USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

WASTE STORAGE FACILITY

CODE 313
(Reported by No.)

DEFINITION

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To temporarily store wastes such as manure, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

CONDITIONS WHERE PRACTICE APPLIES

1. Where the storage facility is a planned component of a Comprehensive Nutrient Management Plan (CNMP) or a Waste Management System (WMS);
2. When temporary storage is needed for organic wastes generated by agricultural production or processing;
3. When the storage facility can be constructed, operated and maintained without polluting air or water resources;
4. Where the soils, geology, topography and other site conditions, are suitable for construction of the facility;
5. To facilities utilizing embankments with an effective embankment height of 35 feet or less, and damage resulting from failure would be limited to damage of farm buildings, agricultural land, or county roads, and,
6. To structures such as tanks, stacking facilities, and pond appurtenances that are fabricated.

Stacking facilities are used for wastes that behave as a solid and may be open or roofed. Storage tanks are used for liquid and slurry wastes and may be:

1. Open roofed or covered;
2. Within or outside an enclosed housing; or,
3. Beneath slotted floors.

This practice does not apply to Waste Treatment Lagoons (Code 359), even though they may have paved ramps or linings.

This practice does not apply to the temporary stacking of wastes in the field without a stacking pad. See the conservation practice standard for Waste Utilization (Code 633) for these requirements.

CONSIDERATIONS

General

The location, layout, and design of the facilities should be compatible with the surrounding landscape. Consider existing landforms and vegetation, along with land shaping and vegetative plantings to minimize any adverse impact upon visual resources.

Improving Air Quality

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, and odor, consider alternatives and additional practices including Waste Treatment Lagoon (Code 359), Covered Anaerobic Digester (Code 365), and Composting Facility (Code 317).

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility, but may increase odor when waste is surface applied. (Refer to the Maryland conservation practice standard for Waste Utilization, Code 633.)

Designing Facilities

Consider methods of filling and emptying agricultural waste storage facilities in the design. With open holding tanks, central loading from an

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service - Maryland or visit the electronic Field Office Technical Guide (eFOTG).

elevation at or above the top of the sidewall allows more complete and uniform filling, particularly with manure containing bedding.

Solid organic wastes such as manure with bedding will produce seepage as a result of waste degradation or exposure to precipitation. This seepage will concentrate in low areas of storage facilities and methods should be provided for its containment and safe utilization. Provision of a roof with good side ventilation will minimize seepage accumulation. Without good ventilation, use of a roof will increase odor problems.

Minimizing Impacts of Waste Field Stacking Pads

Consider whether access to the manure storage will be practical during periods of inclement weather.

Take note of other constraints such as providing access to the site, and maintaining a sufficient distance away from neighboring properties.

Where practical, consider locating waste field stacking pads near natural windbreaks to protect the cover from blowing winds.

Consider the need for additional conservation practices to protect the resource base at and adjacent to the storage site. Supporting practices may include land shaping, access roads, diversions, waterways, subsurface drains, filter strips, and critical area plantings.

CRITERIA

General Criteria Applicable to All Waste Storage Facilities

The waste storage facility must be planned, designed and constructed to meet all federal, state and local laws and regulations. The owner or operator is responsible for securing all required permits and approvals and for performance in accordance with appropriate laws, rules and regulations.

Location – Evaluate the following factors in selecting a site for waste storage facilities:

1. Proximity of the structure to the source of wastes;
2. Access to other facilities;
3. Ease of loading and emptying wastes;
4. Overhead and underground utilities;
5. Applicable health regulations;
6. Location of floodplains;
7. Direction of prevailing winds to minimize odors; and,
8. Location relative to wells, milking centers and nearby homes.

Locate facilities at least 100 feet from wells. When practical, locate facilities at least 100 feet from springs, wetlands, drainage ditches, streams, and ponds.

Locate the waste storage facility and its appurtenances outside the 100-year floodplain when possible. If the only practical alternative is to locate the structure within the 100-year floodplain, design the facility to protect from inundation from the 25-year frequency flood event and damage, such as, loadings, cracking, flotation etc. from the 100-year frequency flood event.

Construction activity within the 100-year floodplain requires permits or authorizations from the Maryland Department of the Environment and/or the U.S. Army Corps of Engineers. Obtain all applicable permits and authorizations prior to the start of construction.

