

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

WASTE TREATMENT LAGOON

(number)
CODE 359

DEFINITION

An impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.

PURPOSE

Biologically treat organic waste, reduce pollution, and protect the environment.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) an overall waste management system has been planned; (2) waste generated by agricultural production or processing needs treatment; (3) lagoon can be located near the source of the waste and a minimum of 300 ft. from a neighboring residence or public area; (4) soils are suitable for retaining the waste or can be sealed; and (5) a water supply is adequate to fill the lagoon about half full before operation and to maintain the design depth when the lagoon becomes fully operational.

CRITERIA

Soil and foundation. Locate on soils of slow to moderate permeability or on soils that can seal through sedimentation and biological action. Avoid gravelly soils and shallow soils over fractured or cavernous rock. If there are questions on geological feasibility, the Missouri Geological Survey may be contacted for their comments regarding the geological suitability. If self-sealing is not probable, the lagoon shall be sealed by mechanical treatment or by the use of an impermeable membrane. Methods for sealing or lining lagoons are discussed on pages 12-87 through 12-92 in the Agricultural Waste Management Field Manual. This work shall be done in accordance with standards and specifications for Pond Sealing or Lining (521).

Waste production. Waste treatment lagoons are designed on the basis of 5-day biochemical oxygen demand (BOD5) or volatile solids (VS) loading. Design loading shall be based on the maximum average weight of animals using the lagoon and other waste introduced. Information on waste production is provided in chapter 4 of the Animal Waste Management Field Manual and in Table 1 and 5 of Missouri Approach to Animal Waste Management. Reliable local determinations shall be used if possible.

Loadings. Anaerobic waste treatment lagoons are usually designed on the basis of daily VS loading per 1,000 cubic feet of lagoon volume. Maximum loading shall be as indicated in Table 1 of Missouri Approach to Animal Waste Management. Unless design volumes are computed using actual degree days, NRCS administrative Areas 1 and 2 shall use north Missouri design volumes, Areas 3 shall use central Missouri design volumes and Areas 4 and 5 shall use south Missouri design volumes. If solids are removed, dairy and cattle lagoon design volumes may be reduced in accordance with DNR design criteria. If a high degree of odor control is necessary, use the facultative-aerobic lagoon design.

Naturally aerobic lagoons are usually designed on the basis of daily BOD5 loading per acre of lagoon surface. Allowable loading shall be as indicated in Table 8 of Missouri Approach to Animal Waste Management.

Mechanically aerated lagoons are usually designed on the basis of BOD5 or ultimate BOD loading and on the basis of the equipment manufacturer's performance data for oxygen transfer and mixing. If used for odor control, aeration equipment shall provide a minimum of 1 pound of oxygen for each pound of BOD5 contributed daily. For complete treatment, refer to the design procedures provided in the

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.
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Agricultural Waste Management Waste Management Field Handbook.

Additional storage volumes shall be added to the above design volume for:

1. Manure and waste water.
2. Maximum rainfall minus evaporation expected in 1 year out of 10.
3. Maximum lot runoff expected 1 year out of 10.

If the lagoon will be pumped down more than once a year, the additional storage volume may be cut accordingly.

Depth. The minimum depth of liquid shall be 6 feet for mechanically aerated and anaerobic lagoons, and 2 feet for aerobic lagoons. If subsurface conditions prevent construction of anaerobic lagoons to a depth of 6 feet, a lesser depth may be used if volume requirements are met. The maximum depth for mechanically aerated and anaerobic lagoons are dictated by the site and equipment. The maximum depth for aerobic lagoons shall be 5 feet.

Bottom and edges. The bottom of aerobic lagoons shall be approximately level. The edges of all lagoons below the planned waterline shall be constructed as steep as soil conditions permit to reduce areas of shallow water and to inhibit weed growth.

Earth embankment. The design height of the embankment shall be increased by the amount needed to insure that the design top elevation is maintained after settlement. This increase shall not be less than 5 percent. The minimum top width shall be 8 feet. The combined slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical. On dairy lagoons where the formation of a crust is a problem, the top should be widened or the slopes flattened so that stirring equipment and crust removal equipment will have ready access to the lagoon. The minimum elevation of the top of the settled embankment shall be 1 foot above the maximum design water surface in the lagoon.

