WASTEWATER TREATMENT STRIP

(acre)
CODE 635

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A treatment component of an agricultural waste management system consisting of a strip or area of herbaceous vegetation.

II. Purposes

To remove sediment and other pollutants from *wastewater*[1] by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing pollution, protecting the environment, and improving water quality.

III. Conditions Where Practice Applies

This practice applies:

- Where a wastewater treatment strip is a component of a planned agricultural waste management system in accordance with Natural Resources Conservation Service (NRCS) Agricultural Waste Management Field Handbook (AWMFH), Chapter 9.
- To the treatment of contaminated runoff from dairy and beef *animal lots* using a *slow rate infiltration process, overland flow process, or buffer process.*
- To not more than 10,000 square feet of animal lot area and to not more than 98 *animal units* per slow rate infiltration process treatment strip or overland flow process treatment strip.
- To the treatment of milking center effluent using an overland flow process or buffer process on operations with less than 98 animal units and producing less than 300 gallons of wastewater per day.

This practice does not apply to:

- Swine animal lots.
- Treatment of leachate from silos, bunk silos, or silage bags.
- Treatment of runoff from manure stacks or storage facilities.
- Treatment of runoff from croplands, which is covered in NRCS Field Office Technical Guide (FOTG) Section IV, Standard 393, Filter Strip.
- Animal lots where manure consistency is such that direct discharge of undiluted manure from the animal lot to the treatment area is possible.

IV. Federal, State, and Local Laws

Wastewater treatment strip practices shall comply with all federal, state, and local laws, rules, or regulations. The operator is responsible for securing required permits. This standard does not contain the text of the federal, state, or local laws.

V. Criteria

A. General Criteria

1. **Management Assessment** – A management assessment shall be performed with the owner/operator to determine planned management and explore design options. The assessment shall be conducted, documented, and incorporated into the design. In addition to the Waste Management Inventory in Chapter 9 of the AWMFH, the management assessment for a wastewater treatment strip shall address the following:

   a. Waste Characterization

      (1) Animal types and numbers

      (2) Feed type

   b. Animal Lot Management

[1] Words in the standard that are shown in italics are described in Section X. - Definitions. The words are italicized the first time they are used in the text.

(1) Cleaning methods and frequency

(2) Feeding locations and methods

(3) Animal time on lot

2. **Site Assessment** – A site assessment shall be conducted, documented, and incorporated into the design. The assessment will determine physical site characteristics that may influence the placement, construction, maintenance, and environmental integrity of the wastewater treatment strip. The assessment shall include input from the owner/operators. In addition to the Waste Management Inventory in Chapter 9 of the AWMFH, the site assessment for a wastewater treatment strip shall address the following:

   a. Identification and characterization of contributing drainage area.

      (1) Lot
         i. Slope, size, shape, drainage pattern, surfacing
         ii. Feeding location
         iii. Equipment - access, cleaning, etc.

      (2) Non-lot areas
         i. Surface types, dimensions
         ii. Slopes
         iii. Soils

   b. Soil boring logs and, if available, a soil survey photo. Soil investigation shall include:

      (1) The number and distribution of soil borings sufficient to characterize the soils to a depth of 4 feet below the planned wastewater treatment strip grade.

      (2) The depth to *bedrock* encountered in soil boring(s) and bedrock type, such as sandstone, limestone, dolomite, or granite.

      (3) Depth to saturation and/or mottling encountered in the boring(s).

3. **Outside Water Exclusion** – All components shall be installed that are needed and practicable to keep uncontaminated runoff from entering the animal lot or treatment area. A 25-year 24-hour design storm shall be used. This includes runoff from:

   a. Outside land area – Runoff from outside land areas shall be excluded from the animal lot area by use of diversions, dikes, drop inlets with underground outlets, etc., in accordance with the criteria specified in the FOTG standard for the applicable practice.

   b. Roof runoff – Runoff from roof areas draining to animal lots shall be excluded in accordance with criteria specified in FOTG Standard 558, Roof Runoff Management System.

   c. Springs or seepage – Springs or seepage shall be intercepted by a drainage system sized to carry the anticipated volume of seepage water.

   d. Other water sources – Measures will be installed to prevent all other water sources such as overflowing waterers or cooling water from draining onto the animal lot.

4. **Uncontrolled Cattle Access** – All treatment areas shall be protected from uncontrolled cattle access.

5. **Vegetation of Treatment Areas.**

   a. Treatment area vegetation shall be established and maintained in accordance with criteria specified in FOTG Standard 342, Critical Area Planting, or Standard 612, Tree/Shrub Establishment.

   b. Recommended plant species and seed mixes can be found in Chapter 10 of the AWMFH.

   c. Vegetation shall be established in the treatment area prior to introducing wastewater.

