield = 110 bu/ac
Phosphorus removal = 0.37 lb P_2O_5
Phosphorus requirement = 110 bu/ac x 0.37 lb/bu = 41 lbs P_2O_5/ac (Assumes zero P contribution from other P sources)
Phosphorus content in septage waste =0.003 lb P_2O_5/ gal*
Agronomic application rate (gallons/ac/yr) = $\frac{41 \text{ lbs } P_2O_5}{0.003 \ P_2O_5/\text{gal}}$
=14,000 gallons/ac/yr

* Mean value obtained from laboratory analysis of some septage waste samples.

6.10 General Guidance about When to Calculate AAR Based on Nitrogen or Phosphorus

Table 6-3 When to Calculate AAR Based on Nitrogen or Phosphorus

Level of Soil Phosphorus (From soil test report) lbs P/ac	**Recommended AAR of Septage Waste Calculation**
≥ 300 (Maximum Limit)	 Septage waste application not permitted Grow high phosphorus removal crop
150 – 299 (High Level)	AAR to be based on phosphorus crop removal Redesign nutrient management plan to include high phosphorus removal crops
≤ 149 (Low to Medium Level)	AAR can be based on nitrogen crop removal or phosphorus crop removal. See Options A in Appendix C and Options B in Appendix D.

6.11 Nutrient Management and Land Application of Special Categories of Septage Waste, PTW, and HTW

PTW: This type of septage is considered a high strength waste. It has been reported that the nitrogen content of portable toilet waste is 4 to 6 times higher than that of domestic septage waste (USEPA Part 503)[6].

HTW: This is septage waste retained in septic tanks or other receptacles on a temporary basis before disposal at approved septage waste receiving facilities or authorized land disposal sites. They are not connected to on-site wastewater disposal units such as drain fields.

The tanks or receptacles are usually emptied on a more regular and frequent basis compared to tanks connected to drain fields.

With regard to nutrient characteristics, HTW is considered a low strength septage waste compared to regular domestic septage waste. The content of nutrients such as nitrogen and phosphorus in each category of septage waste varies with the load location where it is generated and other factors. There are significant differences in nitrogen and phosphorus content in the PTW and HTW compared to regular septage waste. Due to the different amounts of nitrogen in these categories of septage waste, the AAR of PTW and HTW for land application purposes will vary significantly.

6.12 AAR of Portable Toilet Waste

Basic AAR: If PTW is the primary septage waste that is land applied, the AAR can be determined by reducing the AAR obtained from Option A or Option B three times. The AAR in Options A and B are based on the nitrogen content of 0.0026 lb N/gallon as used in the USEPA Part 503.

Example:

The AAR for corn (grain) from Option A = 38,000 gallons/acre/year. (No additional nitrogen sources).

The AAR using PTW = 38,000 gallons/3 = 13,000 gallons/acre/year (Rounded).

AAR Using Laboratory Data

The results from the PTW septage waste analysis can also be used to calculate the AAR for the crop, if the land manager wants to do that. This option is not recommended.

1. Decide on the crop to grow following septage waste application or the crop over which septage waste will be applied.
2. Determine the realistic or expected yield of the crop. See Section 6.3.2 for yield sources.
3. Sample and test typical PTW. The test parameters are stated in Section 13.4.
4. Sample soil and have a standard soil fertility test completed. Obtain MSU nutrient recommendations for the crop, based on soil test results.
5. Calculate AAR based on the formula:

$$\text{AAR (gallons/ac)} = \frac{\text{Nitrogen Recommendation}}{\text{Nitrogen Content of Septage Waste (PTW)}}$$

6.13 AAR of Holding Tank Waste

Basic AAR: If HTW is the primary category of septage waste used for land application, the AAR can be determined by increasing AAR from Option A or Option B three (3) times.

Example:

The AAR for corn (grain) from Option A = 38,000 gallons/acre/year. (No additional nitrogen sources).

The AAR using HTW = 38,000 gallons x 3 = 114,000 gallons/acre/year.

The application of this AAR will require split applications and should be based on the hydraulic loading rate per day, week, or month. See Chapter 14.

AAR Using Laboratory Data

The results from the HTW analysis can also be used to calculate the AAR for the crop, if the land manager wants to do that. This option is not mandatory.

1. Decide on the crop to grow following septage waste application or the crop over which septage waste will be applied.
2. Determine the realistic or expected yield of the crop. See Chapter 6.3.2 for yield sources.
3. Sample and test typical HTW. The test parameters are stated in Chapter 13, Section 13.5.

4. Sample soil and have a standard soil fertility test completed. Obtain nutrient recommendations for the crop, based on soil test results.
5. Calculate AAR based on the formula:

$$\text{AAR (gallons/ac)} = \frac{\text{Nitrogen Recommendation}}{\text{Nitrogen Content of Septage Waste (HTW)}}$$

Note: Haulers who land apply are strongly encouraged to use Comprehensive Nutrient Management Consultants (CNMP) if they do not take advantage of the information in the Guidance Manual and the training opportunities provided by EGLE.

6.14 References

1. Davis, Jessica. 2003. Fact Sheet # 25: Making Decisions About Application Rates. Livestock and poultry Environmental Stewardship (LPES).

2. Downing, T, D. Sullivan, J. Hart, and M. Gamroth. 2007. Manure Application Rates for Forage Production. Oregon State university Extension Service EM 8585-E.

3. Michigan Biosolids Law. 1999. Part 24, Land Application of Biosolids. Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended, R 323.2410(8).

4. National Manual of Good Practice for Biosolids. 2005. Chapter 13- Biosolids Nutrient Management/Calculating Agronomic Rate of Application. National Biosolids Partnership.

5. USDA, National Agricultural Statistics Service. Crop Yield Data in Michigan. NASS.USDA.gov.

6. USEPA. 1993. Domestic Septage Regulatory Guidance. A Guide to the EPA 503 Rule. EPA-832-B-92-005.

7. USEPA. 1993. Hauled Domestic Waste Land Application of Septage. A Region 5 Introspective. Chicago, Illinois.

8. USEPA. 1994. Guide to Septage Treatment and Disposal. EPA-625-R-94- 002

9. USEPA. 1994. Land application of sewage sludge. A guide for land appliers on the requirements of the Federal standards for the use or disposal of sewage sludge, 40 CFR Part 503 EPA-831-B-93-002b

10. Warncke, D, J. Dahl, L. Jacobs and C. Laboski. 2004. Nutrient Recommendations for Field Crops in Michigan. Michigan State University Extension Bulletin E-2904.

Other Additional Reference

MDA. 2005. Generally Accepted Agricultural and Management Practices (GAAMP) for Nutrient Utilization. Michigan Right-to-Farm Act, 1981, PA 93.

Chapter 7

Cropping Plan

7.1 Understanding a Cropping Plan

A cropping plan is a total land site management plan that clearly shows how the hauler or his designated land manager will use the land site for the application of septage waste during twelve consecutive months. Management operations such as tillage (disking, injection), septage waste application, liming, fertilizer application, planting, weed control, crop harvesting and other practices on EGLE approved land sites during a 365-day period are part of the cropping plan.

7.2 Cropping Plan (Land Site Management) Design

The cropping plan design is a layout of information relevant to the land application and management of septage waste.

A comprehensive cropping plan at each land site should include, at the minimum, the following information:

- Septage business identification.
- Land site and field identification.
- Cropping year.
- Acreage of the field that will be used.
- Phosphorus level (soil fertility test).
- Agronomic application rates.
- Type of crop following septage application and previous crop.
- Crop planting and harvest dates.
- Beginning and end period of septage waste application.
- Crop Use (animal feed or other).
- Dominant soil class (e. g., sandy loam).
- Erosion/surface runoff control plan.
- Pathogen and vector attraction reduction methods.
- Septage waste application method.
- Applicator vehicle calibration information.
- Winter disposal plan.
- Soil sampling date.
- Other sources of nutrients apart from septage waste that will be applied.

7.3 Explanation of the Components of a Comprehensive Cropping Plan

The Cropping Plan format and an example of a cropping plan are given in Appendices A and B. See Note 2 at the end of this chapter. Refer to the appendices as you review the sections that follow.

7.3.1 Septage Business Identification

Indicate name of the business and the septage waste license number.

7.3.2 Land Application Site Identification

Identify the location of the land site that is approved for the application of septage waste. If there is no assigned address, use an address that is closest to the location. Indicate clearly the fields within the land site and the site identification number (ID #). Include other identifiers such as Township and Range designation and Section number, and portion of section where site is located.

7.3.3 Cropping Year

Identify the calendar year of the proposed cropping plan.

7.3.4 Acreage: Available Acreage – How to Determine the Acreage
Indicate the proposed number of acres that will be used for the application of septage waste during the cropping year. This number may not be the same as the number of acres owned by the land owner. The acreage in the cropping plan may also not be the same as the number of acres available for you to use.

It simply means the number of acres you intend to use during a given cropping year.

How to Determine the Acreage:

Measure the Length of the Field (in feet) = 900 ft
Measure the Width of the Field (feet) = 484 ft

Multiply the Length and Width = 900 ft x 484 ft = 435,600 sq ft

1 Acre = 43,560 sq ft

$$\text{Number of acres} = \frac{435{,}600 \text{ sq ft}}{43{,}560 \text{ sq ft}} = 10 \text{ Acres}$$

7.3.5 Soil Sampling Date - Soil Phosphorus Level
Indicate the date(s) when soil samples were collected from the site and submitted to the soil testing laboratory. Indicate the current soil phosphorus test level. You can obtain this information from your soil test report. For proper conversion of parts per million (ppm) to pounds per acre (lb/ac) see Chapter 5, Section 5.4.3 of this manual. The soil test report will also show the soil sample analysis date. Soil samples should be within one year of the date of septage waste application. See Chapter 13, 13.2.1 for time of soil sampling.

7.3.6 Agronomic Application Rates
The AAR is the maximum amount of septage waste that may be land applied in a given year to provide the essential nutrients for a crop. The AAR is designed for the current crop, if septage waste is to be land applied over existing crop such as hay crop, or for the next crop that will follow the septage waste application in the same field. Enter the AAR value you obtained using guidance from Chapter 6.

7.3.7 Crops
Indicate the previous crop grown before septage waste application and the crop that will follow after septage waste application on the same field. Example: See Appendix B, Site ID #1, Fields A and B.

7.3.8 Crop Planting and Harvest Date
Using the months at the top of the cropping plan table format, indicate when planting of a crop may begin and when harvesting may commence. The dates may vary depending on the crop or what the land manager may do.

7.3.9 Septage Waste Application
Based on the months of the year in the cropping plan form, show when septage application may begin and when it may end. If septage waste will not be land applied to a particular field within the cropping year, indicate it on the cropping plan. See example in Appendix B.

7.3.10 Crop Use
Indicate how the harvested crop(s) will be used. Go to Chapter 16 for guidance as to how crops harvested from land sites receiving septage waste may be used. Chapter 16 covers crop and grazing restrictions. If the crop planted at the site is only for erosion and surface runoff control or maintenance grass cover and may or may not be plowed under, indicate this clearly in the cropping plan.

7.3.11 Soil Group Class
Indicate the primary soil group of the land site. Go to Chapter 4 for guidance.

7.3.12 Erosion and Surface Runoff Control Methods
The cropping plan submitted should indicate how erosion and runoff may be controlled at the land site. It is important for the septage waste that is land applied to remain where it was applied and not flow over land to neighboring parcels or surface waters due to wet weather events such as rainstorms and melting snow. Indicate the erosion and runoff method. Go to Chapter 8 for various erosion and runoff control methods and indicate all that may apply. You may add an erosion and runoff method that is not listed. In order to keep the septage waste in the field and not move down the slope, it is important to keep in mind the calibrated rate of application as stated in Chapter 10, the slope of the field and type of soil (soil textural class). Furthermore, the AAR is the amount of septage waste that is meant to spread over the field over a period of time within the year.

7.3.13 Pathogen and Vector Attraction Reduction Methods
Indicate the method(s) you intend to use to reduce pathogen and vector attraction reduction. Go to Chapters 11 and 16 for guidance.

7.3.14 Septage Waste Application Method
Indicate whether the method of septage waste application is by surface application or injection into the soil or both depending on the type of your operation and time of the year.

7.3.15 Applicator Vehicle Calibration
Indicate the rate of septage waste application from the applicator vehicle in a single pass per acre. Go to Chapter 10 for guidance.

7.3.16 Winter Disposal Plan
Indicate the winter plan for disposal of septage waste. If you intend to land apply during the winter months when the soil is not frozen, go to Chapter 9 for guidance.

7.3.17 Other Sources of Nutrients Apart from Septage Waste that will be Applied
If other sources of nutrients such as chemical fertilizers and animal manure are used in the same cropping year when septage waste will be applied, state it clearly in the cropping plan. Take the amount of the nutrients, for example nitrogen into consideration when calculating the AAR. See Chapter 6 about calculations.

7.4 Planting, Harvesting, Field Rotation, and Septage Waste Application Patterns
The cropping plan shows land management practices starting from January to December that matches the calendar year. See the cropping plan form in Appendix A. **This is the plan to use**. Any hauler who wants to use a different plan may contact EGLE. Cropping plans different from the recommended plan will be handled on a case by case basis.

Planting, harvesting, and septage waste application patterns within a calendar year will vary from hauler to hauler. For instance, at one land site Field A may be under crops with little or no septage waste application. On the other hand, Field B at the same land site may be used mainly for septage waste application during the year. The following year the process reverses. The form allows you to indicate the previous crop for nutrient credit, current crop, and the crop that will follow septage waste application, if applicable. Do not leave any month of the year unaccounted for regarding the use of the land.

7.5 Cropping Plan for Reserve Land Site (Site or Field Not In Use)
There are some land sites that are considered “reserve.” This means that the hauler does not intend to use the land for septage waste application. They may leave it fallow, allow grass vegetation or grow crops but septage waste will not be applied. They want to keep it as reserve land until they are ready to use it at a later time. This is permissible. However, the hauler is still expected to submit a cropping plan

form identifying the land site or field and clearly indicate "Reserve Land Site" or "No Septage Waste Application until Further Notice." An annual soil test is not required for such land sites or fields.

Note 1: It is the responsibility of the septage waste firm owner to communicate with the land manager if that person is different from the septage business owner. EGLE deals directly with the licensed septage waste business owner and not necessarily the land owner or other persons who are not licensed by the department.

Note 2: This is the cropping plan to be submitted by the licensee showing how EGLE authorized land site will be used for the land application of septage waste. This is a proposed plan. The plan may change. If the entire cropping plan or some parts of the plan changes after submitting it to EGLE, send a revised plan within two weeks of the change. This is especially critical when growing crops for human consumption. See Chapter 16 if growing crops for human consumption.

Chapter 8

Erosion and Surface Runoff Control Practices at Septage Waste Land Application Sites

8.1 Erosion Control Methods at Application Land Sites

Septage waste applied to soil will tend to move away from the point of application, especially for surface applied septage. The degree of septage waste movement away from the point of application depends on the following factors:

- The quantity of septage waste applied.
- The viscosity (thickness) of septage waste.
- The uniformity of septage waste application.
- The type and thickness of vegetative cover, if any.
- Time of year.
- Amount and duration of rainfall.
- Soil type (e.g., loamy sand and sandy clay loam).
- Slope of the land.
- Soil moisture at the time of application.