Design Storage Volume – Size the volume of the facility large enough to store accumulated wastes, including bedding, wash water, and needed dilution water, if applicable, for the maximum period during which such wastes cannot be processed for energy or cannot be applied to the land for reasons such as operational restrictions, weather, or crops.

Base the minimum storage period on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and federal regulations and in accordance with the Comprehensive Nutrient Management Plan or the Waste Management Plan.

Exclude clean runoff to the fullest extent practical except where its storage is advantageous to the operation of the agricultural waste management system. If suitable provisions cannot be made the anticipated volume of runoff likely to enter the structure must be included in the re-

quired volume. The design capacity must allow for any direct rainfall and snow during the storage period.

Provide at least 1.0 foot of freeboard on all earthen liquid storage facilities and for all vertical wall liquid storage facilities. Freeboard is not required for solid stacking facilities. Liquid storage facilities that are roofed and do not receive runoff from other areas do not require freeboard.

Waste production by livestock and poultry varies widely and should be based on actual production for individual farm operations. Variations are due to climate, type of feed, and livestock production methods. Table 1 provides a general guide to manure production for various animals and is to be used as a minimum. Additional guidance may be found in the Agricultural Waste Management Field Handbook.

Use of bedding at the rate of 4 pounds per cubic foot of manure can be expected to increase the volume of manure by about 30 percent. Use actual records for bedding amounts when available.

Table 1 - Daily Manure Production
(not including bedding, wash water, or dilution water)

Animal	Cubic feet/day per 1000 lbs. of animal weight
Dairy Cattle*	1.6
Beef Cattle	1.0
Horses	0.8
Feeder Swine	1.1
Breeder Swine	0.8
Sheep	0.6
Poultry - Layers, Broilers	1.25

*The daily manure production (dmp) shown is based on a heard average of 20,000 lbs./cow-cow year. Actual manure production can be calculated as follows; dmp = (0.00004(MP) + 0.8) where MP = average yearly milk production in lbs./cow. The estimated daily manure production used should represent that actually used.

For milking center wastes, the volume of wash water should be determined by actual measurement, estimated by Table 2, or based on estimated quantities of the operator.

Table 2 - Volume of Milking Center Wastes

Washing Operation	Water Volume
Bulk Tank	
Automatic	50-60 gal/wash
Manual	30-40 gal/wash
Pipeline	
In parlor	75-125 gal/wash
(Volume increases for long lines in a large stanchion barn.)	
Pail milkers	30-40 gal/wash
Misc. equipment	30 gal/day
Cow prep	
Automatic	¼-½ gal/wash per cow
Estimated average	2 gal/wash per cow
Manual	¼-½ gal/wash per cow
Parlor floor	40-75 gal/day
Milkhouse floor	10-20 gal/day

Ref: MWPS-1, Structures and Environment Handbook, 11th Ed.

As a minimum, include the following in the design storage volume, as appropriate:

1. Manure, wastewater, and other wastes accumulated during the storage period;
2. Normal precipitation less evaporation on the surface area of the facility during the storage period;
3. Normal runoff from the facility's drainage area during the storage period;
4. 25-year, 24-hour precipitation on the surface of the facility;
5. 25-year, 24-hour runoff from the facility's drainage area;
6. Residual solids after liquids have been removed. Provide a minimum of 6 inches for tanks;
7. Additional storage as may be required to meet management goals or regulatory requirements.

The design storage volume for a waste storage facility is equal to its required volume.

Karst Areas – Karst (limestone) areas are characterized by sinkholes, caves, and rapid subsurface drainage making them particularly susceptible to groundwater contamination. Locating animal waste storage facilities in Karst regions creates particular concern due to the potential for sinkholes to develop beneath the structure.

Provide one of the following:

1. A flexible membrane liner over a fine grain material with a low permeability rate. A minimum of two feet of (fine grained) material is required;
2. A geosynthetic clay liner (GCL) flexible membrane liner over a minimum 2 feet of fine grain material with a low permeability rate;
3. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness. A minimum of two feet of fine grain material with low permeability is required underneath the concrete liner.

In addition to the above, provide subsurface drainage on all waste storage facilities constructed below grade and divert surface drainage away from the facility.

Differential Settlement – Foundations that are partially on rock and partially on earth are unacceptable due to possibility of differential settlement. When bedrock or rock ledges are encountered during excavation, over-excavate the rock area a minimum of two feet and replace with compacted fill.