B. Specific Criteria

1. **Animal lot runoff treatment using the slow rate infiltration process.**

a. **Siting Parameters** – The treatment area shall be further than 100 feet from any private water well. The bottom of the planned root zone shall be greater than 2 feet above bedrock. The treatment area shall be more than 500 feet from any pond, lake, or sinkhole.

b. **Soils** – This process shall be limited to well-drained loamy soils listed in Chapter 10 of the AWMFH. No evidence of seasonal saturation (mottling) can be observed within 2 feet of the bottom of the planned root zone of the soil profile within the proposed treatment area.

c. **Pretreatment** – Contaminated runoff shall be pretreated by solid/liquid separation using a sediment basin designed in accordance with FOTG Standard 350, Sediment Basin, prior to discharge of liquid to the treatment strip. Pretreatment shall occur between the animal lot and treatment area. Pretreatment shall be designed in accordance with procedures in Chapter 10 of the AWMFH.

d. **Design Criteria** – The treatment area shall be sized to infiltrate the 25-year, 24-hour runoff from the animal lot and contributing area. Runoff shall be infiltrated into the *root zone* of the vegetation to be grown. The depth of water application shall be equal to the *available soil water capacity* of the soil in the root zone.

e. **Treatment Area** – The treatment area shall be level, on native undisturbed soils, and with a maximum length to width ratio of 4:1. Soil shall not be excavated to form the level basin. Fill soils shall be lightly compacted and consist of topsoil of the same texture as the in-place soil. The maximum topsoil fill shall be limited to 2 feet. The treatment area shall be contained such that there is no surface discharge. Treatment shall be designed in accordance with procedures in Chapter 10 of the AWMFH.

2. **Animal lot runoff treatment using the overland flow process.**

a. **Siting Parameters** – The overland flow treatment strip shall be situated or constructed in a 2 foot minimum depth of soil with at least 20% passing the Number 200 sieve (P200 ≥ 20%), and a minimum separation to saturation and bedrock of 2 feet. The treatment strip shall be further than 50 feet from any private water well. Runoff from the end of the treatment strip shall be:

(1) Routed through a non-channelized flow length of over 200 feet to any *channelized flow* or wetland, and have a non-channelized flow length of over 500 feet to any pond, lake, or sinkhole. The soils and slopes would be as required for the treatment strip in V.B.2.a. and V.B.2.c. respectively.

or

(2) Routed through another treatment strip designed in accordance with section V.B.2.c. There shall be 300 feet of non-channelized flow length between the end of the last strip and a lake, pond, or sinkhole.

or

(3) Collected and transferred to storage meeting the criteria contained in FOTG Standard 313, Waste Storage Facility, or to one of the options (1) or (2) above at an off-site location.

See Figure 1 for further illustration.

b. **Pretreatment** – Contaminated runoff shall be pretreated by solid/liquid separation using a sediment basin designed in accordance with FOTG Standard 350, Sediment Basin, prior to discharge of liquid to the treatment strip. Pretreatment shall be designed in accordance with procedures in Chapter 10 of the AWMFH.

c. **Treatment Strip Design Criteria** – The runoff distributed to the treatment

strip must be spread out across the full width of the treatment strip. The treatment strip shall be designed to treat runoff from the 25-year, 24-hour storm event. The treatment strip shall be a maximum of 30 feet wide, and sized to pass the design flow at a depth of 1 inch or less. The Mannings "n" value shall be 0.3. Flow length shall be adequate to provide a minimum of 755 seconds of contact time for a 1-inch flow depth with a minimum length of 100 feet. Slope of the treatment strip shall be between 1% and 4%. Runoff from outside land area shall be excluded from the treatment strip.

3. **Animal lot runoff treatment using the buffer process.**

   a. **Siting Parameters** – The buffer area shall be situated or constructed in a 2 foot minimum depth of soil with at least 20% passing the Number 200 sieve (P200 ≥ 20%), and a minimum separation to saturation and bedrock of 2 feet The buffer area shall be further than 50 feet from any private water well.

   b. **Design Criteria** – The runoff distributed to the buffer area must be spread out across the full width of the upper end of the buffer area. Solids shall be kept off the buffer area. The buffer area must be graded so that overland flow is maintained.

      The annual output of phosphorus from the buffer area shall be 15 lbs. or less as determined based on potentially affected resources documented in the site assessment. If the down-gradient end of the waste treatment buffer area is within 1,000 feet of a lake or sinkhole, or within 300 feet of a solid or dashed blue line on a 1:24,000 scale USGS map, quarry, or wetland, the annual output of phosphorus shall be less than 5 lbs. Design to lower values of phosphorus output may be specified by local ordinances or requirements.

