NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE SEPARATION FACILITY

(No.)

CODE 632

DEFINITION

A filtration or screening device, settling tank, settling basin, or settling channel used to partition solids and/or nutrients from a waste stream.

PURPOSE

To partition solids, liquids and/or their associated nutrients to:

- improve or protect air quality
- improve or protect water quality
- improve manure handling methods or serve as a pre- or post-treatment for other processes

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the waste separation facility will:

- remove solids from a liquid waste stream as a primary treatment process and facilitate further treatment processes.
- reduce problems associated with solids accumulation in liquid waste storage facilities.
- reduce solids content in waste stream so liquids can be recycled for other uses.
- reduce solids content in a waste stream, to better facilitate land application of liquids using irrigation techniques.
- assist with partitioning nutrients in the waste stream to improve handling and application of nutrient management.

CRITERIA

General Criteria Applicable to All Purposes

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

Management Assessment. A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with the owner/operator to explore options for solid/liquid separation components, available resources, and waste characteristics.

The designer shall provide a narrative describing the solid/liquid separation system. The narrative shall also include the strategy for utilization, storage, or land spreading of the waste following separation.

Site Assessment. A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed solid/liquid separation facility. The assessment shall include input from the owner/operator. The site assessment shall include:

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, and easements.

b. Wells, floodplains, surface waters, surface drains, and drain tile.

c. Utilities.

d. Cultural resources.

Location. Position waste separation facilities so that the waste stream can be safely routed to and from the facility.

Waste separation facilities located in flood plain areas shall be protected from inundation, structural damage, and instability. The lowest point at which floodwater could enter the facility shall be 2 feet above the maximum elevation of flow resulting from a 100-year, 24-hour rainfall event.

Waste Separator Selection. Table 1 provides guidance on 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. Base the type of waste separator selected, whether mechanical or non-mechanical, on site specific data for the waste streams and management conditions where specific management objectives are to be met.

A combination of separation unit processes may be necessary to achieve the desired or required results.

Separation Efficiency. Base the volume or percentage of solids separated on estimates of daily waste water (if applicable) and the total solids capture efficiency for the type of separation device selected. Manufacturer separation equipment performance is generally reported as concentration reduction or mass removal efficiency. Where manufacturer information or local data concerning total solids capture efficiencies are not available for the type of waste separation device selected, the efficiencies in Table 1 can be used to estimate the amount of separated material generated.

Chemical Amendments. To enhance the separation process, chemical amendments, such as metal salts and polymers, can be used to flocculate manure solids to enhance the separation process. Addition of chemicals to the liquid waste stream for improving total solids capture efficiencies must be done according to the criteria in NRCS WI Conservation Practice Standard 591, Amendments for Treatment of Agricultural Waste.

Table 1

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%
Membranes	60-99%
Sand Settling Lanes	50-70%
Mechanical Sand Separator	50-95%

Storage of Separated Solids. Provide adequate storage areas for separated solids unless they are transported directly from the separator to the final utilization location.

Design storage facilities for separated solids in accordance with requirements of NRCS WI Conservation Practice Standards 313, Waste Storage Facility and 367, Roofs and Covers.

Discharges. Capture any seepage or discharge from solid or sand storage, waste separation facility, or associated appurtenances in a waste storage or treatment structure unless it meets local, state and federal regulations regarding discharge to surface and ground water.

Conveyance System. Design waste transfer components for separated solids in accordance with requirements of NRCS WI Conservation Practice Standard 634, Waste Transfer.

For conveyance systems, maintain sufficient velocities to keep solids in suspension until material reaches desired separation process or storage area.

Outlets. Provide adequate outlet capacity for a waste separation facility to safely convey the design load 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 for screening used to separate solids at the outlet of settling basins.

Use emergency overflow appurtenances such as notched weirs, or pipe bypasses to control flows exceeding design capacity. For separation facilities exposed to precipitation, 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.

Additional Criteria for Mechanical Separators

Performance. The performance of mechanical separators is generally reported for a given throughput or flow rate. If different flow rates are required, obtain separator efficiencies from the manufacturer.

Flow Rate and Velocity. Follow manufacturer's recommendations for the design flow rate and liquid waste stream velocity for filtration and screening devices.