Conveyance of Liquids – Systems that are designed to store liquid wastes shall include appropriate components for conveying liquids into the storage facility, as follows:

1. Design inlets to resist corrosion, plugging, and freeze damage incorporating erosion protection as necessary. Provide a water-sealed trap and vent or similar devices to control gas entry into the buildings or other confined spaces on all inlets in enclosed buildings.
2. Outlets that automatically release storage from the required storage volume are not permitted. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.
3. A dual valve system or backflow preventer is required on all transfer systems where pipelines are used to convey wastes by gravity or by pumping and failure of the containment valve may result in accidental release or discharge.
4. Equip pipelines with a water-sealed trap and vent or similar devices, if there is a potential, based on design configuration, for gases to enter buildings or other confined spaces.

Emptying Component – Provide some type of facility for emptying the waste storage pond. It may be a dock, a pumping platform, a retaining wall, or a ramp. Ramps used to empty liquids will be no steeper than 4 horizontal to 1 vertical. Those used to empty slurry, semi-solid, or solid waste will be no steeper than 10 horizontal to 1 vertical. Steeper slopes up to 6 horizontal to 1 vertical may be used if special traction surfaces and/or equipment are provided.

Accumulated Solids Removal - Make provision for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the size and shape of the pond and type of seal, if any.

Safety – Include in the design appropriate safety features to minimize the hazards of the facility. Provide adequate maneuvering space for operating loading and unloading equipment. Pushoffs must be structurally sound and have railings, safety bars, or other devices to prevent humans, animals, and equipment from falling into the facility. Provide warning signs, fences, ladders, ropes, bars, rails, and other safety devices and precautions as appropriate for safety of humans and livestock and to prevent use of the facilities for purposes other than intended. Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation.

When ramps are used for access into a storage facility provide a ramp slope no steeper then 4 horizontal to 1 vertical for liquid wastes. For other wastes provide a ramp slope no steeper then 10 horizontal to 1 vertical or flatter unless special traction surfaces, such as grooving or roughening, are provided.

For floor level push-in type holding tanks and stacking areas, the floor should slope moderately

(0.2 to 0.3%) away from the entrance. Equipment operates best with a straight-line push. Make provisions for removing liquids that accumulate in solid waste facilities from precipitation or other sources.

Openings – Size, shape and location of openings in covered holding tanks must accommodate the characteristics of scrapers, conveyors, tractors or other equipment used to place or push wastes into the tank as well as equipment for agitating and emptying.

Protection – Control erosion around embankments and disturbed areas surrounding the facility.

Flexible Membranes - Meet or exceed the requirements for flexible membrane linings specified in NRCS Conservation Practice Standard, Pond Sealing or Lining, Code 521A.

Service Life and Durability - Insure that the structure is sound and of durable materials commensurate with the anticipated service life, initial and replacement costs, maintenance and operation costs, and safety and environmental considerations.

Additional Criteria for Waste Field Stacking Pads

Soils and Foundation – Design the waste field stacking pad so that the pad is above the seasonal high water table.

Types of Pads/Liners – Waste field stacking pads will have a pad or liners that meet the following:

1. Concrete pad – Meet the requirements for concrete, and steel reinforcement for concrete pads as stated in the Fabricated Structure Criteria;
2. Synthetic liner - A synthetic liner a minimum of 20 mils thick, completely free of tears or punctures in order to prevent any seepage from passing through to the groundwater.

   Install the liner by excavating the stacking pad area one-foot below desired finished grade. Remove all sharp stones and other sharp material to prevent puncturing the liner. Cover the liner with one foot of non-stony soil locally available. Installation of the liner to conform to manufacturer's recommendations;
3. Compacted clay pad - A clay pad consisting of a one-foot layer of compacted clayey material (SC, GC, CL). Install clay pads under optimum moisture conditions and compact in 6 to 8-inch lifts. Construct the pad essentially level with only enough gradient away from the center of the pad to allow drainage of water. Excavated or constructed side slopes will not be steeper than three (3) horizontal to one (1) vertical.

Stabilize all disturbed areas beyond the edges of the pad as shown in the vegetative plan.

Jersey barriers or retaining walls may be used to assist in tying down any needed covers over stockpiles, as well as providing a push wall to assist in loading out the pile. When used as a push wall, some backfill (12 to 18 inches) may be desired to prevent sliding.

Size – Size the waste field stacking pads to store the amount manure/litter required for proper nutrient management as identified in the Comprehensive Nutrient Management Plan or the Waste Management Plan.

