



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

CODE 313

(no)

DEFINITION

An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- To store manure, agricultural by-products, wastewater, and contaminated runoff to provide the agricultural operation management flexibility for waste utilization

CONDITIONS WHERE PRACTICE APPLIES

Use where regular storage is needed for wastes generated by agricultural production or processing and where site conditions including soils, geology, and topography are suitable for construction of the facility.

Use where the storage facility is a component of a planned agricultural waste management system.

For liquid waste storage facilities implemented with an embankment, this practice applies only to low hazard structures as defined in the NRCS National Engineering Manual (NEM), Part 520.23.

For reception pits, use the NRCS Conservation Practice Standard (CPS) Waste Transfer (Code 634).

This practice does not apply to the storage of human waste or routine animal mortality.

CRITERIA

General Criteria Applicable to All Purposes

Laws and Regulations

Plan, design, and construct the waste storage facility to meet all Federal, State, and local laws and regulations.

Location

Locate and design the waste storage facility such that it is outside the 100-year floodplain unless site restrictions require locating it within the floodplain. If located in the floodplain, protect the facility from inundation or damage from a 25-year flood event or larger if required by laws, rules or regulations. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, Flood Plain Management, which may require providing additional protection or planning measures for storage structures located within the floodplain.

Locate the facility a minimum of 100 feet from any well.

Conduct a geologic investigation in accordance with NRCS NEM, Part 531, Geology to ensure that technically sound onsite geologic conditions pertinent to conservation planning and engineering design are addressed. The investigation will characterize the physical properties of earth materials for use in construction and identify potential geologic hazards for consideration. The investigation must be of sufficient intensity to determine all the conditions or factors that may influence the planning, design and construction of the structure. The number of test holes and samples required for analysis will depend upon the complexity of the subsurface geology.

Storage Period

The storage period is the maximum length of time anticipated between emptying events. 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.

Design Storage Volume

Size the facility to store the following as appropriate:

Operational Volume

- Manure, wastewater, bedding, and other wastes accumulated during the storage period.
- For liquid or slurry storage facilities, include normal precipitation (omit diverted roof runoff) less evaporation during the storage period in the months of June through September. For storage planned during the months of October through May, use winter precipitation amounts with a 90 percent chance of not being exceeded. These 90 percent precipitation amounts are shown in figures 1 and 2, attached. Roof runoff can be excluded when NRCS CPS Roof Runoff Structure (Code 558), is designed as part of the facility.
- Normal runoff from the facility's drainage area during the storage period, based on required precipitation amounts above.
- Planned maximum residual solids. Provide a minimum of 6 inches for tanks and other structures unless a sump or other device allows for complete emptying.
- Additional storage when required to meet management goals or regulatory requirements.

Emergency Volume

- 25-year, 24-hour precipitation on the surface of the liquid or slurry storage facility at the maximum level of the required design storage.
- 25-year, 24-hour runoff from the facility's drainage area.

Note: One or both of the emergency storage volumes, above, may not be required if the storage is covered or otherwise not exposed to additions from direct precipitation and/or runoff from a contributing drainage area.

Note: For precipitation frequency data, NRCS uses the precipitation amounts from NOAA Atlas 14 Vol. 10, Version 2 and the NYS DEC CAFO permits require the use of the precip.net precipitation amounts for permitting. Both methods, allow the user to obtain precipitation information based on the exact site location. Results may vary. For reference, document in the design narrative the source of the precipitation depths used.

Freeboard Volume

- Minimum of 6" for vertical walled tanks without a drainage area.
- Minimum of 12" for all other facilities.

Exclude non-polluted runoff from the structure to the fullest extent practical except where including the runoff is advantageous to the operation of the agricultural waste management system.

Inlet

Design inlet to resist corrosion, plugging, freeze damage, and ultraviolet deterioration. Incorporate erosion protection as necessary.

Picket Dams and Perforated Risers

Picket dams and perforated risers may be used on uncovered manure stacking facilities for draining rain water, snow melt and liquid manure. Use the NRCS CPS Waste Separation Facility (Code 632) for the design of picket dams and perforated risers. The liquids must be collected and directed to a storage or treatment facility. Picket dams must be designed to handle planned hydrostatic loads from the manure. The openings between pickets must be 3/4 to 1-inch wide.