Septage waste contains pathogens, nutrients, metals, and other pollutants that can adversely affect human health, wildlife, and the environment if it is not managed in accordance with state and federal laws. In order to reduce the movement of soil and septage waste from application sites to adjoining properties and waters, it is essential to reduce the runoff of surface water (rain and melting snow). There are methods that can be used to control soil erosion. These include, among others, vegetative border strips, cover crops, and tillage operations[1, 2, 3].

8.2.1 Vegetative (grass) Filter Strip

A septage waste application area is either entirely or partially surrounded by permanent grass or vegetation filter strip to reduce movement of soil particles from the field (Figure 8-1). If partially surrounded, the grass strip must always be at the lower end of the slope where surface water exits the field. The wider and denser the vegetation, the more effective the control method. The width will depend on the slope and risk of soil loss from the site. A minimum of 50 feet is recommended.

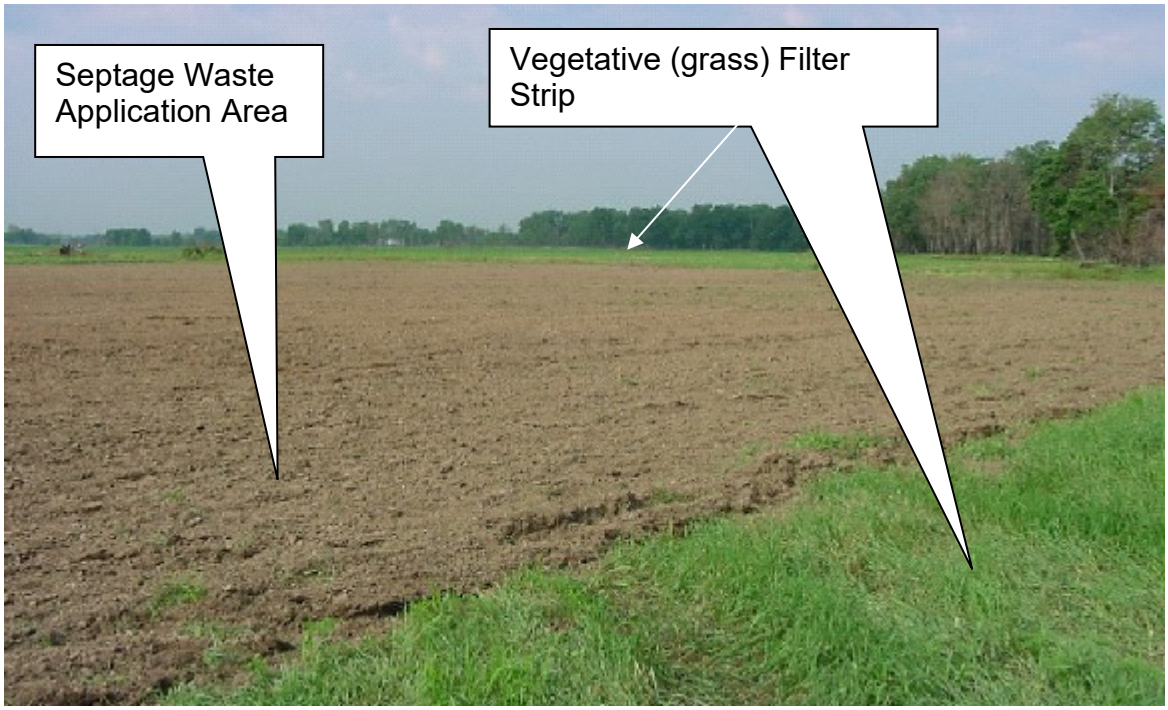


Figure 8-1. Vegetative Border Strip for Surface Erosion Control

8.2.2 Cover Crop

Erosion and surface runoff can also be controlled by a cropping plan that includes cover crops that cover the soil surface during periods when septage waste is not land applied as shown in Figure 8-2.

Figure 8-2. Surface Erosion Control Using Cover Crop

Forage crops such as grasses and legumes are effective erosion control crops. See Section 8.3.2 for details about how planting of cover crops and septage waste application patterns can assist in erosion and runoff control. Cover crops are typically not harvested and can be plowed under.

8.2.3 Windbreak

Land site surrounded by thick and tall vegetation can assist in reducing wind erosion and odor problems as shown in Figure 8-3[4].

Figure 8-3. Use of Windbreaks to Control Wind Erosion

8.2.4 Tillage Operations

The time to incorporate after septage waste application to fallow land shall not exceed 6 hours or 48 hours if lime-stabilized. It is highly recommended that surface applied septage waste be incorporated and injected perpendicular to the slope. This will reduce the potential for septage runoff.

Recommended Action: Determine the flow of water from the application site. Run the septage applicator and incorporation vehicles perpendicular to the direction of flow as shown in Figure 8-4.

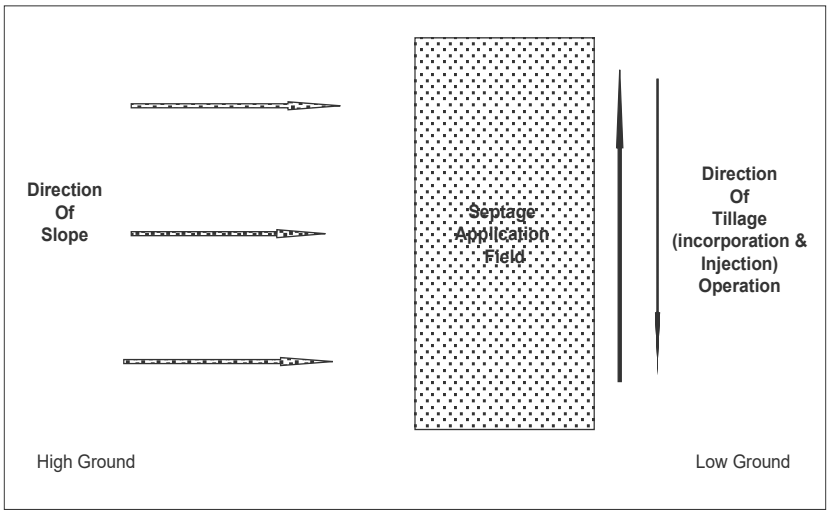


Figure 8-4 Direction of Septage Application in Relation to Slope

8.2.5 Slope of Land

The choice of a land site with a slope of 2 percent or less is an acceptable erosion and runoff control method. A flat field with vegetative filter strip even provides a better method than just the vegetative strip or slope alone.

8.2.6 Other Methods

Other approved methods of erosion control can also be used. The key point is to reduce, as much as possible, the movement of soil particles with septage from the application site to adjacent areas.

Note: The licensee will be required to implement an erosion and runoff control plan at the site if there is evidence of septage waste loss to adjacent properties and/or surface waters during a site visit for annual, follow-up, complaint, or other activity.

8.3 Septage Waste Application Pattern and Erosion and Surface Runoff Control

It is important to indicate how the hauler or land manager will control erosion and surface runoff issues at the land site. At some land sites, erosion may not be a problem due to the slope of the land. Many land sites may encounter surface runoff in one form or another. The degree of the problem will vary depending on the slope, soil type, method of septage waste application, and other factors. The land manager needs to show that he does not allow septage waste to be carried out of the application area to adjacent parcels or to surface waters.

Exposure of the bare soil of the land site to water and wind throughout the spring and summer months of septage waste application is counterproductive to proper soil management. In many land sites, it has been observed that the entire 4-, 6-, or 10-acre field is subjected to haphazard application of septage waste leaving the entire field open to water and wind erosion and run-off.

8.3.1 Open Field Septage Waste Application Pattern

This is the pattern where the septage waste is land applied over the entire field throughout the year with no planned crops. The entire field is exposed to water and wind erosion for several months of the year as shown in Figure 8-5. Open fields are not recommended.

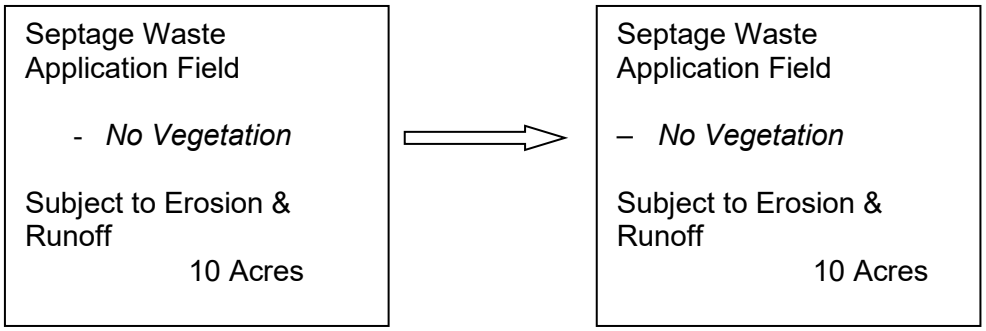


Figure 8-5. Open Field Pattern

8.3.2 Protected Field Septage Waste Application Pattern

In the protected field pattern, only a portion of the entire field designated for septage waste application in the current year is used at a given time until the maximum limit is reached, as seen in Figure 8-6. The other portion of the field is planted with cover crops to protect the soil. The hauler may plow in the cover crop and apply septage waste in that section. The portion that has reached the maximum rate of application is seeded with a crop to protect the soil.

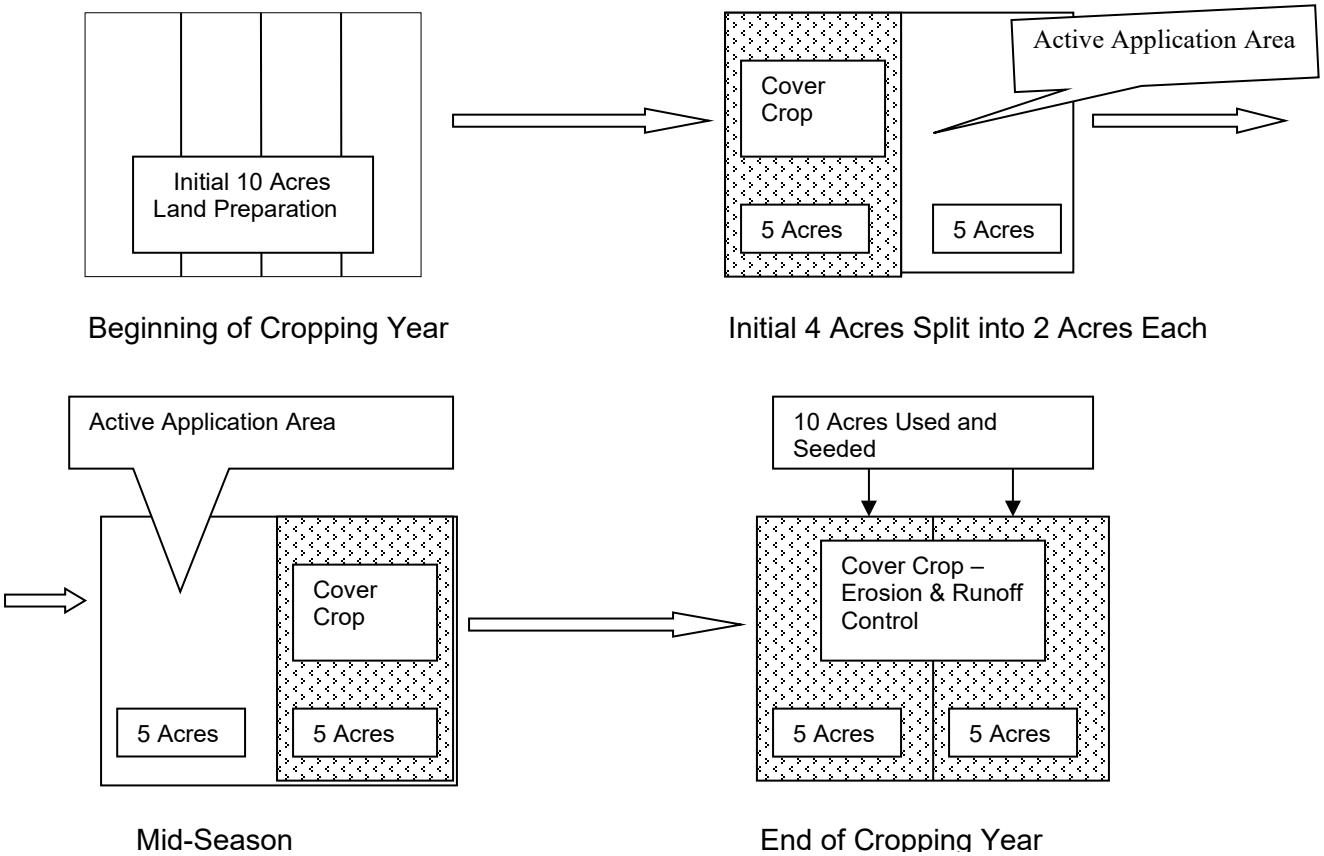


Figure 8-6. Protected Field Pattern

Example:

Number of acres to be used for septage waste application this current year = 10.

1. Divide the 10-acre field into not more than two 5-acre pieces.
2. Apply septage to only 5 acres until the maximum annual application rate is attained. Plant cover crop to this half of the field to reduce erosion/run-off.
3. The other half that was under cover crops may now be used for septage waste application.

8.4 References

1. Feyereisen, G.W, B.N. Wilson, G.R. Sands, J.S. Strock and P.M. Porter. 2006. Potential for a rye cover crop to reduce nitrate loss in southwestern Minnesota. Agronomy Journal 98:14116-1426.

2. Harrigan, T, B. Northcott, N. Rector, and D. Bolinger. 2007. Part 1: Sediment and Contaminant Runoff. Michigan State University Extension Bulletin WO-1036.

3. Michigan Department of Agriculture. 2005. Generally Accepted Agricultural and Management Practices for Nutrient Utilization. Michigan Right-to-Farm Act, 1981, PA 93.

4. Ohio Department of Natural Resources. 2007. State Launches New Effort to Promote Planting Windbreaks to Reduce Erosion. Photo.

Chapter 9

Septage Waste Management in Winter Months

9.1 Land Conditions in Winter Months (December 21- March 21)

In Michigan, soils are wet, saturated, snow-covered, or frozen during the winter months. These conditions make it difficult to apply septage without damaging soil structure and possibly causing runoff of the septage from the site.

9.2 Frozen Field Condition (Not Permitted)

Effective October 12, 2006, land application of septage when the soil is frozen is not permitted.

9.3 When the Soil is not Frozen

Septage waste may be land applied by surface application method followed by incorporation within 6 hours or within 48 hours, if lime-stabilized, or by subsurface injection. This is permitted if the following conditions apply:

- You have received prior authorization from EGLE for that site/location (see Section 9.6).
- The soil is not frozen.
- The septage waste can be uniformly applied at agronomic application rates.
- The soil is not saturated with water (see soil moisture testing in Chapter 14, Section 14.1).
- The surface-applied septage waste can be properly incorporated within 6 hours, or 48 hours if lime-stabilized, without creating frozen soil conditions. If soil freezes in the process of incorporation or injection, application shall cease.
- The subsurface-injected septage waste is properly released below the soil surface without bubbling to the surface within one hour.