Covering and Shaping – Shape all field-stacked manure to minimize percolation of precipitation through the pile. Poultry manure stacked in a conical shape need not be covered. Also, horse manure with a minimum 50:50 ratio of straw bedding to manure may be left uncovered.

All other field-stacked manure may be uncovered if stacked for no longer than 30 days. If 30 days are exceeded, shape and cover the field-stacked manure with opaque plastic or polyethylene sheeting (minimum thickness of 6 mils), or other impermeable and equally strong material. The cover for the stacked manure/litter shall be free of tears or punctures, and place over the pile with care to prevent tearing. Place weights such as used tires over the sheeting to anchor it and prevent tearing during high winds. Construct a trench 12 inches deep around the waste and bury the edges of the sheeting in and through the trench. In lieu of a trench, Jersey barriers or similar materials may be used to secure the cover.

In lieu of covering manure stacks, runoff from any waste field stacking pad must be controlled. This may be accomplished with a surrounding grass filter area or by collection and application. Design in accordance with Wastewater Treatment

Strip (Code 635) or Waste Storage Structure (Code 313) as appropriate.

Additional Criteria for Waste Storage Ponds

Soils and Foundation – Site soil characteristics will be investigated by borings made at least two feet below the planned waste storage pond bottom. Waste storage ponds must be placed in impervious soils or soils suitable for sealing.

The pond bottom elevation must be a minimum of 2 feet above the high water table.

Provide one of the following:

1. A clay liner designed in accordance with procedures of AWMFH, Appendix 10D, with a thickness and coefficient of permeability so that specific discharge is less than 1 x 10 –6 cm/sec. See NEH Part 650, Figure 4-14, for soil permeability rates;
2. A flexible membrane or geosynthetic clay liner (GCL) flexible membrane liner meeting the requirements of the Maryland conservation practice standard for Pond Sealing or Lining, Flexible Membrane (Code 521A);
3. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness.

Embankments – The following criteria are applicable to waste storage ponds that have embankments:

1. Top width - Meet the requirements of Table 3 for embankment top widths. If the embankment needs to be crossed periodically by vehicles, the minimum top width is 10 feet. Guardrails or other safety measures are to be used where necessary.

   For this standard, the maximum effective height of the dam is 35 feet.

Table 3 – Top Width of Embankment

Total Height of Embankment (feet)	Minimum Top Width (feet)
15 or less	8
15 – 20	10
20 – 25	12
25 – 30	14
30 – 35	15

2. Side slopes – The combined side slopes of the settled embankment will be a minimum of five horizontal to one vertical (5:1), with neither slope steeper than 2:1. Slopes must be designed to be stable in all cases, even if flatter side slopes are required. Treat disturbed areas surrounding the facility to control erosion.
3. Auxiliary spillway – Design the pond with an auxiliary (emergency) spillway. Locate the spillway at the design high storage elevation or higher. The minimum bottom width of the spillway is 8 feet.

   In lieu of an auxiliary spillway, a reinforced embankment may be provided. Increase the required embankment top width by two feet and increase the back slope of the dam to a slope no steeper than 5 horizontal to 1 vertical.
4. Allowance for settlement – The top of the settled embankment will be a minimum of 1 foot above the required design storage volume. Increase this height by the amount needed to ensure that the top elevation will be maintained after settlement, but not less than 5 percent.

Additional Criteria for Fabricated Structures

Foundation – Proportion the foundations of waste storage facilities to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or applied loads may create highly variable foundation loads; settlement should be calculated from site specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available.

If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 4 or another

nationally recognized building code. When using presumptive bearing values, use adequate detailing and articulation to avoid distressing movements in the structure.

Table 4 - Presumptive Allowable Bearing Stress Values[1]

Foundation Description	Allowable Stress
Crystalline Bedrock	12,000 psf
Sedimentary Rock	6,000 psf
Sandy Gravel or Gravel	5,000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3,000 psf
Clay, Sandy Clay, Silty Clay, Clayey Silt	2,000 psf

[1] Ref: Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Structural Loadings – Design waste storage structures to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure and load combinations in compliance with this standard and applicable local building codes.

Calculate the lateral earth pressure from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the procedures in TR-74. If soil strength tests are not available, use the presumptive lateral earth pressure values indicated in Table 5.