      Only slopes from 1% to 8% may be considered as part of the buffer area. If a row crop is used as part of the buffer area, it must be planted on the contour.

      The minimum buffer area shall be 150% of the animal lot size for paved lots and 100% of the animal lot size for earth lots. For combination paved/earth lots, the size of the buffer shall be prorated.

      Size the buffer area according to the Wisconsin Barnyard Runoff Model (*BARNY*). See Chapter 10 of the AWMFH for the specific methodology.

4. **Milking center wastewater treatment using the overland flow or buffer processes.**

   a. **Siting Parameters** – The treatment strip shall meet the siting parameter criteria found above in section V.B.2.a. or V.B.3.a.

   b. **Pretreatment** – Wastewater shall be pretreated by solid/liquid fat separation prior to discharge to the treatment strip.

   c. **Design Criteria** – The treatment strip shall meet all criteria found in section V.B.2.c. or V.B.3.b. Storage, multiple treatment strips, or other measures shall be provided to allow the treatment area a minimum of three days rest between dosing.

   See Chapter 10 of the AWMFH for pretreatment and design details.

VI. Considerations – Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice, but are not required to ensure its basic conservation function, are as follows:

- Secondary Storage - Consider collecting a portion or all of the discharge from treatment areas and storing in a waste storage facility.
- Consider storage of lot discharge rather than application to a treatment area when vegetation is dormant or the ground is frozen.
- Consider longer rest periods for milking center wastewater treatment areas to allow

for treatment area maintenance and harvesting.

VII. Plans and Specifications

Plans and specifications for wastewater treatment strips shall be in keeping with this standard and standards for each component of the wastewater treatment strip.

VIII. Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The plan may include the following, or other items, as appropriate:

A. Clean the animal lot and/or settling areas as needed to prevent migration of solids to the treatment strip.

B. Maintain the wastewater spreader to the initial design function.

C. Harvest treatment strip vegetation as appropriate to encourage dense growth, maintain upright growth, and remove nutrients and other contaminants that are contained in the plant tissue. Controlled grazing can be an acceptable method of harvest.

D. Inspect and repair treatment strips after storm events to fill in gullies, remove flow-disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow.

E. Conduct controlled grazing, harvesting, and other maintenance activities only when the treatment strip is dry and moisture content in the surface soil layer will not allow compaction or rutting.

F. Prior to construction, the owner/operator shall sign the operation and maintenance plan to indicate an understanding of the requirements and a commitment to operate and maintain the practice as specified.

IX. References

United States Department of Agriculture - Natural Resources Conservation Service, Wisconsin Field Office Technical Guide, Section IV (Conservation Practice Standards and Wisconsin Construction Specifications).

United States Department of Agriculture – Natural Resources Conservation Service, Agricultural Waste Management Field Handbook.

Young, R.A., Otterby M.A., and Roos, A. 1982. An Evaluation System to Rate Feedlot Pollution Potential, Agricultural Research Service, USDA, ARM-NC-17.

X. Definitions

Animal lots (Section *III*) – An animal lot is an area, a building, or combination of contiguous areas and buildings intended for the confined feeding, breeding, raising or holding of beef and/or dairy cattle. An animal lot is specifically designed as a confinement area in which beef/dairy waste may accumulate, or where the concentration of beef or dairy animals is such that a vegetative cover is denuded and cannot be maintained within the enclosure.

Animal Units (Section III) – A unit of measurement used to determine the total number of single animal types or combination of animal types, as specified in s. NR 243.11, table 2, which are fed, confined, maintained or stabled in an animal feeding operation. One animal unit is equivalent to one head of beef or slaughter cattle weighing more than 1000 pounds.

Available Soil Water Capacity (Section V.B.1.a.) – Expressed as inches of water per foot of soil, it is the amount of water held in a soil between field capacity, which is the moisture content of soil after it is wetted and ceases to drain by gravity, and permanent wilting point, which is the moisture content of soil when plants die.

BARNY (Section V.B.3.b) – BARNY, or the Wisconsin Barnyard Runoff Model, is an inventory and analysis system that is used to assess the water quality impacts of barnyards or feed lots. It is a somewhat modified version of the USDA Agricultural Research Service Feedlot Runoff Model (Young et al. 1982)

Bedrock (V. A. 2. b. (2)) – Consolidated rock material and weathered in-place material with > 50%, by volume, larger than 2 mm in size.

Buffer Process (Section III) – The application of wastewater at the upper reaches of a vegetated slope, with treatment by physical, chemical, and biological means as it flows in a thin film down the length of the slope.