Required Action: Septage waste application shall cease when the soil freezes or is too wet.

Recommended Action: Do not land apply septage waste when application cannot be done uniformly at agronomic rates, proper incorporation or subsurface injection is not possible or the soil is saturated with water. Application may be resumed when weather conditions permit it. For subsurface injection method, septage waste that bubbles to the surface and remains on the surface within one hour of application should be properly incorporated as part of the vector attraction reduction method. It is recommended that land application of septage during the winter months is avoided or significantly reduced. Surface application during winter months is generally not recommended. The use of an approved septage waste storage facility is strongly recommended during the winter months.

Freezing conditions may indicate a layer of ice formed at the soil surface[1]. It can be checked by digging the soil with a shovel or pushing a soil probe into the soil. Local weather reports can also provide information about frozen soil conditions.

Note: See the flow chart (Figure 9-1)[1] for soil and septage waste application during winter months and other seasons.

9.4 Land Application of Septage Waste Over Winter Crops

It is not recommended to land apply septage waste over existing winter crops that are not actively growing during the winter months. Winter crops such as winter wheat, rye, or alfalfa planted in fall may have sprouted but remain dormant and are not actively growing during the winter months. These crops may resume growth under the right conditions in spring.

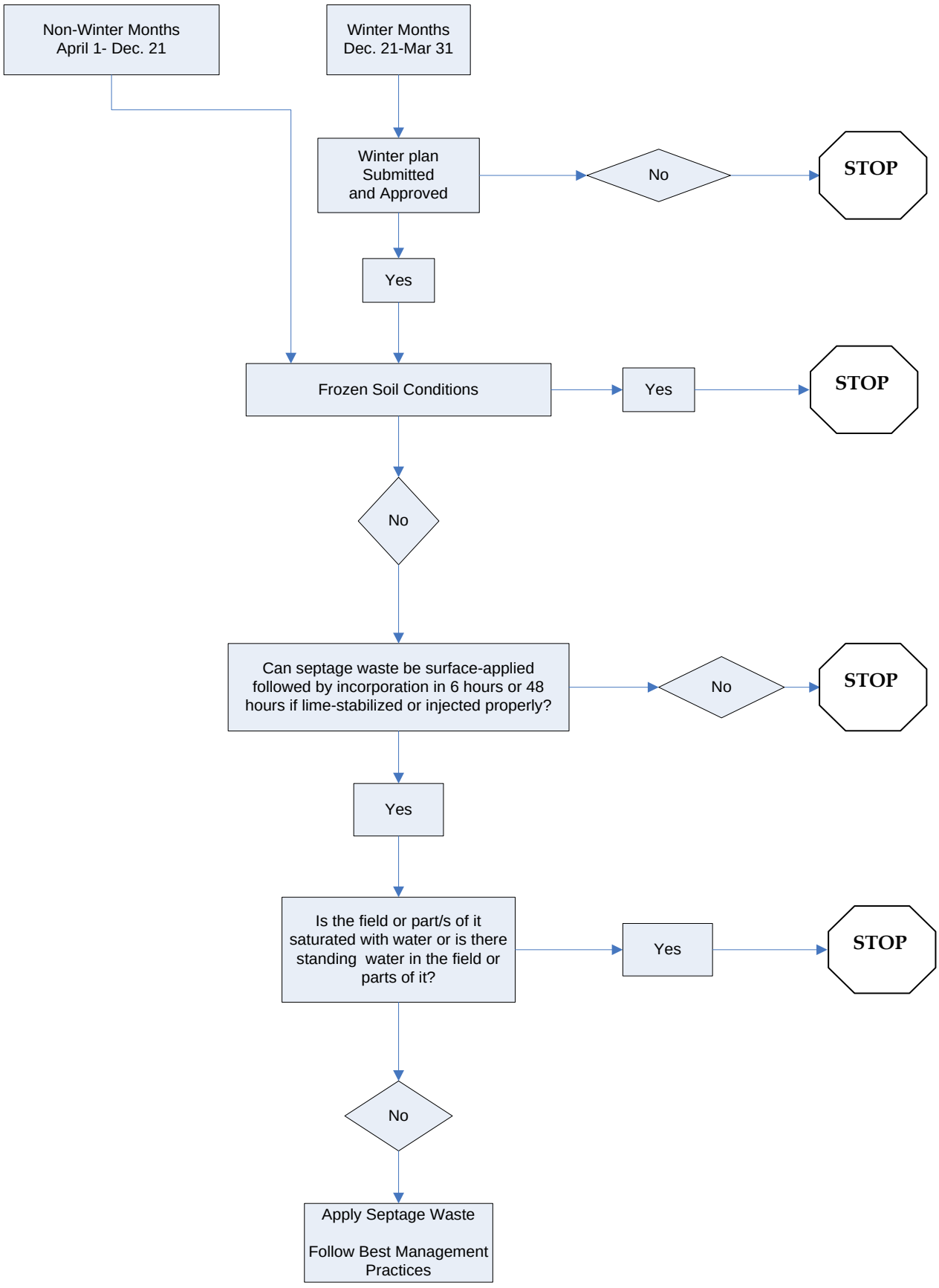


Figure 9-1. Septage Waste Application in Winter Months

9.5 Reasons for the Recommendation

Subsurface injection or surface application of septage waste followed by incorporation, in fields where there are winter crops, will damage the root systems. Making several runs over fields with an applicator vehicle during the winter when the fields are wet has the potential of causing significant soil compaction and physical crop damage. Soil compaction during this period may cause poor crop growth in the spring and summer months. Moreover, it is a challenge to apply the septage waste uniformly at agronomic rates due to the difficulty of achieving proper penetration and release of septage wastes from the injection shafts and/or good soil turnover for those who may surface apply. Furthermore, septage waste applied over crops without incorporation are more likely to be carried away from the application site to adjoining land parcels and subsequently to surface water after snow or ice melt.

9.6 Land Application in Winter (winter plan requirements)

An EGLE approved written plan is needed when land applying septage during the winter months. You may use form EQP5931 "Winter Plan for Land Application of Septage Waste" (see Appendix J). On the other hand, you may submit your own plan that contains, at the minimum, all the items listed below. Attach a site plan showing clearly the area to be used during the winter months. Submit the winter plan to EGLE for review and approval.

- Location of land site where septage will be applied.
- Number of acres for use during winter months.
- Dominant Soil Textural Class.
- Percent slope.
- Land management practice (e.g., cropping, septage waste application, etc.) that will follow.
- Agronomic Application Rate (Not more than 10,000 gallons/acre during winter months).
- Method of septage application.
- Erosion control plan.
- Standard isolation distances.
- Site Plan.

The plan shall be submitted to EGLE for review and approval <u>before</u> land applying in winter months.

It is not necessary to reapply every year within a licensing period for approval for a land site or field that is already approved as long as there are <u>no changes from the initial application and approval.</u>

<u>Note</u>: Approved winter plan does not allow septage waste application when the soil is frozen. All requirements for land management practices still apply. Hauler can check online in the Septage Program website under Septage Hauler Directory to see whether the hauler is authorized to land apply during winter months.

9.7 Fallow Land Concept and Land Application of Septage Waste

Fallow land is a land site that is plowed or unplowed but not seeded with actively growing planned crops or vegetation such as winter wheat, alfalfa, clover, grass hay, corn, soybeans, etc., for a period of time. During the time of inactivity, the soil may regain fertility and moisture for the next crop. A field that is seeded with winter crops, grasses, or other crops as part of a land management plan in fall or other season is not considered fallow land. It is not fallow land just because the crop has not emerged or barely emerged. Crop emergence would eventually take place. <u>Do not apply septage waste over a field during the period when the crops are yet to emerge and get established as actively growing crops</u>. See section 9.9 below for the reasons. On the other hand, a field where there is no seeding as part of a land management plan by the presence of weeds or lack of weeds, is considered fallow land. It is considered fallow land if the hauler has not taken deliberate steps to seed and establish crops or vegetation as part of the land management plan.

9.8 Subsurface Injection and Septage Waste Incorporation

If an injection method is properly used, septage waste incorporation is not required because the waste is introduced 8 to 10 inches below the soil surface. However, if the injected septage waste bubbles to the

soil surface and remains on the surface for up to one hour after application, treat those areas as surface application that requires incorporation of the septage waste with the soil.

9.9 Subsurface Injection and Surface Application Where There are Actively or Inactively Growing Crops

Where there are planned actively growing crops during spring, summer, and fall seasons, septage waste can be applied over the crops depending on the type of crop. The septage waste shall be lime-stabilized before land application over existing and actively growing crops. Septage waste application over existing crops is mostly applicable to grazing or pasture fields, involving grasses, grass-legume mixtures, or other combination. Incorporation of septage waste with soil after application is not required. Incorporation or using the injection method under these conditions would do more damage to the root systems of the crops.

Where the fields are fall-seeded and the crops are not actively growing during the winter months, do not apply septage waste over such emerging young crops. Septage waste applied during this time will likely be carried off the site during snow melt and rains because it is mostly on the ground surface.

9.10 Reference

1. Ministry of Agriculture, Food, & Rural Affairs. 2004. Applying Manure and Other Agricultural Source Materials in Winter. Ontario, Canada.

Chapter 10

Septage Waste Application Methods and Applicator Vehicle Calibration

10.1 Septage Waste Application Methods

There are two main methods of land applying septage waste: surface application and subsurface injection. For both surface and injection application methods, uniform application and control of daily hydraulic application rates are important and necessary.

Uniform application of septage waste: To attain uniform application rates, use of a splash plate, reverse funnel, or other mechanical device is recommended for surface appliers. For injector appliers, all injection knives and discharge tubes, etc., should be evenly spaced and the septage prescreened to prevent clogging. A one-unit injection knife is not recommended.

Daily hydraulic application rate: This is the rate of application per day on the same field. Excessive application per day may result in serious hydraulic problems and soil structure may be severely damaged. Destruction of soil structure may limit infiltration of the water contained in septage into the soil and increase the potential to run off the application site. See Chapter 14 for guidance.

In general, the less permeable the soil is, and the shallower the depth to water table, the lower the rate of daily septage application.

Make sure that the application vehicle is calibrated properly to ensure even distribution of septage. Limit the number of gallons applied to such a site to ensure infiltration of the water contained in the septage. This will prevent ponding.

A good septage management practice at any land application site should consider the following:

- Soils, characteristics, and management.
- Crops, characteristics, and harvesting restrictions.
- Isolation distances.
- Agronomic application rates.
- Erosion control.
- Odor control.
- Weather conditions before, during, and after application.
- Restricted access notice.

10.2 Surface Application

Septage waste is applied on the surface of the land (see Figure 10-1). For fallow land, that is sites with no planted crop or vegetation, the surface applied septage waste shall be incorporated into the soil within 6 hours of application (see Chapter 11, Table 11-2). Lime-stabilized septage waste may be surface applied to fallow land and mechanically incorporated within 48 hours (see Chapter 11, Table 11-2). For sites with actively growing planted crops or vegetation such as field crops, row crops, or pasture, septage waste can be surface applied over the existing crops without incorporation provided it is lime-stabilized before application (see Chapter 11, Table 11-2). Special runoff control practices may be needed around the perimeter of the field. See Chapter 8.

In order to achieve uniform application at agronomic rates, a splash plate, duckbill spray nozzle, or other mechanical device needs to be utilized on the discharge end of the applicator vehicle. The width or spread of septage on the ground should be from 6 to 9 feet or more. In Fig. 10-1, note the wide, uniform application area. Proper septage application methods result in little to no ponding.

Figure 10-1. Surface Application of Septage Waste

10.3 Subsurface Injection Application

Septage waste can be applied to soil using injection knives (see Figure 10-2). The depth of injection may range from 8 inches to 12 inches.

Figure 10-2. Subsurface Injection of Septage Waste

10.4 Septage Waste Applicator Vehicle Calibration

All septage waste applicator vehicles used in land application need to be calibrated. This is to ensure that the correct amount of septage per unit area is applied uniformly at AAR. Equipment calibration is important in both surface and injection methods of septage application.

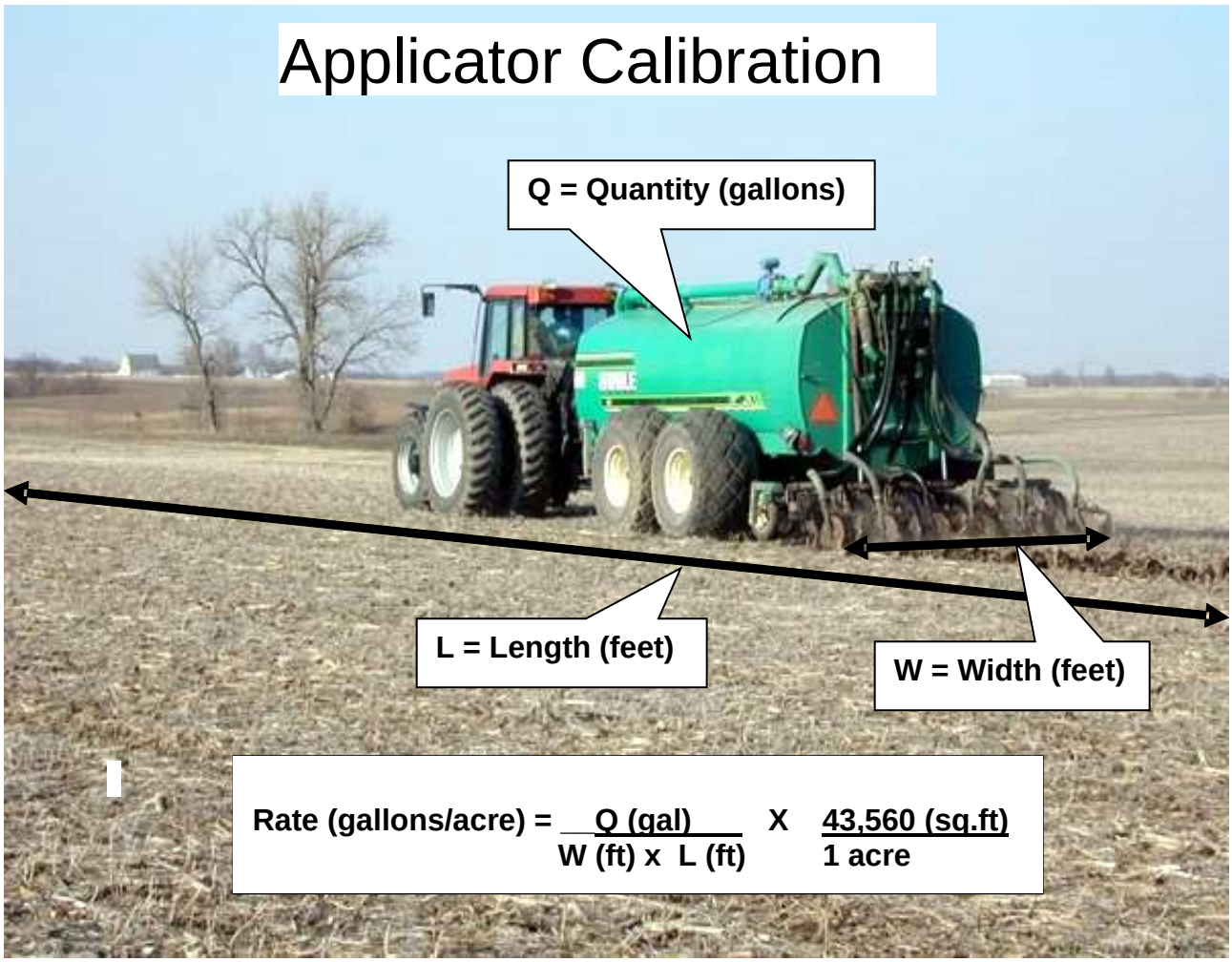


Figure 10-3. Septage Waste Applicator Calibration

Septage waste applicator calibration allows the hauler to know the quantity of septage waste applied per acre. It is important to calibrate the applicator to reduce the guess work about over-application or under-application. The advantage of calibration is to allow the hauler to spread uniform amounts of septage waste at agronomic rates. Over-application of septage waste can provide more plant nutrients than the requirement of the current crop or the crop to follow. Over-application can result in the movement of the excess nutrients beyond the root zone to groundwater or surface waters which are unacceptable if environmental quality and protection is to occur. Under-application can result in poor plant growth due to insufficient supply of plant nutrients from the septage waste and other factors. Those who land apply septage waste are to keep accurate and complete records of septage waste applicator calibrations. The applicator can be calibrated annually if the consistency of septage waste is the same. The frequency of calibration may change depending on type and consistency of the waste. Several trial runs may be necessary to obtain the correct application rate for each applicator.