Assign lateral earth pressures based upon equivalent fluid assumptions according to the structural stiffness or wall yielding as follows:

1. Rigid frame or restrained wall. Use the values shown in Table 5 under the column "Frame Tanks," which gives pressures comparable to the at-rest condition;

2. Flexible or yielding wall. Use the values shown in Table 5 under the column "Free-standing Wall," which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of back-fill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lbs/ft^2 where the stored waste is not protected from precipitation. A value of 60 lbs/ft^2 may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. When heavy equipment will be operated near the wall, add two feet of soil surcharge in the wall analysis.

Design tank covers to withstand both dead and live loads. As a minimum use the live load values for covers contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASAE EP393.2, Manure Storages. Use the actual axle load for tank wagons having more than a 2,000 gallon capacity.

If the facility is to have a roof, snow and wind loads shall be as specified in ASCE 7 Minimum Design Loads for Buildings and Other Structures, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, use the total load in the structural design.

Table 5 - Lateral Earth Pressure Values[1]

Soil		Equivalent Fluid Pressure ($lb/ft^2/ft$ of depth)			
		Above seasonal high water table[2]		Below seasonal high water table[3]	
Description[4]	**Unified classification[4]**	**Free-standing wall**	**Frame tanks**	**Free-standing wall**	**Frame tanks**
1. Clean sand, gravel, or sand-gravel mixtures[5] (maximum 5 percent fines)	GP, GW, SP, SW	30	50	80	90
2. Gravel, sand, silt, and clay mixtures (less than 50% fines) Coarse sands with silt and/or clay (less than 50% fines)	All gravel/sand dual symbol classifica-tions and GM, GC, SC, SM, SC-SM	35	60	80	100
3. Low-plasticity silts and clays with <u>some</u> sand and/or gravel or fine silty and clayey sands (50% or more fines) Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML, SC, SM, SC-SM	45	75	90	105
4. Low to medium-plasticity silts and clay with <u>little</u> sand and/or gravel (50% or more fines)	CL, ML, CL-ML	65	85	95	110
5. High plasticity silts and clays (liquid limit more than 50)[6]	CH, MH	--	--	--	--

1 For lightly compacted soils (85% to 90% maximum standard density). Includes compaction by use of typical farm equipment.

2 Also below seasonal high water table if adequate drainage is provided.

3 Includes hydrostatic pressure.

4 All definitions and procedures in accordance with ASTM D 2488 and D 653.

5 Generally, only washed materials are in this category.

6 Not recommended. Requires special design if used.

Precast Structures – Precast concrete structures shall meet the requirements of ASTM C-913 Standard Specification for Precast Concrete Water and Wastewater Structures or C-478 Precast Reinforced Concrete Manhole Sections, as appropriate.

Structural Design – For the structural design, consider all items that will influence the performance of the structure, including loading assumptions, material properties, and construction quality. Indicate design assumptions and construction requirements on the plans.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. Design the openings in covered tanks to accommodate equipment for loading, agitating, and emptying. Equip these openings with grills or secure covers for safety, for odor, and vector control.

Underlay all structures with free draining material or locate footings below the anticipated frost depth.

Eliminate potential uplift pressures by drainage or include such pressures in the structural design (including buoyancy and flotation). A factor of safety of 1.2 should be used in structural design if drainage is not provided.

Minimum requirements for fabricated structures are as follows:

1. Steel - *Manual of Steel Construction*, American Institute of Steel Construction;

2. Timber - *National Design Specifications for Wood Construction*, American Forest and Paper Association;

3. Concrete - *Building Code Requirements for Reinforced Concrete, ACI 318*, American Concrete Institute;

4. Masonry - *Building Code Requirements for Masonry Structures, ACI 530*, American Concrete Institute;

5. Precast concrete - *ACI-523 Guide for Precast Cellular Concrete Floor, Roof and Wall Units and ACI-533 Guide for Precast Concrete Wall Units*, American Concrete Institute;

6. Slabs on grade - Consider the required performance and the critical applied loads along with both the subgrade material and material resistance of concrete slabs. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness is 4 inches with a minimum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory;

   When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure incorporating a subgrade resistance parameter(s) such as ACI 360 shall be used;

   For applications where liquid-tightness is required, such as floor slabs of storage tanks, the minimum concrete thickness for uniform foundations is 5 inches. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, *Design of Slabs-on-Grade*;

7. Liquid tightness - Applications such as tanks that require liquid tightness shall be designed and constructed in accordance with standard engineering and industry practice appropriate for the construction materials used to achieve this objective;

8. Coatings - Coatings shall be approved in accordance with procedures in the National Engineering Manual (210-512.20 to 512.23);

9. Glass fiber reinforced plastics/resins and glass-fused steel – Approve products in accordance with procedures in the National Engineering Manual (210-512.20 to 512.23).