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

For proper functioning of mechanical separation equipment, environmental conditions may require roofing and or building enclosure. Design roofs and enclosures in accordance with the requirements of NRCS WI Conservation Practices 367, Roofs and Covers and 313, Waste Storage Facility.

General Criteria Applicable to Settling Basins

Velocity. Do not exceed 1.5 feet per second liquid waste stream flow velocity through settling basins.

Depth. Provide sufficient depth for solids and liquids storage and for the depth of influent flow as needed. Include a minimum of one foot freeboard for earthen settling basins.

Base the minimum liquid depth of settling basins on a minimum hydraulic retention time of 30 minutes.

Bottom Width. Establish the minimum bottom width for settling basins on the removal equipment used, but not less than 4 feet.

Construct settling basins of concrete and/or lined with a geosynthetic, compacted soil, or geomembrane liner. Design a settling basin not utilizing a concrete slab for the basin floor to provide adequate support for clean out equipment. Ensure that settling basins constructed according to these criteria also meet appropriate criteria in NRCS WI Conservation Practice Standard 313, Waste Storage Facility.

Access. Establish the minimum top width of earthen embankments for settling basins at 15 feet when equipment access is needed for clean out. Where no access is required to the settling basin for clean out, base the minimum top width on the equipment used to construct the embankment or berm, but not less than 4 feet.

Design access ramps to allow entry into the basin for clean out by normal front end loading equipment at no steeper than 10:1. Allow steeper sloped access ramps where special surfacing of the ramp is done for traction purposes and the equipment used can accommodate the increased slope but in no case steeper than 4:1.

Basin Materials. Settling basins shall be constructed of concrete or may be earthen with a liner as applicable. Earthen settling basins shall meet the criteria contained in NRCS WI Conservation Practice Standard 313, Waste Storage Facility, Table 1, 2 or 5 as applicable. Concrete settling basins shall meet the criteria contained in NRCS WI Conservation Practice Standard 313, Waste Storage Facility, Table 5.

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

Safety. Include in the design appropriate safety features to minimize the hazards of the facility. Provide warning signs, fences, ladders, ropes, bars, rails, and other devices, as appropriate, to ensure the safety of humans and livestock. Ensure that proper ventilation and adequate warning signage is provided for waste separation equipment in an enclosed facility or confined area, as necessary, to prevent explosion, poisoning, or asphyxiation.

Additional Criteria for Livestock Area Sediment Basins

Sediment basins can be used to trap solids from concentrated livestock areas prior to entering storage, buffer, or filter systems. The basin can be either an off-lot basin or an on-lot basin with additional heavy use protection for the livestock area. See NRCS WI Conservation Practice Standard 561, Heavy Use Area Protection, for surfacing options.

The bottom elevation of the sediment basin shall be at least 2 feet above bedrock or subsurface saturation as defined in NRCS WI Conservation Practice Standard 313, Waste Storage Facility. A minimum of 0.3 feet freeboard shall be added to the storage depth.

The sediment basin discharge shall be stored or treated in accordance with NRCS WI Conservation Practice Standards 313, Waste Storage Facility; or 635, Vegetated Treatment Area, as applicable.

The design loadings and quality of materials for walls shall be in accordance with the NRCS WI Conservation Practice Standard 313, Waste Storage Facility.

Runoff shall be based on the 25-year, 24-hour duration storm rainfall. The suggested runoff curve numbers are 90 for unpaved lots and 95 for paved lots. The minimum runoff curve number for unpaved lots shall be 85.

The peak discharge from animal lot areas shall be a minimum of 1010 cubic feet per second per square mile for each inch of runoff. (NRCS Technical Release 55 [TR-55], Exhibit 5-II, Tc=0.1 Hours, Travel Time=0.0 Hours, and I_A/P =0.10).

Flood routing of the sediment basin shall utilize procedures contained in TR-55, Chapter 6, or NRCS National Engineering Handbook (NEH), Part 650, Engineering Field Manual, Chapter 11.

The sediment basin shall have sufficient capacity, as a minimum, to store 65 percent of the peak inflow rate from a 25-year, 24-hour duration storm for a duration of 15 minutes. Any basin outflow shall be disregarded in computing minimum storage.

