NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SOLID/LIQUID WASTE SEPARATION FACILITY

(No.)

CODE 632

DEFINITION

A filtration or screening device, settling tank, settling basin, or settling channel used to separate a portion of solids from a liquid waste stream.

PURPOSE

To partition solids, liquids and their associated nutrients as part of a conservation management system to:

- improve or protect air quality.
- improve or protect water quality.
- improve or protect animal health.
- meet management objectives.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where solid/liquid separation will:

- remove solids from the liquid waste stream as a primary treatment process and allow further treatment processes to be applied such as composting and anaerobic digestion.
- allow partly digested feed to be separated from the liquid waste stream so that it can be used as a feed supplement or for bedding.
- reduce problems associated with solids accumulation in liquid storage facilities.
- reduce solids in stored liquids so liquids can be recycled for other uses (i.e. flush water).
- reduce solids in stored liquids to better facilitate land application of liquids using irrigation techniques.
- assist with partitioning nutrients in the waste stream to improve nutrient management.
- remove sand from the liquid waste stream to protect or prolong the life of equipment, to use as bedding, and/or other uses.

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations. Plan, design and construct waste treatment facilities to meet all federal, state and local regulations.

Rules of Georgia Department of Natural Resources, Environmental Protection Division, Chapter 391-3-6-.20 and 391-3-6-.21 contain the requirements for animal feeding operations in the state of Georgia. These rules are promulgated under the authority of the Georgia Water Quality Control Act (O.C.G.A. Section 12-5-20 et seq.).

Location. Locate solid/liquid separation facilities so that the waste stream can be safely routed to and from the facility.

Georgia DNR rules contain location or separation distance requirements that differ from NRCS criteria. Use the more restrictive or stringent criteria when locating solid/liquid separation facilities. In no case shall the separation distance be less than that required by the DNR or other state agency rules or local ordinances.

NRCS criteria are shown in Table 1 below:

Table 1

Separation Distances for Solid/Liquid Waste Separation Facility and other Components of a liquid manure system

Public or Private Facility Type	Minimum Distance from Solid/Liquid Waste Separation Facility
Any public use area, church, picnic area, playground, etc.	700
Residence or place of habitation other than owner or tenant	700
Potable Well, Private	300
Potable well, Public	500
Non-Potable wells	200
Drainage Ditches	100
Dirt - County Roads	100
Paved - County Roads	200
State Numbered Roads	300
Federal Numbered or Interstate Roads	400

Solid/Liquid Separator Selection. Table 1 provides guidance on the different types of solid/liquid separators available. Capture efficiency varies widely for each type of separator depending on the type and consistency of the waste to be treated. Select the type of solid/liquid separator based on site specific data for the liquid waste stream and management conditions where specific management objectives are to be met.

Solid/Liquid Separation Efficiency. Base the volume of solids separated on estimates of daily waste water volume and the total solids capture efficiency for the type of solid/liquid separation device selected. Where manufacturer information or local data concerning total solids capture efficiencies are not available for the type of solid/liquid separation device selected, the efficiencies in Table 2 can be used to estimate the volume of separated solids generated.

Chemical Amendments. Guidance for the addition of chemicals to the liquid waste stream for improving total solids capture efficiencies is given in Georgia NRCS Conservation Practice Standard 591, Amendments for Treatment of Agricultural Waste.

Table 2

Solid/Liquid Separators	Total Solids Capture Efficiency
Static Inclined Screen	10-20%
Inclined Screen with Drag Chain	10-30%
Vibratory Screen	15-30%
Rotating Screen	20-40%
Centrifuge	20-45%
Screw or Roller Press	30-50%
Settling Basin	40-65%
Weeping Wall	50-85%
Dry Scrape	50-90%
Geotextile Container	50-98%

Storage of Separated Solids. Provide adequate storage areas for separated solids

so they can be properly managed. Provide temporary storage areas for separated solids unless they are transported directly from the separator to the final utilization location (i.e. offsite composter). Base the length of storage and the volume of storage required on a nutrient management plan developed in accordance with Georgia NRCS Conservation Practice Standard 590, Nutrient Management.

Design storage facilities for separated solids in accordance with requirements of Georgia NRCS Conservation Practice Standard 313, Waste Storage Facility.

Direct all seepage from solid storage facilities to short or long term liquid storage facilities.

Waste Transfer Piping. It is standard practice to route flow to and from a solid/liquid separation facility using underground and above ground pipe. Design pipelines according to criteria in Georgia NRCS Conservation Practice Standard 634, Waste Transfer.