Several methods of liquid manure spreader calibration can be used [1, 2,3,4,5]. The references give additional information about the various calibration methods. The manure calibration is adapted to septage waste calibration. For the most part, septage waste is liquid material.

10.5 Methods of Septage Waste Calibration

Field Load Method. This is the method where septage waste is first applied to an entire field and the total amount of the waste and the total number of acres covered are both known.

$$\text{Application Rate (gallons/acre)} = \frac{\text{Total Amount of Septage Waste Applied (gallons)}}{\text{Total Number of Acres Receiving Septage}}$$

This method gives an average application rate over the entire field, assuming that the septage waste was uniformly applied.

It provides the application rate after application is completed. For this reason, this is not recommended as a routine method but can be used to check the other application rate calibrations discussed.

Distance Method: This method involves the measurement of the width of spread, length of travel, or run to empty the contents of the applicator, and known volume of septage waste in the applicator. The length of travel can be measured using a measuring wheel, tape measure, or tire method. This method implies that the applicator is maintained at the same speed of travel. Application rate decreases with an increase in speed and vice versa. **This is the recommended method.**

$$\text{Application Rate (gallons/acre)} = \frac{\text{Quantity of septage waste (gallons)}}{\text{Width of spread (ft) x Length of travel (ft)}} \times \frac{43{,}560\ \text{ft}^2}{\text{acre}}$$

Example:

Quantity of septage waste in applicator = 2,000 gallons*
Width of spread = 10 feet
Length of travel = 1,000 feet

*For calibration purposes, it is best to confirm actual gallons in the applicator by weighing before and after loading with septage waste.

$$\text{Application Rate (gal/ac)} = \frac{2{,}000\ \text{gallons}}{10\ \text{ft} \times 1{,}000\ \text{ft}} \times \frac{43{,}560\ \text{ft}^2}{\text{acre}}$$

= 8,700 gal/ac (rounded). Recommend rounding to at least two significant digits because it is calibration.

Those that do not want to do calculations may use the manure applicator calibration guide chart by Heemstra[3]. To use this method, follow the steps below:

Step 1. Take measurements of the width of spread and length of travel to use the chart.

Step 2. Type in How do you calibrate a manure spreader? by Jill Heemstra 2008[3] in the Google box. This document should appear.

Step 3. Click to get the next page. Read the article.

Step 4. Click the link "Manure Applicator Calibration Guide" at the bottom of the article to get the chart.

Step 5. Using your data from step 1, check the application rate using the chart.

This method assumes that a 2,000 gal tank truck actually will deliver 2,000 gallons.

Time Method: In this method, the time of covering a defined area is used in calculating the application rate.

$$\text{Rate of Application (gal/acre)} = \frac{\text{Quantity of septage waste in tank (gal)} \times 29{,}700^*}{\text{Width of spread (ft) x Time (sec) x Speed of travel (mph)}}$$

Quantity of septage waste in applicator = 2,000 gallons

Width of spread = 20 feet (Make allowance for overlap application)

Time needed to empty the applicator tank = 300 seconds

Speed of travel at a selected gear (rpm) = 2nd gear at 1,700 rpms

$$\text{Rate of application (gal/ac)} = \frac{2{,}000 \text{ gal} \times 29{,}700 \text{ ft-sec/ac*}}{20 \text{ ft} \times 300 \text{ sec.} \times 2.0}$$

$$= \frac{2 \text{ gal} \times 29{,}700}{2 \times 3 \times 2 \times \text{ac}}$$

$$= \frac{59{,}400 \text{ gal}}{12 \text{ ac}}$$

$$= 4{,}950 \text{ gal/ac}$$

* 29,700 is a conversion factor from miles per hour to feet per second plus the distance in feet needed at a given width of spread in feet to equal one acre covered with 43, 560 ft ^{2}= 1 acre.

10.6 References

1. Bollinger, Dann 2004. Making Manure Spreader Calibration Practical and Useful. Michigan Dairy Review.

2. Davis, J.G, and R.B Meyer. 2002. Manure Spreader Calibration. Colorado State Cooperative Extension.

3. Heemstra, Jill. 2008. How to Calibrate a Manure Spreader. Univ of Nebraska Cooperative Extension.

4. Jokela, B. 2003. Manure Spreader Calibration. University of Vermont Extension. Burlington, Vermont.

5. Koelsch, R. 1995. Manure Application Calibration. University of Nebraska Cooperative Extension NebGuide G95-1267-A.

Chapter 11

Lime Stabilization of Septage Waste

11.1 Lime Stabilization of Septage Waste

Lime stabilization involves mixing septage waste with lime (see Figure 11-1). The pH of the mixture shall be at least 12 and shall remain at 12 or higher for at least one-half hour prior to applying to land. The amount of liming material needed to mix with a known volume of septage waste to achieve the desired pH depends on the type of liming material; form of the liming material, that is, dry (as in quicklime) or slurry; and septage waste characteristics. For beginners in lime stabilization, it is important to start small and perform some trial runs before increasing the amount of lime and septage waste. Please refer to these references: 1, 2, 3, and 4, for additional information.

The lime stabilization process shall be documented for review by regulatory inspector(s) at any time as allowed under the law. Lime stabilization is also a method of pathogen reduction and vector attraction reduction (Table 11-1).

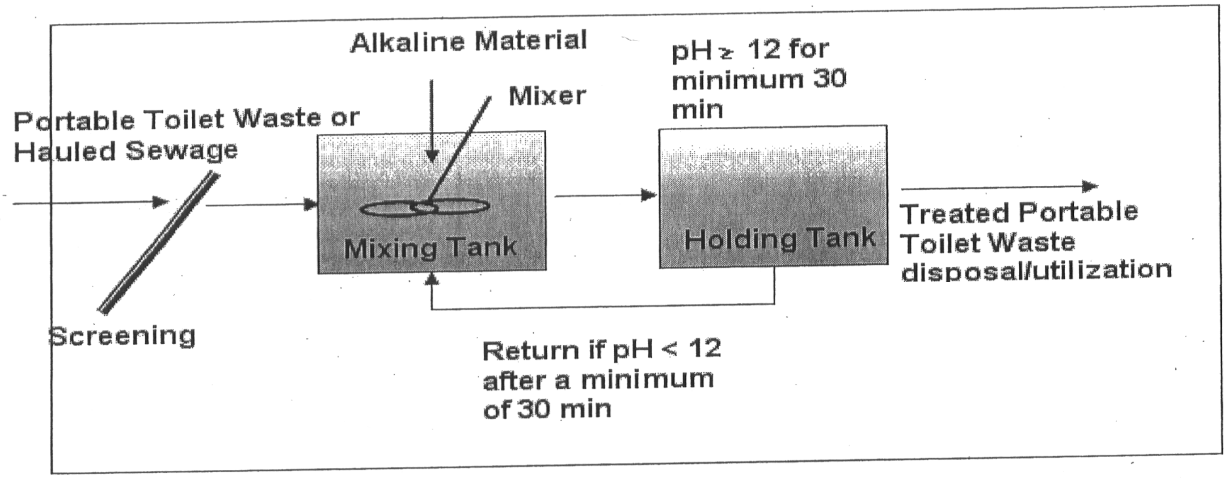


Figure 11-1. Alkaline Stabilization[1]

Minimum Requirement: pH 12 for at least 30 minutes before land application.

Table 11-1. Pathogen Reduction and Vector Attraction Reduction Methods.

Pathogen Reduction	Vector Attraction Reduction
Lime stabilization	Lime stabilization
Site restrictions as per USEPA Part 503	Surface application followed by incorporation within 6 hours
	Subsurface injection

11.2 Equipment, Materials, and Safety

If you lime stabilize septage waste for land application, the following tools are recommended and they should be available at the mixing location, storage site, or land application site:

<u>pH Testing Tools</u>

- pH meters
- pH paper
- Sampling container
- Pole for attachment to sampling container when necessary
- Other _____

Liming Materials

- Hydrated lime (calcium hydroxide)
- Quicklime (calcium oxide)
- Other _____

Equipment for Lime Preparation and Transportation

- Manual paddle
- Electric Mixer
- Cleaning tools
- Water source
- Appropriate slurry preparation drum and/or tank
- Submersible pump
- Lime stabilization log
- Other _____

Safety Equipment

Due to the potential danger to safety and health, use appropriate safety equipment at all times during the storage, preparation, and disposal of liming materials. Some of the equipment is listed below:

- Emergency eyewash station
- Carbon dioxide fire extinguisher
- Shoulder-length fully coated neoprene gloves
- Half-mask respirator with appropriate cartridge
- Safety goggles
- Protective clothing

11.3 Septage Waste Lime Stabilization Log

Always use a log to document your operations. The log is subject to review by Septage Waste Program staff, designated representatives of the local health department, or the U.S. Environmental Protection Agency staff. A septage lime stabilization log is available in Appendix G for use by licensees. An example of a completed septage waste lime stabilization log is in Appendix H.

Record Keeping

The following records should be kept in the pump vehicle and/or business office:

- ❖ Location of land site.
- ❖ Number of acres of the land site/field.
- ❖ Quantity (in gallons) of septage applied per day in each field.
- ❖ Method of septage waste application.
- ❖ Whether septage waste was lime stabilized or not.
- ❖ Date of septage waste application.
- ❖ Time of septage waste application.
- ❖ Time of incorporation, if surface-applied.

See Appendix F for a sample Land Application Volume Record.

11.4 Septage Waste and Lime Stabilization

The treatment discussed in Table 11-2 below summarizes what to do with septage that is lime stabilized and septage that has not been lime stabilized with regard to fallow land and cropped land.

Table 11-2. Land Applying Septage Waste Not Lime Stabilized and Lime Stabilized Septage Waste

Septage Waste Not Lime Stabilized	Lime Stabilized Septage Waste
Can be: Surface applied on fallow land followed by incorporation within 6 hours. Cropping to follow within one year after septage application.	Can be: Surface applied on fallow land followed by incorporation within 48 hours. Cropping to follow within one year of septage application.
Can be: Surface applied over scattered weeds or vegetation followed by incorporation within 6 hours. Cropping to follow within one year after septage application.	Can be: Surface applied over actively growing forage crops or vegetation without incorporation. It can also be applied early where row crops are planted without incorporation.
Can be: Subsurface injected on fallow ground. Cropping to follow within one year of septage application.	Can be: Subsurface injected early where row crops or vegetation are planted.
Recommendation: It is always a good practice to keep fallow ground covered, after the end of septage application, with cover crops and/or other control methods to reduce soil erosion before the next cropping year.	

11.5 References

1. Ministry of the Environment. 2005. Lime Stabilization and Screening of Septage. Phase 2. Ontario Field Demonstration of Lime.

2. Ohio State University Bulletin. Septage Management in Ohio. Part 1. Land Application of Septage. Bulletin 854

3. U.S. Environmental Protection Agency. 1993. Domestic Septage Regulatory Guidance. A Guide to the EPA 503 Rule. EPA-832-B-92-005.

4. U.S. Environmental Protection Agency. 1994. Guide to Septage Treatment and Disposal. EPA-625-R-94-002.

Chapter 12

Septage Waste Screening and Storage Practices for Land Application

12.1 Screening

Septage waste can be screened or put through a grinder before land application. There are several methods that are available to screen or grind septage waste. Licensees should select the method that is suitable for their operation and need. The screen size or grinding size of the solid particles is shown in Table 12-1.

Table 12-1. Septage Waste Screening and Particle Size

Septage Waste Screening and Particle Reduction Method	Screen and Particle Size	
	Mesh	Slats
	½-inch mesh or less	3/8- inch or less
Screening		
Grinding	½ - inch or less particle size	

REMINDER: Effective October 12, 2006, it is a violation to land apply septage waste without screening or putting through a grinder.

12.2 Managing Septage Waste Storage Facility for Land Application

Septage waste storage facility (SWSF) is an important tool that can be used to properly manage the land application of septage waste. The advantages of a SWSF include:

- Ability to properly screen the septage waste before land application. Good screening reduces unwanted solid materials that would have been applied to the land.
- Ability to store septage waste during periods of inclement weather. Application during inclement weather creates runoff possibilities to surface waters.
- Storage reduces vehicular traffic to the land site thereby reducing possible soil damage.
- Ability to uniformly apply at agronomic rates. Without a storage facility, land manager is forced to land apply in a hurry and get out before night fall.
- Allows the manager to properly comingle food establishment waste (FES) with regular domestic septage, if manager pumps FES.
- Allows the manager to conduct emergency septage waste servicing on weekends and in special events because a storage facility is available.

12.3 Capacity of Septage Waste Storage Facility

The capacity of a septage waste storage can vary from as small as 5,000 to as large as 200,000 gallons or more (Table 12-2).

12.4 Type of Septage Waste Storage Facility

The septage waste storage facility can be constructed with a steel, concrete, fiberglass, or other acceptable material.

12.5 Elevation of Septage Waste Storage Facility

The septage waste storage facility can be at grade, above grade, or partially below grade.

12.6 Application and Approval Guidelines

Any person interested in exploring the possibility of installing a septage waste facility should consult the document "EGLE- Septage Waste Storage Facility Management Practices" before making any decisions. Engineering plans may be involved depending on the capacity and cost of constructing such a storage facility. A site plan with appropriate information is required regardless of the capacity of the storage facility (Table 12-2).

Table 12-2. Summary of Septage Waste Storage Facility Requirements

Requirements*	Combined Septage Waste Storage Capacity (gallons)	
	10,000 or less	More than 10,000
Engineering Plans	No	Yes
Site Plan	Yes	Yes
Isolation Distances	Yes	Yes
EGLE Review & Approval	Yes	Yes
Other Requirements	Yes	Yes

*For additional information see the Septage Waste Storage Facility Management Practices document at Michigan.gov/EGLESeptage.

Other permits or approvals by other governmental agencies may be required. It is your responsibility to obtain such authorizations that may be required in addition to approval by EGLE.