Perforated risers must be located out of the way, and braced or protected from damage by equipment. The openings must be 3/4 inch to 1-inch holes or slots randomly spaced around the entire riser to its full height. Screens may be installed to reduce plugging of the openings. Picket dams and perforated risers may be used together.

Waste Removal

Provide components for removing waste such as gates, pipes, docks, wet wells, pumping platforms, retaining walls, or ramps. Incorporate features to protect against erosion, tampering, and accidental release of stored waste as necessary. Design ramp slopes to accommodate anticipated equipment and traction available. Use NRCS CPS Nutrient Management (Code 590) for land application of stored material or follow other disposal options outlined in a Comprehensive Nutrient Management Plan (CNMP).

Accumulated Solids Removal

To preserve storage volume, make provision for periodic removal of accumulated solids. The anticipated method for solids removal must be accommodated in design, particularly in determining the configuration of impoundments and the type of liner to be used.

Maximum Operating Level

The maximum operating level for liquid storage structures is the level that provides the operational volume.

Staff Gauge

Place a staff gauge or other permanent marker in the liquid storage facility to clearly indicate the following elevations:

- Maximum operating level (top of the operational volume).
- Emergency level (top of the design storage volume, meaning the maximum operating level plus the emergency volume for the major storm event; freeboard is in addition to this level).

For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste in the Operation and Maintenance Plan.

Safety

Include appropriate safety features to minimize the hazards of the facility (refer to American Society of Agricultural and Biological Engineers (ASABE) Standard EP470, Manure Storage Safety for guidance, as needed).

Provide warning signs, fences, ladders, ropes, bars, rails, and other devices as appropriate, to ensure the safety of humans and livestock. Provide ventilation and warning signs for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation. Post warning signs at all reception pits, hoppers and any other confined areas.

Design covers and grating over openings such that livestock or humans cannot accidentally displace them and fall into the facility.

Design pipelines with a water-sealed trap and vent, or similar device, if there is a potential for gases from the pipe to accumulate in confined spaces.

Place a fence around impoundments and uncovered tanks which have exposed walls less than 5 feet above ground surface. Use the NRCS CPS Fence (Code 382) for design of a fence and features that can prevent accidental entry by people or livestock. Fencing around the facility must be one of the following:

- Woven wire (48 inches high, 6 inch grid, 6 gauge) with a single strand of barbed wire above, minimum total height of 50 inches
- Five strands barbed wire,
- Six strands high-tensile, or
- Chain link.

Fences installed around waste storage facilities must be a minimum of 50 inches high from the ground to the top of the wire. At push-off locations, install safety features such as a bar, rail, chain or other type of barrier to prevent equipment from accidentally falling into the facility. At all push-off, agitation and unloading locations, install a heavy duty gate with a minimum of 6 rails which needs to be kept closed except during loading and unloading activities.

Post a minimum of four (4) universal warning signs to prevent children and others from entering liquid waste storage structures.

Roofs and Covers

Use NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed.

Treated Wood

Use criteria from NRCS CPS Roof and Covers (Code 367) for treated wood and fasteners.

Erosion and Sediment Control

An erosion and sediment control plan must be developed for all disturbed areas. For disturbed areas larger than one acre, the erosion and sediment control plan must meet the planning, installation, and maintenance requirements of NYS Pollutant Discharge Elimination System General Permit for Stormwater Discharges. All erosion and sediment structures and measures must be installed before earth disturbing activities, unless otherwise directed in the construction drawings. NRCS CPS Critical Area Seeding (342) will be used to vegetate disturbed areas not protected by other measures.

Additional Criteria for Liquid Waste Storage Impoundments

A liquid waste storage impoundment is a facility where the stored material does not consistently stack. The impoundment is a manmade excavation, or diked area formed primarily of earthen materials, such as soil (although the unit may be lined with manmade materials) .