Channelized flow (V. B. 2. a. (1)) – Water movement in a surface drainage feature including, but not necessarily limited to: swales, draws, grassed waterways, ditches, gullies, creeks, or rivers.

Overland Flow Process (Section III) – The application of wastewater at the upper reaches of a grass covered slope, with treatment by physical, chemical, and biological means as it flows in a thin film down the length of the slope.

Root Zone (Section V.B.1.a.) – Depth to which the roots of mature crops will extract available soil water.

Slow Rate Infiltration Process (Section III) – The application of wastewater to a vegetated land surface with the applied water being treated as it flows through the plant-soil matrix.

Wastewater (Section II) – Wastewater is milking center effluent and runoff from animal lots.

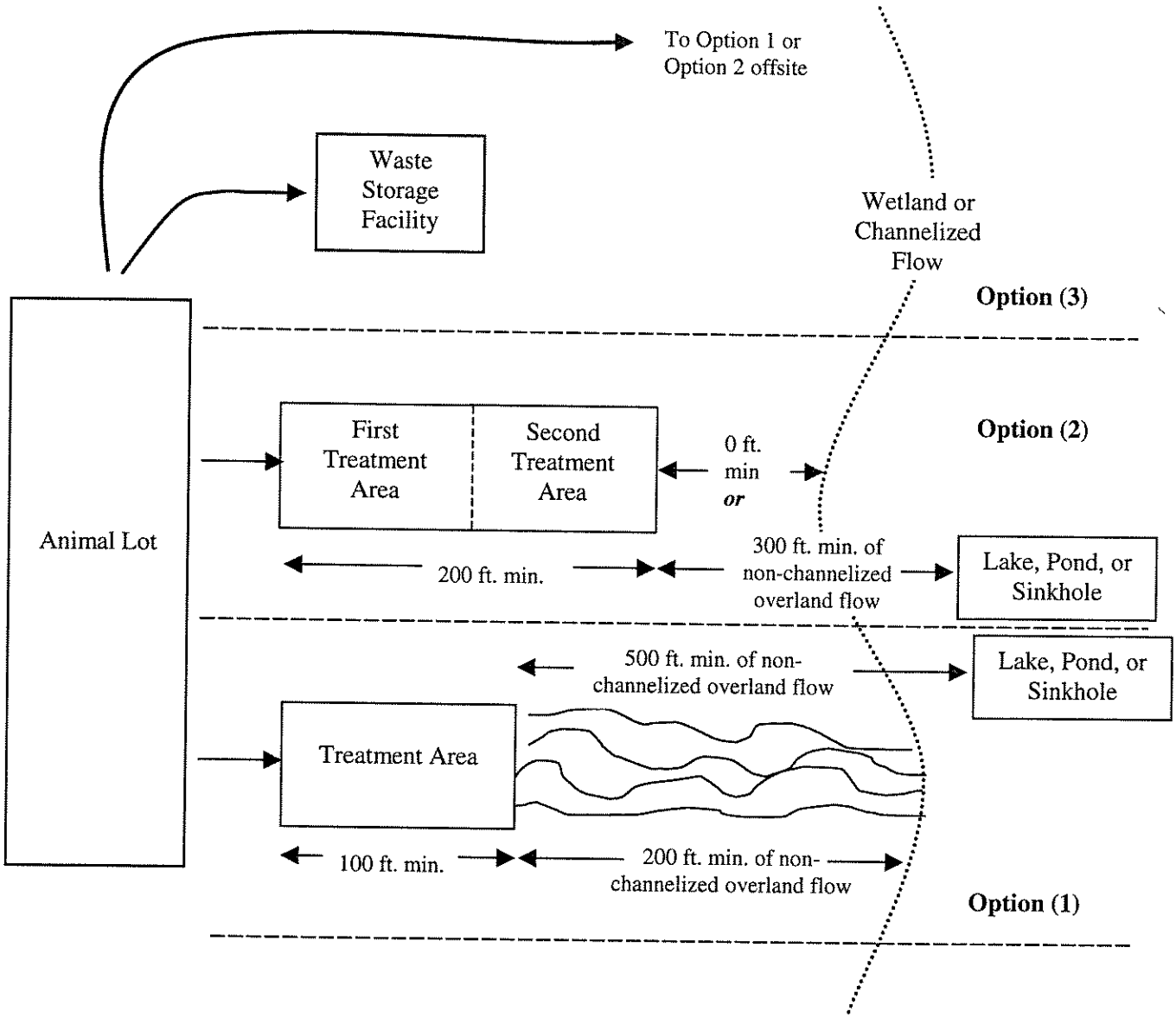

Figure 1. The three options described in section V.B.2. (not to scale)