Chapter 13

Soil and Septage Waste Sampling and Testing Requirements

13.1 Soil Fertility Test

A standard soil fertility test shall be performed using soil sample(s) taken from the land site where septage waste is applied or will be applied. In order to perform the soil analysis, it is important to take a composite soil sample that is representative of the location. Basic parameters in a soil sample report should include, among others:

- Soil pH.
- Soil nutrient levels of phosphorus, potassium, magnesium, and calcium reported in parts per million (ppm) or pounds per acres (lbs/ac).
- Phosphorus shall be analyzed using the P1 (Bray and Kurtz P1) or Mehlich 3 Test.
- Cation exchange capacity (CEC usually reported in meq/100 g).
- Base saturation (usually reported as percent of exchangeable bases).
- Recommendations for lime.
- Recommendations for nitrogen, phosphorus and potassium.

Note: It is not necessary to get nitrate nitrogen (NO_3 – N) analysis unless it is part of a standard soil fertility test with no extra fees. See section 5.3.1 for a discussion about nitrate-nitrogen testing.

13.2 How to Sample Soils

A summary description of how to take a soil sample for a soil fertility test is given in Appendix K. Additional information about soil sampling[3] is also available in the Septage Program website under Related Links.

13.2.1 Time of Soil Sampling

Soil sample may be taken at any time in the cropping year provided the soil is not frozen or saturated with water.

Sampling in Fall: Although soil samples can be taken at any time during the year, it is highly recommended that soil samples be taken in the fall of each year. Soil samples taken in the fall gives the licensee or land manager enough time to get the test results from the laboratory and plan for spring and summer cropping the following year. Furthermore, it allows the licensee to submit to EGLE, in a timely manner, the annual soil sample reports with the cropping plan and annual license fee due in March of the following year.

13.2.2 Frequency of Soil Sampling

An annual soil fertility test shall be provided for each field where septage waste is land applied. Annual soil sampling is not required for "reserve" land sites where septage waste will not be applied for at least 12 months or more. However, before you use a "reserve" land site or field for septage waste application, a current soil test report and cropping plan for the reserve fields shall be submitted to EGLE for review and approval. See Section 7.5 for an explanation of a reserve land site or field.

13.2.3 Number of Composite Soil Samples

At least one composite sample shall be taken from each field. A composite sample is made up of several core samples depending on the size of the field. However, the more core samples you take to make a composite sample the better it represents the field.

For a field of 10 acres and where the soil is homogenous, about 15 - 20 core samples should be collected to form one composite sample for laboratory analysis. For larger fields, more core samples should be taken to make a composite sample. Where there is significant soil variability within a field,

more than one composite soil sample may be taken from the field and analyzed. The soil sample(s) collected for the fertility test should be representative of the entire field where septage has been applied or will be applied. If the soil sample(s) is not "representative," then the soil test results from the laboratory will not provide correct nutrient and lime recommendations.

13.2.4 Information to submit to Soil Laboratory with Soil Sample

Provide the following information when a soil sample is taken to the soil testing laboratory for analysis:

- Land Site ID number (numerical) and Field Identification (alphabetical) where sample was taken.
- Date soil sample was taken.
- The number of acres represented by the soil sample.
- Previous crop grown at the site **before** septage waste application.
- Crop that will be grown **after** septage waste application.
- Expected yield of the crop that will be grown following septage waste application.
- Depth of tillage (subsurface injection or surface soil incorporation depth).
- Indicate whether manure* will be applied or has been applied to the land site or field.

13.3 Soil Sampling by EGLE

EGLE may take soil sample(s) from any field at any EGLE authorized land site at any time for analysis. The soil test report(s) obtained from such sampling(s) can be evaluated and compared with the soil test report(s) submitted by the licensee.

13.4 Septage Waste Characteristics

According to Part 117, domestic septage is defined as "*Liquid or solid material removed from a septic tank, cesspool, portable toilet, type III marine sanitation device, or similar storage or treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar facility that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease interceptor, grease trap, or other appurtenance used to retain grease or other fatty substances contained in restaurant waste.*"

The general septage characteristics as reported by USEPA[5, 6] are shown in Table 13-1. This table is presented as a guide only.

Table 13-1.Septage Waste Characteristics

Wastewater Parameter	**Septage** mg/L	**Sewage** mg/L	**Relative Strength Ratio** (Septage : Sewage)
Compatibles:			
5 – day BOD	6,500	220	30 : 1
Chemical Oxygen Demand	32,000	500	65 : 1
Total Suspended Solids	13,000	220	60 : 1
Total Kjeldahl Nitrogen	600	40	15 : 1
Ammonia Nitrogen	100	25	4 : 1
Total Phosphorus	210	8	25 : 1
Oil and Grease	5,500	100	55 : 1
Toxics:			
Arsenic	0.140	0.003	50 : 1
Cadmium	0.100	0.003	33 : 1
Chromium	0.500	0.050	10 : 1
Copper	4.800	0.061	95 : 1
Cyanide	0.470	0.041	10 : 1
Lead	1.200	0.049	25 : 1
Mercury	0.005	<0.0002	>25 : 1
Nickel	0.500	0.021	25 : 1
Silver	0.100	0.005	20 : 1
Zinc	10.000	0.175	55 : 1

Domestic septage contains nutrients, heavy metals, and pathogens. The characteristics of the septage waste that haulers pump in Michigan may vary from location to location and from load to load. For purposes of this discussion, a location means a region of a county or state and load means an individual residential septic system. The emphasis in this manual is on nitrogen, phosphorus, and to some extent, pathogens.

13.5 Septage Waste Sampling

Septage waste can be analyzed in a laboratory that analyzes this type of waste or residuals. Always find out if the laboratories where you want to have your septage waste analyzed does that type of analysis. Basic parameters to consider include among others:

- Total Kjeldahl Nitrogen (TKN).
- Ammonium-Nitrogen (NH_4-N).
- Nitrate-Nitrogen (NO_3–N).
- Total phosphorus.
- Potassium.

Note: There is no requirement for routine septage waste analysis. However, haulers can obtain septage waste analyses on their own for their individual nutrient management plan.

EGLE may require septage waste analysis when the situation demands such a need. The determination to sample septage waste will be handled on a case by case basis. Meanwhile, EGLE uses the USEPA estimate of 0.0026 lbs N/gallon of septage waste as the guideline involving nitrogen content in septage waste. See Chapter 5 for additional information on agronomic application rate calculations.

13.6 How to Take a Septage Waste Sample

Follow the instructions from the laboratory about the method of sampling and safe handling of the waste from the time of sampling to the time the sample gets to the laboratory for analysis. Some of the following guidelines may assist you:

- Identify the type or category of septage waste (e.g., holding tank waste, portable toilet waste, food establishment septage, regular septic tank waste). If it is taken from a septage waste storage facility, indicate that the septage waste is from a storage facility and indicate the types of septage waste in the storage facility.
- Take a sample from the homogenous mix of each type or category of septage waste from the septic tank, pump vehicle tank or mixed septage waste in a storage facility.

13.7 Food Establishment Septage (FES)

FES is material pumped from a grease interceptor, grease trap, or other appurtenance used to retain grease or other fatty substances contained in restaurant wastes and that is blended into a uniform mixture, consisting of not more than one part of restaurant-derived material per 3 parts of domestic septage, prior to land application or disposed of at a receiving facility.

Mixing Ratio: FES shall be mixed with regular domestic septage in no greater than 1:3 ratio, that is, one part of FES to three parts of domestic septage[1].

1 Part FES + 3 Parts of Domestic Septage = Septage/FES Mixture

FES shall not be land applied unless mixed in the ratio described above. Mixing may occur in the septage waste storage facility, in the pump vehicle tank, or other device designed for proper mixing.

13.8 FES Testing for Land Application

FES waste shall not be land applied unless testing for cadmium and polychlorinated biphenyls (PCB) has been conducted of the mixed septage waste in a storage facility in accordance with the requirements in

40 CFR Part 257.3-5[1,4] or soil testing in that location. For additional information of the testing requirements of cadmium and PCB, see the Septage Program website.

13.9 References

1. Michigan Septage Law. Part 117, Septage Waste Servicers, NREPA, 1994 PA 451, as amended. Enacted 2004.

2. Recommended Chemical Soil Test Procedures for the North Central Region. 1998. North Central Regional Research Publication No. 221 (Revised). Missouri Agricultural Experiment Station SB 1001.

3. Sampling Soils for Fertilizer and Lime Recommendations. 1998. Michigan State University Extension Bulletin E- 498

4. U.S. Environmental Protection Agency. Federal Septage Law, CFR 40, Part 257.3 – 5. Criteria for Classification of Solid Waste Disposal Facilities and Practices.

5. U.S. Environmental Protection Agency. 1994. Guide to Septage Treatment and Disposal. EPA-625-R-94-002

6. U.S. Environmental Protection Agency. 1984. Handbook: Septage Treatment and Disposal. EPA-625-6-84-009

Chapter 14

Good and Bad Practices of Soil and Septage Waste Management

14.1 Is it Too Wet to Land Apply Septage Waste?

Determining the Moisture Content of Soils Used for Land Application of Septage Waste

During winter or early spring, one of the frequent questions asked by haulers who land apply septage wastes, “Is the soil dry enough for me to land apply septage waste?” The general response provided is “When you see the farmers start working their fields for crop production in the spring that is a good time, depending on the type of soils.”

Soils are usually very wet during the winter months and early spring. The degree of wetness will depend on the type of soil. Tillage operations such as surface application followed by incorporation and subsurface injection conducted when soils are wet will result in soil compaction and poor plant growth. It is important to determine the moisture content of soils before land applying septage waste in the winter or spring months using the plastic limit method. The plastic limit is also used as a tool to protect soils in areas for mound systems for disposal of onsite wastewater.

Plastic Limit Method

Plastic limit is the moisture content of a soil at which it starts to crumble when rolled into a thin ¼ inch rod, like the shape of a pencil.

Field Procedure [1, 2]

1. Grab a handful of soil from the plow layer (0 to 10 inches deep).
2. Roll it between the palms of the hands to form a thin uniform diameter to pass through ¼ inch or smaller wire mesh.
3. If the soil crumbles, it is at its plastic limit so it can be worked. If it does not crumble, it is below its plastic limit and it is too wet to work the soil for septage application purposes.
4. Repeat steps 1 through 3 randomly at various locations of the field.

Am I Applying Too Much Septage Waste to the Soil at a Given Time?

Hydraulic Loading Rate

In simple terms, the hydraulic loading rate of a soil is the quantity of liquid, for example, water that can be absorbed by a certain quantity of soil within a given period of time. It is usually expressed as gallons per day per square feet. In other words, how much liquid can one put into a certain area of land without creating a puddle.

For haulers who land apply septage waste, it is important to know the type of soil in the field, the area of application and how much liquid can be applied to it in one day. This concept is generally used in the installation of onsite wastewater systems.

There is a different hydraulic loading rate for different types of soils. It is important to determine the loading rate for the type of soils at your land site if you intend to apply large amounts of septage waste in a short period of time. This is especially relevant to haulers that land apply holding tank waste.

14.2 Good and Bad Practices of Soil Management at Land Application Sites - Summary

It is important to reduce the frequency of vehicular traffic over the area where septage waste is applied. Vehicular traffic and application of septage waste during inclement weather can have serious effects on the physical properties of the soil and the environment (Table 14-1).

Table 14-1. Practical Management of Soils at Land Sites.

Bad Practice	Effects
Haphazard movement of septage applicator truck all over the field under wet, sometimes saturated, or snow covered conditions in fall, winter, and spring. Frequent trips to the same field per day or week. No grasses and legumes in the rotation of crops for improved nutrient recycling, e.g., nitrogen and phosphorus. Little or no erosion control plan at land site. No uniform septage application over the field.	Soil compaction. Destruction of soil structure. Reduction of pore space. Poor or stunted crop growth. Loss of soil particles and septage attached to them. Poor growth » low crop yields » low agronomic application rate.
Good Practice	**Effects**
Plan septage applicator truck movement along defined paths in the field when the soils are not wet, saturated, or snow covered. Reduce number of trips to the same field per day or week. Introduce grasses and legumes into the rotation of crops at some point to improve nutrient recycling. e.g., nitrogen and phosphorus. Adopt erosion control plan suitable for the land site. Apply septage uniformly using splash plate or another device over the field. Use authorized septage storage facility.	Reduction of soil compaction. Improvement of soil structure. More pore space with air and water. Good crop growth. Reduction of soil loss and septage from land site. Able to manage when to apply septage and when to stay off the field. Good growth » high crop yield » high agronomic application rate.

14.3 Good and Bad Practices of Septage Waste Management at Land Application Sites – Summary

Proper subsurface injection and incorporation after surface application of septage waste are practical methods of reducing septage movement away from application areas (Table 14-2). They are also efficient pathogen and vector attraction reduction methods. Subsurface injection of septage waste that bubbles to the surface shall be incorporated just like surface application.

Table 14-2. Practical Septage Waste Management at Land Sites.

Bad Practice	Effects
Septage waste still left on soil surface due to improper incorporation or injection, e.g., ponding. Ponding: Liquid on soil surface after: 1 hour - Injection 6 hours – Surface Application of septage waste to site with slope greater than 6% (surface) or 12% (injection). Application of septage waste in the same direction of the flow of water.	Septage waste is likely to be carried by storm water runoff or melted snow to adjacent properties, roads, or waters. Too much septage applied to the field can also result in runoff.
Good Practice	**Effects**
After incorporation or injection, get down from vehicle and evaluate operation before leaving site. Disc again to incorporate properly. If ponding is occurring, adjust injector to penetrate deeper into the soil. Measure slope if not sure. Apply to slope not greater than 6% (surface) or 12% (injection). Apply septage and incorporate or inject perpendicular to slope.	Septage waste is less likely to be carried away from the application site to neighboring areas if: • Properly incorporated or injected. • Applied at proper slopes. • Applied across (or perpendicular to) slopes. • Followed by seeding at the proper time.

14.4 References

1. Western Alliance for Quality Transportation Construction (WAQTC). 2003. Determining the Plastic Limit and Plasticity of Index Soils FOP for AASHTO T90.

2. Michigan Department of Environment, Great Lakes, and Energy. 2003. Pressure Mound Systems. Technical Guidance for Sire Suitability, Design, Construction and Operation and Maintenance.

Chapter 15

Septage Waste Application to Trees and Land Sites with Drainage Tiles

15.1 Trees and Application of Septage Waste

Some haulers have inquired about whether they can land apply septage waste to trees such as maple and Christmas trees. Trees can benefit from nutrients available in septage waste. However, the mechanics of supplying these nutrients to the trees uniformly at agronomic rates and at the same time reducing vector attraction and pathogens efficiently are real challenges that confront the haulers and the community.

15.2 Recommendation

It is not recommended for septage waste to be land applied to tree crops. Any request for land application to trees shall be handled on a case by case basis.