Inlet. If freezing is not a problem, an open inlet, such as a concrete channel, may be used. If freezing is a problem the inlet shall consist of a pipe having a minimum diameter of 6 inches and a minimum slope of 1 percent, except that a diameter of 4 inches may be used for a milking

center waste. The inlet pipe shall terminate a sufficient distance from the shoreline to insure good distribution. It shall be far enough below the surface to avoid freezing or be provided with other protective measures. Access shall be provided to the pipe for rodding in case of blockage. A water-sealed trap and vent or a similar device shall be provided on pipelines from enclosed buildings discharging to enclosed settling tanks or beneath the lagoon surface to prevent gases from entering the building. Inlet lines shall be of materials that will not separate at the joints, that will be watertight and that can withstand sunlight, weather, and earth and traffic loading.

Outlet. Waste treatment lagoons shall not discharge to surface waters unless the owner determines through the state regulatory agency that such discharge will not contravene established water quality standards. Lagoons having a maximum design liquid level of 3 feet or more above natural ground shall be provided with an emergency spillway to prevent overtopping. The crest of the emergency spillway shall be at least 1 foot below the top of the settled embankment. The emergency spillway, if used, shall have a minimum bottom width of 4 feet. Where a lagoon discharges into another cell, the emergency spillway of the upper lagoon may be replaced by a 6 inch minimum diameter pipe between the two cells.

Protection. If the location will create a safety hazard, the lagoon shall be fenced and warning signs posted to prevent children and others from using it for purposes other than intended. The embankment and surrounding areas shall be vegetated to control erosion. The seedbed preparation and treatment and the seeding mixtures and methods shall be as outlined in the standards and specifications for Critical Area Planting (342). Vegetative screens or other methods shall be used to shield lagoons from public view and to improve visual conditions.

CONSIDERATIONS

Types. Waste treatment lagoons are of three general types--anaerobic, naturally aerobic, and mechanically aerated. Anaerobic lagoons require less surface area than naturally aerobic lagoons but may give off odors.

Naturally aerobic lagoons are relatively odor free. Mechanically aerated lagoons are comparable in size to anaerobic lagoons and are generally odor free, but they require energy for aeration.

Location. The lagoon shall be located near the source of waste and as far from neighboring dwellings as practicable, a minimum distance of 300 feet. If possible, locate the lagoon where prevailing winds will carry odors away from residences and public areas. Runoff from outside drainage areas should not enter the lagoon. The lagoon shall not be located on a flood plain unless it is protected from inundation for damage by a 25-year-frequency flood event. Plans must show the location of any well in relation to the proposed animal waste facility. The Missouri Department of Natural Resources has the following guidelines concerning the distance between animal waste facilities and water supply wells: 1) Wells drawing water from bedrock formations with casing sealed: 300 feet is recommended and 100 feet is the minimum distance; 2) Wells drawing water from unconsolidated formation (sand, gravel, or alluvium) or unsealed wells: 1000 feet is recommended and 300 feet is the minimum distance.

Solids removal. To reduce the size of the lagoon, remove solids from waste of animals, such as dairy cattle, fed high roughage rations. A solids trap or a separator may be provided between the waste sources and the lagoon. This may be a concrete or earth structure that can be emptied periodically. A minimum of 7 days storage should be provided, based on a minimum of 6 gallons per day per horse or cow and 1 gallon per day per sheep or hog, except that a minimum of 3 days of storage may be provided for milking center waste. If earth structures are used, a minimum of two should be planned so that one can be dried and cleaned while the other is functioning.

PLANS AND SPECIFICATIONS

Plans and specification for installing waste treatment lagoons shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Operation and maintenance shall be performed according to the written operation plan provided for in the overall waste management plan.

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**NATURAL RESOURCES CONSERVATION SERVICE
OPERATION AND MAINTENANCE**

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Loading

The lagoon should be filled with water to the minimum of one-half the design volume for anaerobic lagoons and 2.0 feet of depth for aerobic lagoons. Start a new lagoon at the beginning of warm weather for best results. The first loading in summer should be gradual. Daily loading results in the best operations. If intermittent loading is necessary, the minimum depth should be maintained by addition of water and hydrated lime or caustic soda should be added to keep pH above 6.7.