Outlets. Provide outlet capacity for a solid/liquid separation facility to safely convey the design capacity to a storage or utilization location.

Outlets may include pipelines, perforated or slotted pipe risers, porous plank walls or dams, or screened walls. Provide at least 10% open area in screening used to separate solids at the outlet of settling basins.

Emergency overflow appurtenances such as notched weirs, or pipe bypasses can be used to control flows exceeding design capacity. Design emergency overflow appurtenances to pass the peak runoff from the drainage area of the facility for a 25 year-24 hour storm frequency plus the normal waste stream discharge. Capture any discharge from the solid/liquid separation facility in a waste storage or treatment structure, land apply the discharge, or otherwise contain the discharge to prevent the discharge from entering surface or ground water.

Utilization. Utilize separated solids and liquids in accordance with Georgia NRCS Conservation Practice Standards 590, Nutrient Management and 633, Waste Utilization.

Additional Criteria for Filtration or Screening Devices

Flow rate. Design the flow rate (combined flow of solid and liquid waste) for filtration and screening devices in accordance with the manufacturer's recommendations.

Velocity. Design the liquid waste stream velocity through filtration and screening devices in accordance with the manufacturer's recommendations.

Structural Design. Design structural supports for filtration and screening devices in accordance with the requirements of Georgia NRCS Conservation Practice Standard 313, Waste Storage Facility.

General Criteria Applicable to Settling Basins

Velocity. Design the liquid waste stream velocity through settling basins to not exceed 1.5 feet per second.

Depth. Provide a total depth of 5 feet or less for settling basins that are to be cleaned out using conventional front end loading equipment. Address safety concerns during cleanout where the total depth for settling basins will exceed 5 feet.

Base the total depth of earthen settling basins on the sum of the depth needed for liquids and solids storage plus 1 foot of freeboard.

Base the total depth of concrete settling basins on the sum of the depth needed for liquids and solids storage.

Base the minimum liquid depth of settling basins on a minimum hydraulic retention time and the solids settling rate. Use a minimum hydraulic retention time of 30 minutes, except where sand is a major component of the liquid waste stream. Where sand is a major component in the liquid waste stream provide a hydraulic retention time of a minimum of 3 minutes and a maximum of 5 minutes.

Design the maximum solids settling to be 4 feet per hour for settling basins with a total storage depth greater than 2 feet and 2 feet per hour for settling basins with a total storage depth equal to or less than 2 feet.

Bottom Width. Provide a minimum bottom width for settling basins of 10 feet.

Design settling basins used for dewatering to be constructed of concrete and/or lined with a geosynthetic, compacted soil, or geomembrane liner meeting applicable local laws and regulations. Design a settling basin not utilizing a concrete slab for the basin floor to provide adequate support for clean out equipment. Design settling basins constructed according to these criteria to meet appropriate criteria in Georgia NRCS Conservation Practice Standard 313, Waste Storage Facility.

Liners. Self-sealing settling basins are not an acceptable means of preventing the nutrients from causing an environmental problem. Construct an appropriate liner for settling basins in conformance with Georgia NRCS Conservation Practice Standard 313, Waste Storage Facility.

Access. Provide a minimum top width of earthen embankments for settling basins of 15 feet where equipment access is needed for clean out. Where no access is needed for clean out, design the minimum top width according to the equipment used to construct the embankment or berm, but not be less than 4 feet.

Design the side slopes of earthen embankments to be 2 horizontal to 1 vertical (2:1) or greater. For earthen embankments greater than 3 feet in height, design the side slopes to be no steeper than 3:1 on the outside and 2:1 on the inside of the embankment.

Design access ramps to allow entry into the basin for clean out by normal front end loading equipment to be no steeper than 10:1 for four wheel drive equipment and 12:1 for two wheel drive equipment.

Additional Criteria for Settling Basins Receiving Lot Runoff

Settling basins used in conjunction with or without screening to remove waste solids from process generated liquid waste streams (i.e. flush water from covered freestall barns, or milking parlor waste water) that include significant external drainage fall into this category.

Flow rate. Base the design flow rate for a settling basin that receives lot runoff on the normal liquid waste stream discharge from the operation plus the peak runoff from the drainage area of the basin computed using a 10 year-1 hour storm frequency.

Volume. Base the design volume for settling basins receiving lot runoff on the total depth needed for a minimum of 30 days of solids storage, including sludge accumulation from the lot surfaces and runoff from the lot surface area for the storage period. Where no specific information is available on sludge accumulation rates from lot surfaces, use 0.05 cubic feet per square foot per month for unpaved lots and 0.01 cubic feet per square foot per month for paved lots. Increase these values by 50% if lots are steep or poorly maintained.