15.3 Basis for the Recommendation

The recommendation of not allowing the land application of septage waste to tree crops is based on the following challenges:

15.3.1 Vector Attraction Reduction and Pathogen Reduction

Current methods of nutrient application to trees do not address vector attraction and pathogen reduction issues when septage waste is the means of supplying the nutrients. Surface application of septage waste followed by incorporation within 6 hours or 48 hours, if lime-stabilized and subsurface injection methods are not effective vector attraction reduction and pathogen reduction methods for trees. The ineffectiveness is due to the presence of extensive root systems that interrupt proper incorporation and/or injection. Moreover, tree roots would be damaged during the process of nutrient application. Foliar or trunk application of septage waste is unacceptable due to health, aesthetic, and nuisance concerns.

15.3.2 Uniform Agronomic Application

Uniform application at agronomic rates is very difficult to achieve when septage waste is applied to trees. Effective nutrient application to trees depends on understanding the interaction of factors such as the type of plant, stage of plant growth, pattern of plant arrangement, length of space between plants in a row and between rows, and other factors.

15.4. Drainage Tiles at Septage Waste Application Land Sites

Some land sites used for septage waste application have drainage tiles. Drainage tiles are usually installed in agricultural fields to improve drainage. They tend to lower the water table, making more land available for crop production. The movement of nutrients and other contaminants through drainage tiles to ditches and other bodies of water is possible and can create environmental problems. Best management practices (BMPs), including soil and nutrient management, can reduce the pathways of nutrient movement and loads to the drainage tiles and subsequently to surface waters. Some of the pathways of subsurface nutrient movement to drainage tiles include cracks and channels caused by earthworms, plant roots, and residues. Cracks tend to occur more during the dry period of the year. The degree of their occurrence depends on the soil type. You may get additional information from these references [1, 2].

15.5 Recommended Action

Where drainage tiles are present at the land application site:

- Prepare a diagram of the field and identify the location of the drain tiles in the field on the diagram.
- Check and determine whether the tiles are still open and doing what they are supposed to do or are they clogged and not working.

- ❖ If they are open and working, till the land to cover cracks and other potential pathways prior to septage waste application.
- ❖ Do not apply more nutrients than the recommended maximum agronomic application rates.
- ❖ Do not apply more septage waste than the ability of the soils to absorb the liquid (or do not exceed the hydraulic loading rate of the soil).
- ❖ Do not land apply during rain.
- ❖ For new land sites that have not received septage waste, it is important to get a baseline sample and analyze the effluent for E. coli, fecal coliform, phosphates, ammonium, nitrates, and nitrites prior to land application of septage waste. This will provide a base line value for comparison with future sampling results. Submit sample result to EGLE.

  After the initial baseline sampling, collect another effluent sample from the outlet after 2 years for analysis of the same parameters as stated earlier about the same time of the year but preferably shortly after rainfall during the period septage waste is being applied.

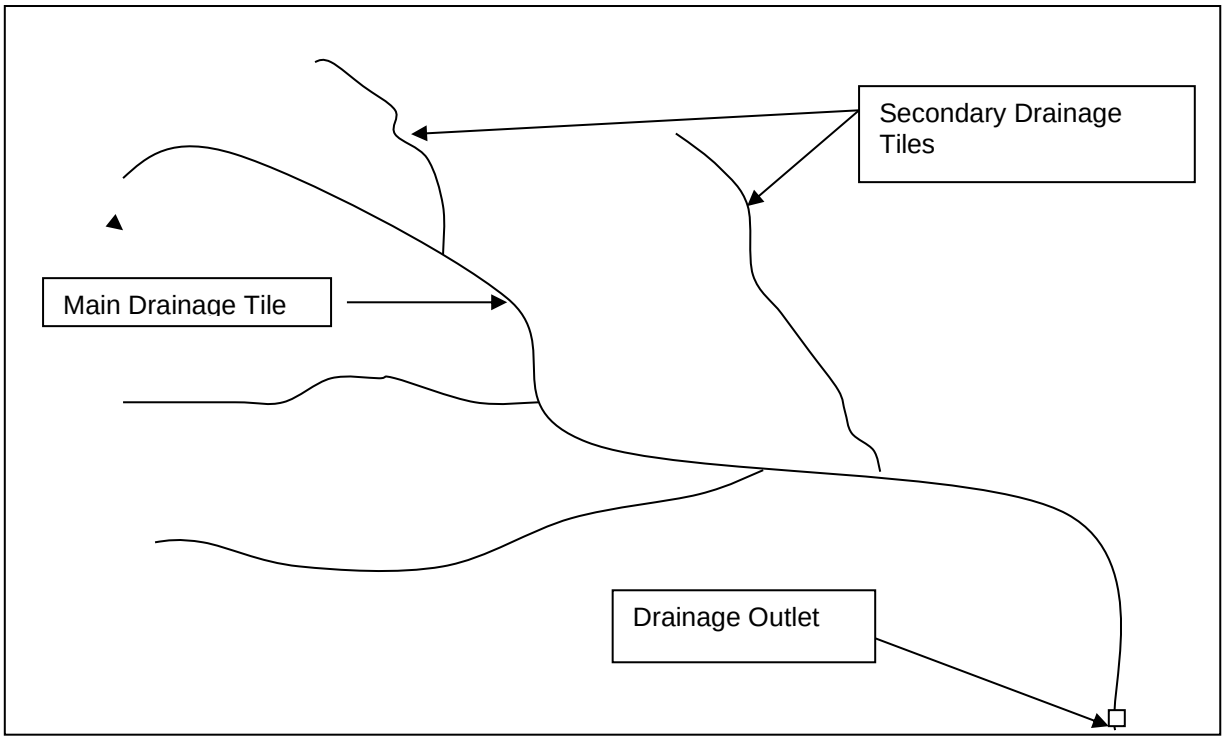


Figure 15-1. Septage Waste Application in Fields with Drainage Tiles

15.6 References

1. Busman, L, and G. Sands. 2002. Agricultural Drainage. Issues and Answers. University of Minnesota Extension Service, MI -07740.

2. Harrigan, T, B. Northcott, N. Rector, and D. Bolinger. 2007. Part 2: Tile-drained Land. Michigan State University Extension Bulletin WO-1037.

Chapter 16

United States Environmental Protection Agency Rule 503

16.1 Introduction

This chapter provides a brief overview of some of the requirements under USEPA Part 503. The USEPA adopted regulations in 1993 and 1994 (40 CFR Part 503). Most of the information in this chapter is directly lifted from references 2 and 3. Part 503 provides minimum requirements for the land application of domestic septage. In some instances, Michigan standards are more restrictive than USEPA Part 503. Each licensee in Michigan is required to follow Michigan Part 117 and the federal Part 503 requirements.

Key requirements of the USEPA Part 503 are:

- Part 503 authorizing the land application of domestic septage only.
- Determining the annual application rate.
- Pathogen reduction requirements.
- Vector attraction reduction requirements.
- Certification requirements.
- Restrictions on crop harvesting.
- Record keeping.

16.2 Domestic Septage and Septage Waste*

To meet the Federal Part 503 requirement, the septage that is land applied to a nonpublic contact site will be domestic septage only. Michigan Part 117 authorizes the land application of septage waste as defined in the law. It states "*Septage waste" means the fluid mixture of untreated and partially treated sewage solids, liquids, and sludge of human or domestic origin that is removed from a wastewater system. Septage waste consists only of food establishment septage, domestic septage, domestic treatment plant septage, or sanitary sewer cleanout septage, or any combination of these*.

*This is one example where Michigan Part 117 goes further than USEPA Part 503.

16.3 Annual Application Rate and Nitrogen Requirement

In order to prevent the over application of nitrogen that may contaminate our waters, the nitrogen requirement of the crop will be determined. The land applier shall not apply more than what the crop needs for good growth and yield.

16.4 Pathogen Reduction

To meet the federal USEPA requirement, prescribed requirements need to be adopted to reduce disease-causing pathogens in the septage. Pathogen reduction alternatives 1 and 2 are given in Tables 16-1 and 16-2.

16.5 Vector Attraction Reduction

Septage attracts different kinds of vectors. Action must be taken to reduce vector attraction. Details of three vector attraction reduction alternatives are given in Table 16-3.

16.6 Certification Statement

The land applier shall certify that pathogen and vector attraction reduction methods have been met. An example of a certification statement is given in Table 16-6.

16.7 Crop Harvesting, Animal Grazing, and Site Access Restrictions

There are site restrictions involving the land application of domestic Septage. Details of site restrictions are given in Tables 16-2 and 16-3. A case example is shown in Table 16-4.

16.8 Record Keeping

Land application records of septage waste should be kept for 5 years. Records may be requested for review by regulatory agencies at any time. What is required for record keeping is stated as a summary in Table 16-5.

16.9 Federal Standards for the Application of Domestic Septage

The following tables (16-1 to 16-6) are taken from the USEPA Part 503.

Table16-1. Pathogen Reduction Alternative 1.

PATHOGEN REDUCTION ALTERNATIVE 1[1] for Domestic Septage Septage (without additional treatment) applied to nonpublic contact sites
Domestic septage is pumped from the septic tank or holding tank and land applied without treatment, and <u>Crop Restrictions</u>: i) Food crops with harvested parts that touch the septage/soil mixture and are totally above ground shall not be harvested for 14 months after application of domestic septage. ii) Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of domestic septage. iii) Animal feed, fiber, and those food crops that do not touch the soil surface shall not be harvested for 30 days after application of the domestic septage. iv) Turf grown on land where domestic septage is applied shall not be harvested for one year after application of the domestic septage when the harvested turf is placed on either a lawn or land with a high potential for public exposure, unless otherwise specified by the permitting authority. <u>Grazing Restrictions</u>: i) Animals shall not be allowed to graze on the land for 30 days after application of domestic septage. <u>Site Restrictions</u>: i) Public access to land with a low potential for public exposure shall be restricted for 30 days after application of domestic septage. Examples of restricted access include remoteness of site, posting with no trespassing signs, and/or simple fencing.
[1] You must meet either of the two pathogen reduction alternatives discussed in Alternative 1 or 2 (not both).

Table 16-2. Pathogen Reduction Alternative 2.

PATHOGEN REDUCTION ALTERNATIVE 2[1] for domestic Septage (with pH treatment) applied to nonpublic contact sites
The domestic septage pumped from the septic tank or holding tank has had its pH raised to 12 or higher by the addition of material such as hydrated lime or quicklime and, without adding more alkaline material, the domestic septage remains at a pH of 12 or higher for at least 30 minutes prior to being land applied, and Crop Restrictions: i) Food crops with harvested parts that touch the septage/soil mixture and are totally above ground shall not be harvested for 14 months after application of domestic septage. ii) Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of domestic septage when the domestic septage remains on the land surface for 4 months or longer prior to incorporation into the soil. iii) Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of domestic septage when the domestic septage remains on the land surface for less than 4 months prior to incorporation into the soil. iv) Animal feed, fiber, and those food crops whose harvested parts do not touch the soil surface shall not be harvested for 30 days after application of the domestic septage. v) Turf grown on land where domestic septage is applied shall not be harvested for one year after application of the domestic septage when the harvested turf is placed on either a lawn or land with a high potential for public exposure, unless otherwise specified by the permitting authority. Grazing Restrictions: None Site Restrictions: None
[1]You must meet either of the two pathogen reduction alternatives in Alternative 1 or 2 (not both). Note: If you meet this pH 12 pathogen reduction alternative, you also meet vector attraction reduction in Alternative 3.

Table16-3. Vector Attraction Reduction Alternative 3.

VECTOR ATTRACTION REDUCTION ALTERNATIVE 3[1] For Domestic Septage Applied to Nonpublic Contact Land
VECTOR ATTRACTION REDUCTION ALTERNATIVE 1: Injection Domestic septage shall be injected below the surface of the land, AND no significant amount of the domestic septage shall be present on the land surface within one hour after the domestic septage is injected;
OR
VECTOR ATTRACTION REDUCTION ALTERNATIVE 2: Incorporation Domestic septage applied to the land surface shall be incorporated into the soil surface plow layer within 6 hours after application;
OR
VECTOR ATTRACTION REDUCTION ALTERNATIVE 3: pH Adjustment The pH of domestic septage shall be raised to 12 or higher by addition of alkaline material and, without the addition of more alkaline material, shall remain at 12 or higher for 30 minutes.
[1] You must meet vector attraction reduction Alternatives 1, 2, or 3 – only one.

Table16-4.Case Example of Management of Untreated Domestic Septage.

CASE EXAMPLE Management of Untreated Domestic Septage
1. The untreated domestic septage is pumped directly into the truck's tank and hauled to a nonpublic contact site.
2. The domestic septage is injected below the land surface with no significant amount of domestic septage remaining on the land surface within one hour after the domestic septage is injected (vector attraction reduction Alternative 1).
OR
2b. The domestic septage is incorporated into the soil surface within 6 hours after application to the land (vector attraction reduction alternative 2).
3a. If an animal feed crop like hay, a food crop like corn (that usually does not touch the surface of the soil), or a fiber crop like cotton is grown, a minimum wait of 30 days after application of the domestic septage is required before the crop may be harvested.
OR
3b. A minimum wait of 30 days after application of the domestic septage is required before letting animals graze the pasture.
OR
3c. If a food crop, like melons or cucumbers that touch the surface of the soil, is grown, a wait of 14 months after application of the domestic septage is required before that food crop may be harvested.
OR
3d. If you raise a food crop, like potatoes or onions that grow below the surface of the soil, a minimum wait of 38 months after application of the domestic septage is required before that food crop may be harvested. Additional examples of the different kinds of crops described in 3a to 3c are listed in Figure 6.
4. Public access to this nonpublic contact site (site with a low potential for public exposure) must be restricted for 30 days after application of untreated domestic septage. Examples of restricted access includes remoteness of site, posting with "no trespassing" signs, and simple fencing.
5. You must complete and sign the certification listed in Form #3 about meeting the pathogen and vector attraction reduction requirements.

Table16-5. Record Keeping.

RECORD KEEPING REQUIREMENTS
1. The location of the site where domestic septage is applied, either the street address, or the longitude and latitude of the site (available from the U.S. Geological Survey maps). 2. The number of acres to which domestic septage is applied at each site. 3. The date and time of each domestic septage application. 4. The nitrogen requirement for the crop or vegetation grown on each site during the year. Also, while not required, indicating the expected crop yield would help establish the nitrogen requirement. 5. The gallons of septage that are applied to the site during the specified 365-day period. 6. The certification shown in Table 16-6. 7. A description of how the pathogen requirements are met for each batch of domestic septage that is land applied. 8. A description of how the vector attraction reduction requirement is met for each batch of domestic septage that is land applied.

Pathogen and Vector Attraction Reduction Certification Statement

This federal certification statement is required under 40 CFR 503 - Standards for the Use or Disposal of Sewage Sludge. Please note that this federal law includes septage as well.

State of Michigan licensed septage waste servicers must include this certification statement, signature, and date the statement is signed on every land disposal record form used to track the amount/volume of septage land applied at each EGLE authorized disposal site. This includes every separate location that may be used on each site.

Table16-6. Certification Statement.