Floating material

Provisions should be made to keep bedding material, straw, oil and other floating material out of the lagoon. Grass clippings from mowing operations should be prevented from entering the lagoons.

Maintenance

The lagoon should be inspected periodically, the grass kept mowed, and the embankment and edges kept free of weeds, shrubs, trees, and burrowing animals. Infrequent removal of sludge may be necessary. Weeds must be kept under control to prevent mosquito breeding and other nuisances.

Operation

The depth of operation of the lagoon should be at or above the minimum depth. Periodic pumping of the lagoon effluent and diluting the remaining liquids with water help to prevent concentration of salts and other chemicals which will inhibit bacterial action.

Safety

If the location will create a safety hazard, the lagoon should be fenced and warning signs

posted to prevent children and others from using for purposes other than intended.

Effluent disposal

The effluent from these lagoons is not sufficiently treated to permit discharge to surface waters. Properly constructed lagoons do not have seepage and will overflow because the amount of run-off and waste added exceeds the amount of pond evaporation. This excess liquid must be properly disposed of to prevent water pollution. This can most easily be done by using irrigation equipment. The following recommendations for the application of this liquid should be followed.

1. Do not lower the lagoon below the minimum design depth.
2. Do not apply waste material on frozen ground or on snow.
3. Do not apply waste material immediately after a rain or within 12 hours of a forecasted rain.
4. Do not apply more liquid at one time than can be applied without producing run-off and never more than 3.0 inches.
5. Disposal of waste that produces offensive odors must be made on areas and at times that will minimize the inconvenience to nearby residences.
6. As animal waste and associated run-off contain nitrogen, phosphorus, potassium, and organic matter, adequate soils testing should be performed to guide in the addition of supplemental commercial fertilizer and to prevent the application of these waste materials at a rate that may be toxic to plants and animals.

Additional details: _____

**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI CONSTRUCTION SPECIFICATION**

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GENERAL

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within legal limits.

The completed job shall present a workmanlike appearance and shall conform to the line, grades, and elevations shown on the drawings or as staked in the field.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used.

FOUNDATION PREPARATION

The foundation area shall be cleared if trees, logs, stumps, roots, brush, boulders, sod and rubbish. The topsoil and sod are to be stockpiled. After stripping, the foundation area will be prepared to assure bond with the fill by removing loose dry material, scarifying, disking, adjusting moisture, and compacting as necessary.

CUTOFF TRENCH

A cutoff trench shall be constructed when shown on the construction drawing. Final depth of cutoff trench shall be determined by observation. Sand, gravel, and other water conducting materials shall be removed to prevent leakage under the embankment.

EXCAVATION

The completed excavation shall conform to the lines, grades, and elevation shown on the plans as nearly as can be achieved by skillful operation of the excavating equipment.

FILL PLACEMENT

The material placed in the fill shall be free of detrimental amounts of sod, roots, frozen soil, stones over 6 inches in diameter (except for rock fills), and other objectionable material. To the extent they are suitable, excavated materials are to be used as fill. The distribution and gradation of materials shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.

The fill shall be brought up in approximately horizontal layers not to exceed 9 inches in thickness. Each layer will be compacted by complete coverage with the hauling and spreading equipment or two (2) passes of standard tamping roller unless otherwise specified.

PLACEMENT OF TOPSOIL

Available topsoil should be placed on the top and the exposed slopes at the lagoon embankment.

MOISTURE CONTROL

The minimum moisture content of the fill material and foundation shall be such that when kneaded in the hand, the fill material will form a ball which does not readily separate. The maximum moisture content is when conditions are too wet for efficient use of the hauling and compaction equipment.

MATERIALS

Materials and fabrication shall be as specified on the drawings.

INSTALLATION

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The inlet structure or conduit shall be placed on a firm foundation to the lines and grades shown on the plans. Installation shall be constructed in a skillful and workmanlike manner. Extreme caution must be exercised in backfill and

compaction around structures or conduits to prevent damage, movement or deflection.

Additional details: _____