SPECIFICATIONS

Plans and specifications for waste storage structures shall be in keeping with this standard and describe the requirements for applying the practice to achieve its intended purpose.

All phases of construction shall comply with the appropriate standards and specifications for the work items including, but not restricted to, the following construction techniques:

1. All waste storage structures must be essentially watertight for the life of the structure. Seal all joints, seams, cracks, splices, etc. in the manner and with the materials specified on the construction plans;

2. If joint sealant and method of sealing are not specified, it is the responsibility of the NRCS personnel to develop the specifications of sealing the structures prior to start of construction.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and design criteria. Include in the plan operational requirements for emptying and utilizing the contents of the storage facility at locations, times, rates, and volumes in accordance with the overall Comprehensive Nutrient Management Plan or the Waste Management Plan. Ensure sufficient capacity is available to accommodate storms by removing wastes at the earliest environmentally safe period to ensure that sufficient capacity is available to accommodate subsequent storms.

Waste handling equipment shall be available to remove waste materials from agricultural waste storage facilities and processing it for energy, commercial uses, or applying it to the land at the locations, times, and rates shown in the overall Comprehensive Nutrient Management Plan or the Waste Management Plan. Commercial agitators, pumps, conveyors, liquid manure spreaders, and irrigation, plow-down, or sub-sod injection equipment is available for liquid and slurry wastes. Conventional loading and spreading equipment can be used for solid wastes.

Emptying and disposal shall be scheduled to be compatible with weather, land availability, stage of crop growth, and labor availability, and must meet the requirements specified in the Comprehensive Nutrient Management Plan or the Waste Management Plan.

SUPPORTING DATA AND DOCUMENTATION

Field Data and Survey Notes

The following is a list of the minimum data needed:

1. System plan sketch;
2. Topographic survey of the site showing building locations, elevations at structure location and at outlets from barns, separators, etc., location of dwellings, wells, floodplains, etc.;
3. Soils investigation showing seasonal high water table and location of test holes;
4. Operator data such as desired storage time and volumes of manure, bedding or wash water generated.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Comprehensive Nutrient Management Plan or Waste Management Plan, as appropriate;
2. All required permits and documentation on file with the design information;
3. Plan view including, location map, all system components, material and construction specifications;
4. Construction drawings, and component details;
5. Structure sizing computations;
6. Structure and component design and details;
7. Area grading plan;
8. Quantities estimate;
9. Job class on plan;
10. Details of foundation drainage, when required;
11. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard for Critical Area Planting (Code 342).

Construction Check Data/As-built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted on plans in red. The following is a list of minimum data needed for As-builts:

1. Documentation of site visits on CPA-6. Include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Actual dimensions of installed structure;
3. Verification of adequate foundation preparation;
4. Documentation of installation of foundation drainage;
5. Documentation of reinforcing steel and proper concrete installation, if applicable;
6. Condition of precast panels, if applicable;
7. Certification statement from the contractor(s) that they have constructed/assembled the structure in accordance with the plans and specifications;
8. Statement on seeding and fencing;
9. Final quantities and documentation for quantity changes, and materials certification;
10. Sign and date checknotes and plans by a person with appropriate approval authority. Include statement that the practice meets or exceeds plans and NRCS practice standards.

REFERENCES

1. American Society for Testing and Materials, *ASTM Standards*, Philadelphia, Pennsylvania.
2. Maryland Department of Transportation, State Highway Administration, January 2001. *Standard Specifications for Construction and Materials*, Baltimore, Maryland.
3. Maryland State Soil Conservation Committee, 1989. *Manure Management Handbook.*
4. MidWest Plan Service, 1975. *MWPS-18, Livestock Waste Facilities Handbook*.
5. MidWest Plan Service, 1983. *Structures and Environment Handbook*.
6. USDA, Natural Resources Conservation Service. *Maryland Field Office Technical Guide, Section IV, Standards and Specifications.*
7. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650.*
8. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Agricultural Waste Management Field Handbook, Part 651*.
9. USDA, Natural Resources Conservation Service. *National Engineering Manual.*
10. USDA, Natural Resources Conservation Service. *National Handbook of Conservation Practices*.