The certification statement found in 40 CFR 503, 503.17 (6)(b)(6) (Recordkeeping) shall read: I certify, under penalty of law, that the information that will be used to determine compliance with the pathogen requirements [insert either Sec. 503.32(c)(1) or Sec. 503.32(c)(2)] and the vector attraction reduction requirement in [insert Sec. 503.33(b)(9), 503.33(b)(10), or Sec. 503.33(b)(12)] was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment. _____ Signature Date (To be signed by the person designated as responsible in the firm that applies septage)

16.10 Crop Harvesting Restrictions - Federal Standards for the Application of Domestic Septage
Crop Harvesting, Animal Grazing, and Site Restrictions involving Land Application of Domestic Septage

Table 16-7 Crop Harvesting, Grazing, and Site Restrictions Summary

Crop Restrictions		**Waiting Time after Domestic Septage Application**	
		Domestic Septage Not Lime- Stabilized	**Domestic Septage Lime Stabilized**
Crop Type	**Description**		
Food Crops	Harvested parts that touch the septage/soil mixture and are totally above ground	14 Months	14 Months
Food Crops	Harvested parts below the surface of the land	38 Months	20 Months*
			38 Months**
Animal Feed Fiber Crops Food Crops	Harvested parts do not touch the soil surface	30 Days	30 Days
Turf	Harvested turf is placed on either lawn or land with high potential for public exposure	1 Year	1 Year
Grazing Restrictions			
Animals		30 days	None
Site restrictions			
Public access	Land with low potential for public exposure	30 Days	None

* When domestic septage remains on the land surface for 4 months or longer before incorporation.
** When domestic septage remains on the land surface for less than 4 months prior to incorporation into the soil.

Note: These are USEPA standards for domestic septage. Michigan Part 117 is more restrictive with regard to time of incorporation after land application of septage waste. <u>The standards listed above apply whether septage waste is surface applied and incorporated or subsurface injected as far as Michigan is concerned.</u>

16.11 References

1. Michigan Septage Law. Part 117, Septage Waste Servicers, NREPA, 1994 PA 451, as amended. Enacted 2004.

2. U.S. Environmental Protection Agency. 1993. Domestic Septage Regulatory Guidance. A Guide to the EPA 503 Rule. EPA-832-B-92-005.

3. U.S. Environmental Protection Agency. Federal Septage Law, CFR 40. Part 503 Standards for the Use or Disposal of Sewage Sludge. Effective 1993.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

APPENDIX A

EGLE

LAND SITE MANAGEMENT (CROPPING PLAN) FORM

Business Name: ______________________ **Septage License #:** ______________________ **Cropping Year:** ____________
Land Site Address: ______________________ **Site ID #:** __________ **Land Owner's Name:** ______________________
City: ______________ **Twp:** ______________ **County:** ______________ **Twn/Rng/Sec:** ____/____/____

Previous Crop Grown	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Next Crop (to be grown *following* septage application in this or next cropping year)
Field: **Acreage*:** **Phosphorus Level:** **lb/ac**** **Agronomic Application Rate (AAR):** **gal/ac/yr**													
Crop (list):													
Septage Applied:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
Field: **Acreage*:** **Phosphorus Level:** **lb/ac**** **Agronomic Application Rate (AAR):** **gal/ac/yr**													
Crop (list):													
Septage Applied:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
Field: **Acreage*:** **Phosphorus Level:** **lb/ac**** **Agronomic Application Rate (AAR):** **gal/ac/yr**													
Crop (list):													
Septage Applied:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
Field: **Acreage*:** **Phosphorus Level:** **lb/ac**** **Agronomic Application Rate (AAR):** **gal/ac/yr**													
Crop (list):													
Septage Applied:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Crop Use: ☐ Animal Feed ☐ Food Crop ☐ Erosion & Runoff Control ☐ Plow under ☐ Other: **Method of Septage Waste Application:** ☐ Injection ☐ Surface

Erosion & Runoff Control Method: (Check all that apply) ☐ Border Strip ☐ Cover Crop ☐ Earth Berm ☐ Windbreak ☐ Tillage Across Slope ☐ Other:

Pathogen Reduction Method & Vector Attraction Reduction Method: (Check all that apply) ☐ Injection ☐ Lime Stabilization ☐ Surface Application & Incorporation within 6 hours ☐ Surface Application with Lime Stabilization & Incorporation within 48 hours ☐ Surface Application over Existing Actively Growing Crops/Vegetation with Lime Stabilization

Other Nutrient Sources to be Land Applied in Addition to Septage Waste: ☐ None* ☐ Chemical Fertilizers ☐ Manure ☐ Other
***** If any other box apart from "None" is checked, calculate AAR using Option B.

Winter Disposal Plan (Dec. 21 – Mar. 21): ☐ Septage Waste Receiving Facility ☐ Septage Waste Storage Facility
(Check all that apply) ☐ <u>No</u> Land Application in winter months ☐ Land Application when ground is <u>not</u> frozen (Submit Initial Written Plan for Review and Approval)

Land Application of Food Establishment Septage (FES): ☐ Yes ☐ No If yes, explain how FES is combined with domestic septage and blended into a uniform mixture prior to land application.

Land Application of Portable Toilet Waste: ☐ Yes ☐ No **Land Application of Holding Tank Waste:** ☐ Yes ☐ No **Septage Waste Storage Facility Available**: ☐ Yes ☐ No

Septage Waste Applicator Calibration Rate = gal/ac **Drainage Tiles:** ☐ Yes ☐ No **Soil Group:** **(See Guidance Manual)**

Septage Application over Actively Growing Crops/Vegetation: ☐ Yes ☐ No If yes, explain type of crop, number, yield and use of cuttings, etc. or crop harvesting/grazing restrictions.

***Acreage**: Proposed number of acres that will be used in the current cropping year.* *****Phosphorus Level**: Pounds per acre = parts per million (ppm) x 2.*

Check the Guidance Manual for definitions, description/explanation of items. Use additional sheets as necessary. Send copies to your local health department and EGLE.

Business Name: John Doe Septic Service **Septage License #:** 00-00 **Cropping Year:** 2020

Land Site Address: 9090 Septage Road **Site I.D. #:** 1, 2, and 3 **Land Owner:** My Property

City: Pollution Control Twp**:** Waste Manager County**:** Tolerant **Section of Land Site:** 2

Prev. Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Next Crop
Site I.D. # 1													
Field A = 10 acres **Phosphorus Level = 80 lb/ac** **Agronomic Application Rate (AAR) = 38,000 gal/ac/yr**													
Soybeans	***No Septage Application***				***Septage Application***	***Corn(grain)***						***Fall Soil Sampling for Next Cropping Year***	***Corn***
Field B = 8 acres **Phosphorus Level = 55 lb/ac** **Agronomic Application Rate (AAR) = 23,000 gal/ac/yr**													
Rye	***Winter Wheat***					***Winter Wheat***	***Septage Application***					***Fall Soil Sampling for Next Cropping Year***	***Wheat***
	No Septage Application												

Site I.D. # 2

Acreage = 15 acres	Phosphorus Level = 110 lb/ac	Agronomic Application Rate (AAR) = 60,000 gal/ac/yr	
Oats	***No Septage Application***	***Septage Application over Grass-Alfalfa-Clover Hay Crop*** ***Requires Lime Stabilization of Septage Before Application*** ***Document Cuttings to Determine Yield*** ***Soil Sampling***	***Grass-Legume Mixture***

Site I.D. # 3

Acreage Field A = 5 acres	Phosphorus Level = 95 lbs/ac	Agronomic Application Rate (AAR) = 60,000 gal/ac/yr	
Corn	***Septage to Unfrozen Ground*** ***Winter Plan Approval Required***	***Soybeans*** ***Fall Soil Sampling for Next Cropping Year***	***Soybeans***
Acreage Field B = 25 acres	**Phosphorus Level = 70 lb/ac**	**Agronomic Application Rate (AAR) = 23,000 gal/ac/yr**	
Rye	***Winter Rye*** **Winter Rye** ***No Septage Application***	***Fall Soil Sampling for Septage Application Next Cropping Year***	***Rye***

Time of Soil Sampling: Fall soil sampling is recommended. Results of fall soil sampling can the used for the cropping plan of the following cropping year. Spring soil sampling may be done if soils were not sampled in fall and the soil test results should be provided before septage is land applied in that cropping year. ***Use one form for each land site.***

AGRONOMIC APPLICATION RATES (AAR) FOR SELECTED CROPS
OPTION A

Completion is required under authority of Part 117 Act 451 PA 1994
Failure to comply is a misdemeanor.

Crop	**Nitrogen Requirement*** (Lb N/Ac)	**Agronomic Application Rate** AAR = N Requirement / 0.0026 (Gal/Ac/Yr)
Grass-Legume Mixtures Alfalfa Clover Soybeans Trefoil	160	60,000
Corn	100	38,000
Bromegrass Orchard grass Timothy	90	35,000
Small grains Barley Buckwheat Millet Oats Rye Sorghum-Sudan grass Wheat	60	23,000

* Nitrogen Requirement values reported in this table are based on considerations for:
1) Nitrogen recommendation as reported in Table 4 (Nitrogen recommendations for field crops grown on mineral and organic soils),
2) Nutrient removal as reported in Table 3 (Nutrient removal in harvest portion of several Michigan field crops) of reference below.
Source: Nutrient Recommendations for Field Crops in Michigan. Extension Bulletin E2904, 2004 (Ref. # 5, Chapter 5).
Assumes no additional nitrogen sources such as chemical fertilizers, manure, etc.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

CALCULATING AGRONOMIC APPLICATION RATES (AAR)
OPTION B

Completion is required under authority of Part 117 Act 451 PA 1994
Failure to comply is a misdemeanor.

Business Name: _____ County: _____ Year: _____

Site Address: _____ Township: _____ Site I.D. #:_____ Field #: _____

Crop	Expected Crop Yield (bu/ac, ton/ac)		Nitrogen Removal (lb/unit yield)		Nitrogen Requirement (lb N/ac)		Nitrogen from Previous Crop (lb N/ac)		Nitrogen from Chemical Fertilizer (lb N/ac)	Total Nitrogen Requirement (lb N/ac)	Agronomic Application Rate AAR = N Regd. / 0.0026 (gal/ac/yr) Max = 100,000

APPENDIX E

CALCULATING AGRONOMIC APPLICATION RATES (AAR) EXAMPLE
OPTION B

Completion is required under authority of Part 117 Act 451 PA 1994
Failure to comply is a misdemeanor.

Crop	Expected Crop Yield (bu/ac, ton/ac)		Nitrogen Removal (lb/unit yield)		Nitrogen Requirement (lb N/ac)		Nitrogen from Previous Crop (lb N/ac)		Nitrogen from Chemical Fertilizer (lb N/ac)	Total Nitrogen Requirement (lb N/ac)	Agronomic Application Rate AAR = N Reqd. / 0.0026 (gal/ac/yr) Max = 100,000
Example: Corn with No Nitrogen Contribution from Previous Crop (e.g., Wheat) and Chemical Fertilizer											
Corn (grain)	150	X	0.9	=	135	-	0	-	0	135	52,000
Example: Corn with Nitrogen Contribution from Previous Crop (e.g., Soybeans) and No Chemical Fertilizer											
Corn (grain)	150	X	0.9	=	135	-	30	-	0	105	40,000
Example: Corn with Nitrogen Contribution from Chemical Fertilizer and No Contribution from Previous Crop											
Corn(grain)	150	X	0.9	=	135	-	0	-	20	115	44,000
Example: Wheat with Nitrogen Contribution from Previous Crop (e.g., Dry Edible Beans) and No Chemical Fertilizer											
Wheat	60	X	1.2	=	72	-	20	-	0	52	20,000

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

LAND APPLICATION VOLUME RECORD

Business Name: _____ **County of Land Site**: _____ **Section:** ___ **Year:** _____

Site Address: _____ **Site I.D. #:** _____ **City:** _____ **Twp:** _____

Date of Septage Application	Field Number (A,B,C, etc.)	Number of Acres	Number of Gallons	Method of Application		Time of Application	Time of Incorporation (if applicable)	Lime Stabilization (if applicable)	Comment
				Surface	Injection				
Total Volume =									

Note: Complete this form for one land site with one or more fields.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

SEPTAGE LIME STABILIZATION LOG

APPENDIX G

Septage Waste Firm Name: _____

Land Site Address: _____ Site I.D. #: _____ Field #: _____

Date	Amount of Septage Waste (gallons)	Type of Alkaline Material (or Lime) Used	Amount of Alkaline Material (or Lime) Used (lbs)	Form of Lime Mixed with Septage waste	Initial pH after mixing with Lime	pH after 30 minutes	Method of Application (Injection/ Surface)	Field Type (Fallow/Cropped)	Driver

Additional Comments/Observations of Crops/Septage Waste/Soil/Weather Conditions (Use extra sheet/s as needed):

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

SEPTAGE LIME STABILIZATION LOG

Septage Waste Firm Name: Septage Waste Hauler #1

Land site Address: Land Application Road Site I.D. #: 1 Field #: A

Date	Amount of Septage Waste (gallons)	Type of Alkaline Material (or Lime) Used	Amount of Alkaline Material (or Lime) Used (lbs)	Form of Lime Mixed with Septage waste	Initial pH after mixing with Lime	pH after 30 minutes	Method of Application (Injection/ Surface)	Field Type (Fallow/Cropped)	Driver
7/14/2008	2000	Quicklime	60	Dry	12	12	Injection	Fallow	John Doe

Septage Waste Firm Name: My Septic Service

Land site Address: Nutrient Management Road Site I.D. #: 3 Field #: B

8/21/2008	1500	Hydrated Lime	50	Slurry	12	12	Surface	Over alfalfa Hay	John Doe Jnr

Additional Comments/Observations of Crops/Septage Waste/Soil/Weather Conditions (Use extra sheet/s as needed):

APPENDIX I

NUTRIENT REMOVAL IN HARVEST PORTION OF SEVERAL MICHIGAN FIELD CROPS

Nutrient removal in harvest portion of several Michigan field crops.					
Crop		**Unit**	**N lb./unit of yield**	**P_2O_5 lb./unit of yield**	**K_2O lb./unit of yield**
Alfalfa	(Hay)	Ton	45	13.0	50.0
	(Haylage)	Ton	14	3.2	12.0
Barley	(Grain)	Bu	0.88	0.38	0.25
	(Straw)	Ton	13	3.2	52
Beans (dry edible)	(Grain)	Cwt	3.6	1.2	1.6
Bromegrass	(Hay)	Ton	33	13	51
Buckwheat	(Grain)	Bu	1.7	0.25	0.25
Canola	(Grain)	Bu	1.9	0.91	0.46
Clover	(Hay)	Ton	40	10	40
Clover-grass	(Hay)	Ton	41	13	39
Corn	(Grain)	Bu	0.90	0.37	0.27
	(Stover)	Ton	22.0	8.2	32.0
	(Silage)	Ton	9.4	3.30	8.00
Millet	(Grain)	Bu	1.1	0.25	0.25
Oats	(Grain)	Bu	0.62	0.25	0.19
	(Straw)	Ton	13	2.8	57
Orchard grass	(Hay)	Ton	50	17	62
Potato	(Tubers)	Cwt	0.33	0.13	0.63
Rye	(Grain)	Bu	1.1	0.41	0.31
	(Straw)	Ton	8.6	3.7	21
	(Silage)	Ton	3.5	1.5	5.2
Sorghum	(Grain)	Bu	1.1	0.39	0.39
Sorghum-Sudan grass	(Hay)	Ton	40	15	58
	(Haylage)	Ton	12	4.6	18
Soybean	(Grain)	Bu	3.8	0.80	1.40
Spelts	(Grain)	Bu	1.2	0.38	0.25
Sugar beets	(Roots)	Ton	4.0	1.3	3.3
Sunflower	(Grain)	Bu	2.5	1.2	1.6
Timothy	(Hay)	Ton	45	17	62
Trefoil	(Hay)	Ton	48	12	42
Wheat	(Grain)	Bu	1.2	0.63	0.37
	(Straw)	Ton	13.0	3.3	23

Source: Nutrient Recommendations for Field Crops in Michigan.
MSU Extension Bulletin E-2904, 2004 (Ref. #5, Chapter 5).