Additional storage capacity, based on frequency of cleaning, shall be provided for manure and other solids settled within the basin. The solids storage volume shall be based on the number of livestock, time on the lot (minimum of 25 percent), and seven days between cleanings. The minimum daily volume of solids per animal for design purposes shall be as specified in Table 2.

Table 2

Livestock	Minimum Daily Volume of Solids per Animal
1,400 lb. dairy cow	1.6 cubic feet
young dairy stock	1.1 cubic feet/1,000 lbs.
1,000 lb. beef animal	0.9 cubic feet

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. Design the 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 liquid and solids storage and the minimum surface area required for the basin. Where no specific information is available on sludge accumulation rates from lot surfaces, use 0.05 cubic feet per square foot of surface area per month for unpaved lots and 0.01 cubic feet per square foot of surface area per month for paved lots. Increase these values by 50% if lots are steep or poorly maintained. The minimum accumulation storage period is one month.

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. Design the 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 plus temporary liquid storage necessary during dewatering. Use a minimum temporary liquid storage based on the volume of the liquid waste stream for one-day.

General Criteria for Sand Separation and Reuse

Separation processes that remove sand from water and organic material fall into this category.

Dilution. Provide adequate dilution water for sand laden manure to keep organic solids in suspension for proper sand separation. Use a minimum water to sand laden manure dilution ratio of 2:1 (volume basis).

Capacity. Provide adequate capacity for the system design to handle the required manure and sand loadings.

Sand Storage. Provide adequate storage of separated sand to allow for additional liquid drainage from the sand.

Additional Criteria for Non-Mechanical Sand Separation and Reuse

Velocity. Design the waste stream velocity between 1 and 2 feet per second. Adjust flow velocity according to sand size and distribution.

Volume. Provide a minimum settling area storage volume to correspond to the maximum cleanout period. Design the bottom width to be compatible with the removal equipment, but not be less than 8 feet.

Hydraulic Retention Time. Design the hydraulic retention time to be between a minimum of 3 minutes and a maximum of 5 minutes. Make adjustments according to sand size and distribution.

CONSIDERATIONS

Location. When locating waste separation facilities, consider elevation and distance from the source of material to be separated and the location of long-term liquid and solid waste storage facilities.

Take advantage of gravity flow wherever possible for locating waste separation facilities.

Other considerations for locating waste 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, install weeping walls around the entire perimeter of the waste to be treated and maintain drainage paths to and through the walls. Consider waste particle size, particle size distribution and length of flow paths when selecting screen opening size and spacing. Ensure drainage is transferred to a liquid storage facility.

Sand Bedding. When sand bedding is reused, select a uniformly sized sand to improve separation efficiency.

Solid/Solid Separation. When separating poultry litter into fine and coarse fractions, a higher percentage of the nutrients is partitioned with the fine fraction.

The coarse material, consisting mostly of shavings and feathers, has a lower nutrient content and could be reused as bedding or as an energy source.

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

Rainfall. Rainfall falling on the solids storage areas associated with waste 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 System Abrasion Resistance. Where sand is a major component of the liquid waste stream, encourage the use of abrasion resistant waste transfer piping and pumps to reduce frequency of repairs.

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 waste separation facilities in the plans and specifications.

As a minimum, provide the following 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 waste separation devices.
4. Fencing and signage as appropriate for safety purposes.
5. Operating characteristics.

Warranties. If a manufactured waste separation device is installed, the manufacturer shall provide a warranty that describes the design life of the device and what the warranty covers.

OPERATION AND MAINTENANCE

Develop and review an operation and maintenance (O&M) plan with the owner and operator prior to constructing the waste separation facility. Ensure that the O&M plan is consistent with the purposes of the waste separation device chosen, its intended life, safety requirements, and the criteria for its design. As a minimum, include the following elements in the operation and maintenance plan:

1. Documentation of design factors related to operation and maintenance.
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 and/or periodic (as described in the plan) inspection of the following:
    - Separation device and support structure.
    - Screens and outlets.
    - Remaining capacity in storage facilities.

Ensure that the owner and operator understand the level of operation and maintenance (O&M) required for the type of separator selected to operate as intended.

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