Foundation

Locate the impoundment in soils with a permeability that meets all applicable regulations or line the impoundment with suitable material. Use liners which meet or exceed NRCS CPS Pond Sealing or Lining, Compacted Soil Treatment (Code 520), CPS Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Code 521), or CPS Pond Sealing or Lining, Concrete (Code 522).

Information and guidance on controlling seepage from waste impoundments is in the NRCS National Engineering Handbook (NEH) Part 651 - Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

Perform subsurface investigations for all waste storage impoundments sufficient in detail and analysis to support the design in accordance with NRCS NEM, Part 531, Geology. Describe the soil material encountered, location of any seeps, depth-to-high-water table, depth to bedrock, and presence of sink holes in karst topography.

For the design of a liner on a site located in a floodplain and other locations where there is potential for uplift, include an evaluation of all potential buoyant uplift forces on the liner. Limit projected uplift head

under clay liners to a gradient of less than 0.5 ft/ft in the clay liner. The gradient is determined as the difference in total head between the top and the bottom of a clay liner when buoyant forces exist (such as when the floodplain is flooded) divided by the thickness of the clay liner.

Design Bottom Elevation

Locate the impoundment bottom elevation a minimum of 2 feet above the seasonal high water table unless special design features are incorporated that address buoyant forces, impoundment seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of drains to meet this requirement. Locate the impoundment bottom elevation a minimum of 2 feet above bedrock regardless of lining type. Subsurface drains must meet or exceed the criteria in NRCS CPS, Subsurface Drain (Code 606).

Outlet

Installation of gravity outlet structures of any kind is not permitted. An outlet that can automatically release stored material is not permitted except for tanks that feed a treatment system such as a vegetated treatment area (use NRCS CPS Vegetated Treatment Area (Code 635) for design), designed irrigation system (use NRCS CPS Sprinkler System, (Code 442) for design), or outlets leading to another storage facility with adequate capacity.

Design a permanent outlet that will resist corrosion and plugging. Provide a backflow prevention measure for an outlet that pumps wastewater to secondary storage located at a higher elevation. Install anti-scour pads at all planned pump out and agitation locations to prevent erosion or damage to the foundation, embankment or lining of the waste storage facility. Use the NRCS CPS Heavy Use Area Protection (Code 561) for the design of anti-scour pads.

Embankments

For an impoundment with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for calculated wave height. The minimum elevation of the top of the settled embankment must be 1 foot above the waste storage pond's required volume. This height must be increased by the amount needed to ensure that the top elevation will be maintained after settlement. In all cases, increase the constructed embankment height by at least 5 percent to allow for settlement. Stabilize all embankments to prevent erosion or deterioration.

Minimum embankment top widths are shown in table 1. Design the combined side slopes of the settled embankment to be equal to or flatter than 5 horizontal to 1 vertical, with neither slope steeper than 2 horizontal to 1 vertical unless provisions are made for stability. The total embankment height (effective height) is the difference in elevation between the auxiliary (emergency) spillway crest or the settled top of the embankment if there is no auxiliary spillway and the lowest point in the cross section taken along the centerline of the embankment.

Table 1. Minimum Top Widths

Total embankment height (ft)	Top width, (ft)
Less than 15	8
15–19.9	10
20–24.9	12
25–30	14
30–35	15

Spillway or Equivalent Protection

For a facility having a total embankment height greater than 20 feet, construct an auxiliary (emergency) spillway. Route the planned emergency flow through the auxiliary spillway and store below the spillway another volume equivalent to the emergency volume.

Excavations

Unless supported by a soil investigation, excavated side slopes must be no steeper than 2 horizontal to 1 vertical (2H:1V). Design excavated side slopes to meet the requirements of the liner used, see NRCS CPS Pond Sealing or Lining, Compacted Soil Treatment (Code 520), Pond Sealing or Lining, Flexible Membrane (Code 521a) or Pond Sealing or Lining, Concrete (Code 522).

Additional Criteria for Fabricated Structures

A fabricated structure stores material that does not consistently stack. It is primarily constructed of walls made from concrete, timber, glass lined steel, or other non-earthen materials.