Additional Criteria for Settling Basins that Exclude Lot Runoff

Settling basins used in conjunction with or without screening to remove waste solids from process generated liquid waste streams (i.e. flush water from covered freestall barns, or milking parlor waste water) and do not receive significant external drainage fall into this category.

Flow rate. Base the design capacity for a settling basin that excludes lot runoff on the normal liquid waste stream discharge from the operation.

Volume. Base the design volume for settling basins that exclude lot runoff on the volume needed to provide solids storage for a specified treatment period, not less than 30 days, plus temporary liquid storage necessary during dewatering. Base the minimum temporary liquid storage on the volume of the liquid waste stream for one-day.

Additional Criteria for Sand Collection Lanes

Concrete lanes used to collect sand from liquid waste streams by gravity for reuse as bedding fall into this category.

Velocity. Design the waste stream velocity through the flume to be between 1 and 2 fps.

Volume. Provide adequate volume in the sand lane to store one day of settled sands. Design the bottom width to be compatible with the equipment used to remove the sand from the lane.

Hydraulic Retention Time. Provide a hydraulic retention time of a minimum of 3 minutes and a maximum of 5 minutes.

Storage of Collected Sand. Provide adequate temporary storage location for collected sand to compost to kill microorganisms and bacteria that could potentially be harmful to animal health.

Direct all seepage from sand storage facilities to short or long term liquid storage facilities.

CONSIDERATIONS

Location. Consider locating solid/liquid separation facilities based on elevation and distance from the source of material to be separated and the location of long-term liquid and solid waste storage facilities. Location of solid/liquid separation facilities should take advantage of gravity flow wherever possible.

Other considerations for locating solid/liquid separation facilities include vehicle access, wind direction, neighboring dwellings, proximity of streams and floodplains, and visibility.

Weeping Walls. To maximize drainage and solid/liquid separation, use weeping walls on the entire perimeter of the waste to be treated and drainage paths maintained to and through the walls. Ensure drainage is transferred to a liquid storage facility. When basin cell width exceeds 40 feet consider using 2 weep walls.

Visual Screening. Consider vegetative screens or other methods to shield solids separation facilities from public view and for more aesthetic conditions.

Rainfall. Rainfall on the solids storage areas associated with solid/liquid separation facilities can result in increased waste water discharge into the long term storage facility. Consider covering of solids storage facilities in locations where high rainfall amounts occur.

Sand Separation. Consider using sand separation prior to mechanical separators to improve the mechanical life of the system.

Operation and Maintenance. Where sand is a major component of the liquid waste stream, give special emphasis to abrasion resistant waste transfer piping and pumps to reduce frequency of repairs.

The owner and operator should understand the level of operation and maintenance (O&M) required ensuring the type of separator selected will be operated as intended.

PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard and good engineering practice. Include all details necessary for construction and completion of the solid/liquid separation facilities in the plans and specifications.

As a minimum, provide the following items in the plans and specifications:

1. Layout of waste production facilities, waste collection points, waste transfer pipelines, waste treatment and storage facilities.
2. Location of all inflow and discharge pipelines and a description of pipeline materials, diameter and slope.
3. Details of support systems for solid/liquid separation devices.
4. Fencing and signage as appropriate for safety purposes.
5. Operating characteristics.

Warranties. Require the contractor to provide a one-year warranty on all construction. If a manufactured solid/liquid separation device is installed, require the manufacturer to provide a warranty that describes the design life of the device and what the warranty covers.

OPERATION AND MAINTENANCE

Develop an operation and maintenance (O&M) plan and review the plan with the owner and operator prior to constructing the solid/liquid separation facility. Prepare the O&M plan to be consistent with the purposes of the solid/liquid separation device chosen, its intended life, safety requirements, and the criteria for its design. Include as a minimum the following operation and maintenance requirements in the plan:

1. Documentation of design assumptions.

2. Design capacity for the facility.
3. A description of normal operation of the facility, safety issues, and normal maintenance items.
4. Alternative operation procedures in the event of equipment failure.
5. Daily inspection of the following:
    - Separation device and support structure.
    - Screens and outlets.
    - Remaining capacity in storage facilities.

REFERENCES

1. USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.1992, Last revised, June 1999.
2. Mid West Plan Services Handbook 18, Livestock Waste Facilities Handbook, Third Edition, 1993.
3. Burns, R.T. and Moody, L.B.. 2003. Development of a Standard Method for Testing Mechanical Manure Solids Separators. ASAE-CIGR Meeting Paper No. 034131. St. Joseph, MI.: ASAE