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
DRINKING WATER AND ENVIRONMENTAL HEALTH DIVISION

APPENDIX J

WINTER PLAN FOR LAND APPLICATION OF SEPTAGE WASTE

This information is required by authority of Part 117, 1994 PA 451, as amended.
Failure to submit this information is a felony.

Business Name: _____ **Septage License No.:** _____ **Cropping Year:** _____

Land Site Address: _____ **Site I.D. No.:** _____

City: _____ **Twp:** _____ **County:** _____ **Section:** _____

Number of Acres for Use During Winter Months: _____	**Site Plan** *(Attach plan showing field to be used in winter)*: ☐ Yes ☐ No

Method of Septage Waste Application: ☐ **Injection* (Recommended)** ☐ **Surface***

Percent of Slope:

Surface (Maximum)	☐ 2%	☐ 2-6%	
Injection (Maximum)	☐ 2%	☐ 2-6%	☐ 6.1 - 12%

Maximum Application Rate* (gallons per acre during winter months): 10,000 gallons

Depth of Injection/Incorporation: ☐ 0 - 8 inches ☐ 0 - 12 inches

Dominant Soil Class (Within Depth of Injection or Incorporation) *e.g. sandy loam*:

Land Management Practice that will Follow after Winter application at this site:
☐ Crops ☐ Septage Waste Application ☐ Other _____

Pathogen Reduction and Vector Attraction Reduction Method: *(Check all that apply)*
☐ Lime stabilization ☐ Injection ☐ Incorporation within 6 hours ☐ Other _____

Equipment to be used for injection or proper soil incorporation *(Surface application)*:

Erosion Control Plan: ☐ Border Strip (winter crop) ☐ Cover Crop (winter crop)
(Check all that apply) ☐ Tillage Across Slope ☐ Flat Land (< 2% slope) ☐ Other _____

Other Winter Disposal Plan: ☐ Wastewater Treatment Plant ☐ Septage Waste Storage Facility
(Check all that apply)

*Note: * Surface applied septage waste or septage waste that bubbles to soil surface after injection must be incorporated within 6 hours or 48 hours if lime-stabilized.*

Isolation Distances: Make sure that isolation distances are met with regard to the winter disposal area.

Name of Septage Business Owner (Print): _____

Signature of Septage Business Owner: _____ Date: _____

Reminder: The land application of septage waste when soil is frozen is not permitted.

Winter Period: December 21 – March 21

EGLE OFFICIAL USE
☐ Approved ☐ Not Approved

EGLE Signature: _____ Date: _____

Comments: (Use additional sheet, if necessary)

APPENDIX K

SUMMARY OF HOW TO TAKE SOIL SAMPLES*

Number of <u>cores (or borings)</u> to make one composite sample = 15 – 20.

Field (land) size area covered by <u>one composite sample</u> = 10 – 15 acres.
About 1- 2 cores (borings) per acre.
Mix cores (borings) in a clean pail to make composite sample.

Quantity of a composite sample to put inside sample container = About 1-2 cups.

Depth to sample = 6-8 inches (or tillage depth).

How often to sample = Once every year (Septage Program).

When to sample = Any time, but best when soil is not frozen or too wet. Sample at about the same time each year if possible.

Where to sample = Sample uniform areas to make a composite sample.
Delineate areas that look alike and get a composite sample from each area.
Avoid unusual spots such as manure or lime piles, near fences or roads, fertilizer bands, very low spots, etc.

Pattern of sampling = Zig-zag or "W-shaped" pattern across sampling area.

Tools to use = Soil sampling probe (best); soil auger; pointed shovel; plastic pail; sample box or bag.

Sample Identification = Identify sample box or bag properly (Your name, field [land] location and other requested information printed on the sample box or bag).

Where to send soil sample = MSU Soil & Plant Nutrient Lab or other commercial soil testing lab of your choice. *Samples for MSU Soil & Plant Nutrient Lab may be dropped off at the MSUE office nearest to you.*

* Refer to "Sampling Soils for Fertilizer and Lime Recommendations. 1998. Michigan State University Extension Bulletin E- 498", for guidance.

For additional information about soil sampling and laboratory procedures in soil analysis, consult:
Recommended Chemical Soil Test Procedures for the North Central Region. 1998. North Central Regional Research Publication No. 221 (Revised). Missouri Agricultural Experiment Station SB 1001.

APPENDIX L

NEW LAND SITE APPLICATION CHECKLIST

Business Name:_____ Septage License #: _____
(To be provided by EGLE if new business)

Land Site Address:_____ Site I.D. #: _____
(To be provided by EGLE)

City:_____ Twp:_____ County:_____ Sec:_____

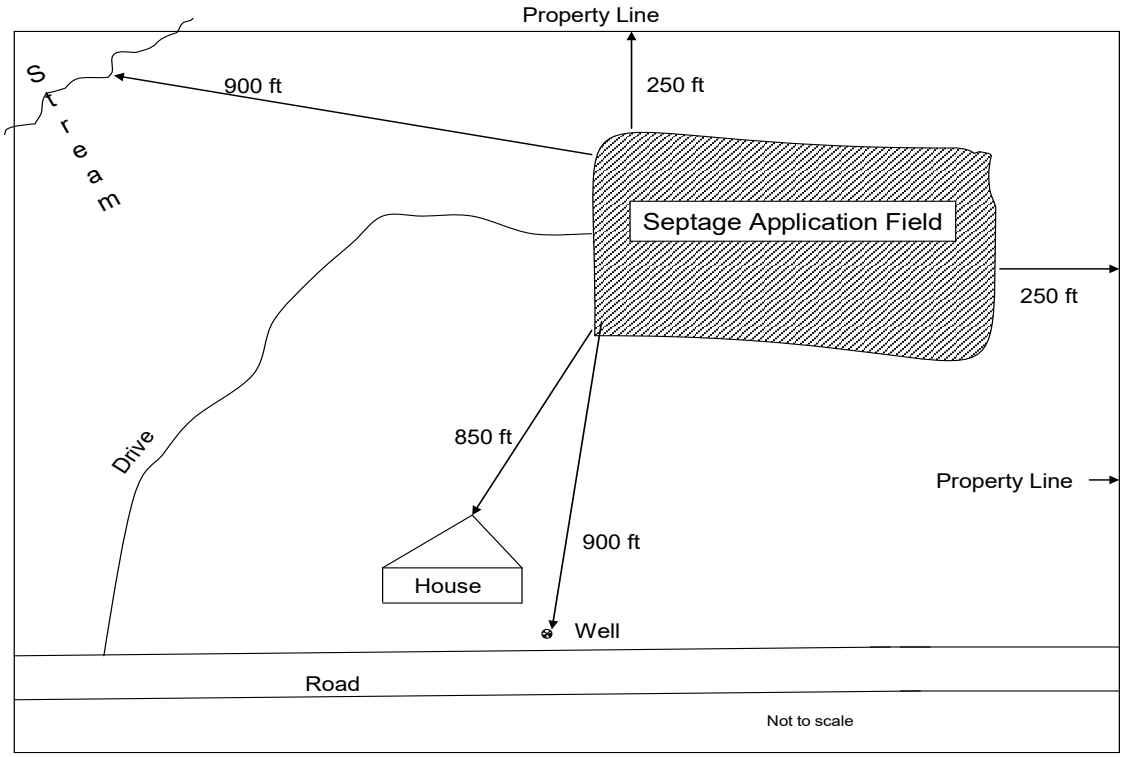
Item	Attached/Submitted	Comments
Completed Application Form EQP5837	Yes ☐ No ☐	
Latitude and Longitude	Yes ☐ No ☐	
Name and Address of Land Owner	Yes ☐ No ☐	
Name and Address of Land Manager	Yes ☐ No ☐	
Maps		
Atlas/Plat Book	Yes ☐ No ☐	
Aerial	Yes ☐ No ☐	
Topographic	Yes ☐ No ☐	
Soil	Yes ☐ No ☐	
Land Site Plan Drawing	Yes ☐ No ☐	
Site plan showing isolation distances:		
Homes or Commercial Buildings	Yes ☐ No ☐	
Water Wells (public, private, other)	Yes ☐ No ☐	
Surface Waters	Yes ☐ No ☐	
Roads	Yes ☐ No ☐	
Property Lines	Yes ☐ No ☐	
Soil Fertility Test Report	Yes ☐ No ☐	
Notice of Application with items specified in Part 11709 (1) (a) to (d) sent to:		
Local Health Department*	Yes ☐ No ☐	
Clerk of City, Village or Township	Yes ☐ No ☐	
Contiguous Lot/Parcel Owners	Yes ☐ No ☐	
Lot/Parcel owners within 150 ft/800 ft	Yes ☐ No ☐	
Completed Cropping Plan Form EQP5928	Yes ☐ No ☐	
Completed Winter Plan Form	Yes ☐ No ☐	
Fee Payment	Yes ☐ No ☐	

* LHD will receive additional land application materials sent by applicant through EGLE.

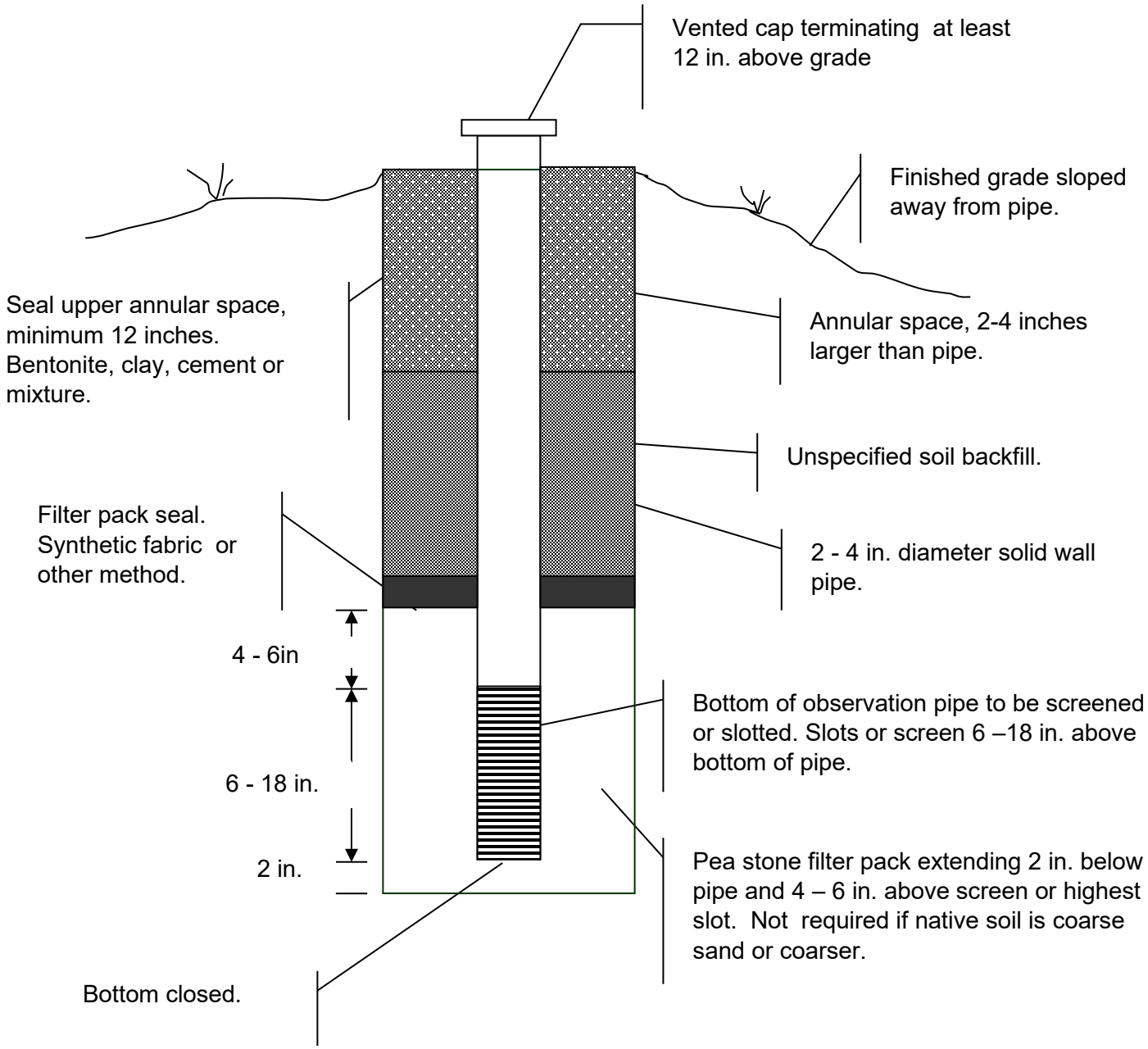
Note 1: If necessary, you may use the space under "Comments" or the back of the form to explain an item that does not apply.
2: You may list item(s) not shown above.
3. See the land application Guidance Manual for additional information.

Submitted by: _____ Date: _____

LAND SITE EXAMPLE



SUGGESTED GROUNDWATER ELEVATION MONITORING WELL FOR SEPTAGE DISPOSAL SITES WITH HIGH SEASONAL GROUNDWATER



IMPORTANT NOTES

- Approval of specific locations and depths of proposed monitoring wells must be obtained from EGLE or authorized local health department having jurisdiction.

- Monitoring of saturated conditions in fine textured soils may be inconclusive using the detail suggested. Alternate methods to address the direct determination of saturated soil conditions may be necessary.

APPENDIX O

SAMPLE NOTICE OF APPLICATION

Date

Name of lot or parcel owner or neighbor
Address

Dear _____:

My company is in the business of pumping and servicing septic tanks. As a part of that business, the waste must be disposed of in an environmentally safe manner once it has been cleaned out of the septic tank. My method of disposal involves the recycling of the waste by uniform application and incorporation into the soil with subsequent planting and harvest of crops, which utilize nutrients contained in the applied waste. This notice is being provided to you as required by Section 11709 of Part 117, Septage Waste Servicers, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 117), in conjunction with our permit application for land application to the Department of Environment, Great Lakes, and Energy (EGLE).

I am also attaching the following information to you as required by Part 117:

- A map identifying the site from a county land atlas and plat book.
- The site location by latitude and longitude.
- The name and address of the land owner.
- The name and address of the manager of the land, if different than the owner.

The requirements of the law are designed to protect the environment, and my company fully intends to comply with those requirements. There may be conditions, however, which we are not aware of that could prevent the use of the site. Please forward any comments in writing directly to me and to EGLE at the following address:

Department of Environment, Great Lakes, and Energy
Drinking Water and Environmental Health Division–DWEHS–OSWU
Septage Waste Program
P. O. Box 30817
Lansing, Michigan 48909-8311

Sincerely,

Name
Address of Applicant for a Site Permit