

NATURAL RESOURCES CONSERVATION SERVICE
PACIFIC BASIN AREA
CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(Number)
CODE 313

DEFINITION

A waste 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 function of an agricultural waste management system.

CONDITIONS WHERE PRACTICE APPLIES

Temporary storage is needed for organic wastes generated by agricultural production or processing.

The storage facility can be constructed, operated and maintained without polluting air or water resources.

Soils, geology, and topography are suitable for construction of the facility.

The practice applies to facilities utilizing embankments with an effective height of 10.7 Meters (35 feet) or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or village and rural roads. Fabricated structure facilities applies to tanks, stacking facilities, and pond appurtenances.

CRITERIA

General Criteria

Storage Period. The storage period is the maximum length of time anticipated between emptying events, or the storage facility waste capacity (excluding volumes required for runoff, precipitation solids storage and freeboard) divided by the daily waste volume. The minimum storage period shall be:

1. For vehicle (tank) based land application or removal to other locations, the

minimum storage period shall be 2 weeks.

2. For Irrigation System, Sprinkler (442) distribution of the effluent, the storage period shall be based on irrigation design (plant moisture needs, soil infiltration rate) or nutrient uptake rate as in Waste Utilization (633), whichever is greatest.
3. For surface application of screened effluent (solids removed), the storage period shall be based on application rates shown in Filter Strip (393A) for controlled overland flow treatment of liquid wastes.
4. Where the purpose of the waste storage facility is secondary solids removal based on settling time and none of the above apply, e.g. effluent is recycled for wash water, the minimum period shall be 4 days.

All design storage periods will be in conformance with local, territorial, commonwealth, state, or Federal regulations.

Design Storage Volume. The design storage volume shall consist of the total of the following as appropriate:

5. Manure, wastewater, and other wastes accumulated during the storage period.
6. Normal precipitation less evaporation on the surface area of the facility during the storage period, unless it is roofed.
7. Normal runoff from the facility's drainage area during the storage period.
8. 25-year, 24-hour precipitation on the surface of the facility, unless it is roofed.
9. 25-year, 24-hour runoff from the facility's drainage area.
10. Residual solids after liquids have been removed. A minimum of 15 cm (6 inches) shall be provided for tanks.

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11. 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.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, and any other damage incorporating erosion protection as necessary. Inlets from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings or other confined spaces.

Safety. Design shall include appropriate safety features to minimize the hazards of the facility.

Protection. Embankments and disturbed areas surrounding the facility shall be treated to control erosion, and fenced to exclude animals from the embankment.

Flexible membranes. Flexible membranes shall meet or exceed the requirements of flexible membrane linings specified in Pacific Basin standard Pond Sealing or Lining, Flexible Membrane (521A).

Pond Criteria

Location. Waste storage ponds, if located within floodplains, shall be protected from inundation or damage from a 25-year flood event.

Soil and foundation. The pond shall be located in soils with acceptable permeabilities, or the pond shall be lined. Information and guidance on controlling seepage from waste storage ponds can be found in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 7. The pond shall have a bottom elevation that is a minimum of 0.61 meters (2 feet) above the high water table.

Outlet. No outlet shall automatically release storage from the required storage volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

Embankments. The minimum elevation of the top of the settled embankment shall be 0.31 meters (1 foot) above the required storage volume. This height shall be increased by the amount needed to ensure that the top elevation will be maintained after settlement. This increase shall be not less than 5 percent. The minimum top width shall be 2.5 meters (8 feet). The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1).

Emptying Facilities. Some type of facility shall be provided for emptying the pond. It may be a dock, a pumping platform, a retaining wall, or a ramp. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical (4:1) or flatter. Those used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical (10:1) or flatter. Steeper slopes may be used if special traction surfaces are provided.

Provision shall be made 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. The pond shall be fenced and warning signs posted to prevent children and others from using it for other than its intended purpose. Fence shall be specifically designed to exclude persons from the storage pond.

Fabricated Structure Criteria

Foundation. The foundations of waste storage structures shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided 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 1 or another nationally recognized building code. In using

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presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing' movements in the structure.

Table 1. Presumptive allowable bearing stress values.

Foundation Description	Allowable Stress
Crystalline Bedrock	575,000 Pa
Sedimentary Rock	287,000 Pa
Sandy Gravel or Gravel	239,000 Pa
Sand, Silty Sand, Clayey Sand, Silty Sand, Clayey Gravel	144,000 Pa
Clay, Sandy Clay, Silty Clay, Clayey Silt	95,000 Pa
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

'Basic Building Code, 1 2th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Structural Loadings. Waste storage structures shall be designed 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 load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated 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, the presumptive lateral earth pressure values indicated in Table 2 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the structural stiffness or wall yielding as follows:

Rigid Frame or Restrained Wall. Use the values shown in Table 2 under the column "Frame Tanks," which gives pressures comparable to the at rest condition.

Flexible or Yielding Wall. Use the values shown in Table 2 under the column "Freestanding 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 backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 3.1 kPa (65 lbs/ft²) where the stored waste is not protected from precipitation. A value of 2.9 kPa (60 lbs/ft²) 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. If heavy equipment will be operated near the wall, an additional 0.61 meters (2 feet) of soil surcharge shall be considered in the wall analysis.

Tank covers shall be designed to withstand both dead and live loads. 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, shall be the minimum used. The actual axle load for tank wagons having more than a 7,600 liter (2,000 gallon) capacity shall be used.

If the facility is to have a roof, wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Structural Design. The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties and construction, quality. Design assumptions and construction requirement shall be indicated 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. The openings in covered tanks shall be designed to accommodate equipment for loading, agitating, and emptying. These openings shall be equipped with grills or secure covers for safety, and for odor and vector control.

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All structures shall be underlain by free draining material.

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. **Slabs on grade.** Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the sub-grade is uniform and dense, the minimum slab thickness shall be 10.2 cm (4 inches) with a minimum joint spacing of 3.05 meters (10 feet). Joint spacing can be increased if steel reinforcing is added based on sub-grade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 13 cm (5 inches) and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on sub-grade drag theory as discussed in, industry guidelines such as American Concrete Institute, ACI 360, "Design of Slabson-Grade".

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

Safety Provisions. Entrance ramps shall be no steeper than 10 horizontal to 1 vertical. Warning signs, ladders, ropes, bars, rails, fences and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock. Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation. Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings.

CONSIDERATIONS

Waste storage facilities should be located as close to the source of waste and polluted runoff as practical. In addition they should be located considering prevailing winds and landscape elements such as building arrangement, landform, and vegetation to minimize odors and visual resource problems.

An auxiliary (emergency) spillway and/or additional embankment height should be considered to protect the embankment. Factors such as drainage area, pond size, precipitation amounts, downstream hazards, and receiving waters should be evaluated in this consideration.

Non-polluted runoff should be excluded to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

An auxiliary (emergency spillway and/or additional embankment height should be considered to protect the embankment. Factors such as drainage area, pond size, precipitation amounts, downstream hazards, and receiving waters should be evaluated in this consideration.

Non-polluted runoff should be excluded to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

Freeboard for waste storage structures should be considered.

Solid/liquid separation of runoff or wastewater entering pond facilities should be considered

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to minimize the frequency of accumulated solid removal and to facilitate pumping and application of the stored waste.

Due consideration should be given to economics, the overall waste management system plan, and safety and health factors.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Preliminary to developing design and construction plans, survey data must be obtained. Such data shall include sufficient points to develop and show waste storage facility footprint, profile, cross sections, location of physical features (roads, trees, livestock facilities, watercourses, wells, etc.) and spoil placement. All surveys will be in accordance with Chapter 1 of the Engineering Field Handbook (EFH) and Technical Release 62.

A soil investigation is required to determine the adequacy of soils for pond lining (waste storage ponds), or the soil's bearing strength and wall loads (structures). Auger holes or backhoe test pits logged with the Unified Soil Classification System in accordance with Chapter 4 of the EFH shall be used for soil classification and determination of properties. The soils information will be carried on the plans for all waste storage ponds and for structures greater than 1.5 meters (5 feet) height and 4.3 meters (14 feet) in longest horizontal dimension.

Construction plans shall include a to scale plan view, profiles, facility sectional views and spoil disposal requirements as a minimum. If additional conservation practices are included in the project for water management and water quality concerns, the information necessary to construct these practices will also be conveyed on the plans. Development of plans will be guided by EFH - Chapter 5.

Incidental information necessary to construct the job will need to be either communicated in the construction specifications or carried on

the construction drawings in the form of construction notes.

As-Built-Plans. As-Built-Plans, when required by the approving individual, shall reflect all significant changes in alignment, cross section, structure location, etc. It is expected that all changes will be with prior consent of the individual approving the design. If there were no changes, the original drawings shall be marked, "As-Built."

OPERATIONS 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 shall contain the operational requirements' for emptying the storage facility. This shall include the requirement that waste shall be removed from storage and utilized at locations, times, rates, and volume that meet quality criteria for all resources.

In addition, for ponds, the plan shall include the requirement that following storms, waste shall be removed at the earliest environmentally safe period to ensure that sufficient capacity is available to accommodate subsequent storms.

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Table 2. Lateral earth pressure values¹

Description ²	Soil Unified Classification ² (U.S.C.S)	Equivalent fluid pressure kPa/meter of depth (lb/ft ² /ft of depth)			
		Above seasonal high water table ³		Below seasonal high water table ⁴	
		Free Standing Wall	Frame Tanks	Free Standing Wall	Frame Tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines) ⁵	GP, GW, SP, SW	5 (10)	8 (50)	13 (80)	15 (90)
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 classifications and GM, GC, SC, SM, SC-SM	6 (35)	10 (60)	13 (80)	16 (100)
Low-plasticity silts and clays with some sand and/or gravel (50% or more fines). Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML SC, SM, SC-SM	7 (45)	12 (75)	15 (90)	17 (105)
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL, ML, CL-ML	11 (65)	14 (85)	15 (95)	18 (110)
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.