Foundation

Based on subsurface investigation, provide a foundation for fabricated waste storage structures to safely support all superimposed loads without excessive movement or settlement. Perform subsurface investigations for all fabricated structures sufficient in detail and analysis to support the design in accordance with NRCS NEM, Part 531, Geology. Describe the soil material encountered, location of any seeps, depth to high water table, depth to bedrock, and presence of sink holes in karst topography.

Where a nonuniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, calculate settlement based upon 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 are available, use presumptive bearing strength values for assessing actual bearing pressures obtained from table 2 or another nationally recognized building code. In using presumptive bearing values, provide adequate detailing and articulation to avoid distressing movements in the structure.

For bedrock foundations with joints, fractures, or solution channels, separate the floor slab and the bedrock by—

- A minimum of 1 foot of soil.
- A liner that meets or exceeds NRCS CPS Pond Sealing or Lining (Codes 520, 521, or 522)).
- Other appropriate method or alternative that achieves equal protection.

Table 2. Presumptive Allowable Foundation and Lateral Pressure¹

Class of materials	Allowable foundation pressure (psf)	Lateral bearing (psf/ft) below natural grade	Coefficient of friction	Cohesion (psf)
Crystalline bedrock	12,000	1,200	0.70	-
Sedimentary and foliated rock	4,000	400	0.35	-
Sandy gravel or gravel (GW and GP)	3,000	200	0.35	-
Sand, silty sand, clayey sand, silty gravel, clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	-
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	-	130

Class of materials	Allowable foundation pressure (psf)	Lateral bearing (psf/ft) below natural grade	Coefficient of friction	Cohesion (psf)
¹ International Building Code (IBC), 2015, International Code Council (ICC)				

Structural Loadings

Design the waste storage structure to withstand all anticipated structural loads in accordance with the requirements in NRCS NEM, Part 536, Structural Design. Such loads should include internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, and water pressure due to seasonal high water table, frost or ice.

Calculate loading from lateral earth pressures using soil strength values determined from the results of appropriate soil tests and procedures described in Technical Release 210-74, Lateral Earth Pressures. Table 3 provides minimum lateral earth pressure values when soil strength tests are not available. If heavy equipment will operate near the wall, use an additional soil surcharge or an additional internal lateral pressure in the wall analysis as appropriate.

For the lateral load from stored waste not protected from precipitation, use a minimum 65 lb/ft²/ft of depth as the design internal lateral pressure. Use a minimum value of 60 lb/ft²/ft of depth for the lateral load from stored waste protected from precipitation and not likely to become saturated. Use a minimum internal lateral pressure of 72 lb/ft²/ft of depth for sand-laden manure storage if the percentage of sand exceeds 20 percent. Designers may use lesser values if supported by measurement of actual pressures of the waste to be stored.

Table 3. Minimum Lateral Earth Pressure Values¹

Description of backfill material ^c	Unified soil classification	Design lateral soil load (lb/ft ² /ft of depth) ^a	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-sand mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Sand-silt clay mix with plastic fines	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	CL-ML	60	100
Inorganic clays of low to medium plasticity	CL	60	100
	OL	Note ^b	Note ^b

Description of backfill material ^c	Unified soil classification	Design lateral soil load (lb/ft ² /ft of depth) ^a	
		Active pressure	At-rest pressure
Organic silts and silt clays, low plasticity			
Inorganic clayey silts, elastic silts	MH	Note ^b	Note ^b
Inorganic clays of high plasticity	CH	Note ^b	Note ^b
Organic clays and silty clays	OH	Note ^b	Note ^b

¹ Table 1610.1, Lateral Soil Load, International Building Code (IBC), 2015, International Code Council (ICC).

^a Design loads based on moist conditions for the specified soils at optimum density. Include the weight of the buoyant soil plus hydrostatic pressure for submerged or saturated soil.

^b Unsuitable as backfill material.

^c Base the definition and classification of soil in accordance with ASTM D 2487.

Structural Design

Design structures with reinforced concrete, steel, wood, or masonry materials in accordance with NRCS-NEM, Part 536, Structural Engineering. Account for all items that will influence the performance of the structure, including loading assumptions, durability, serviceability, material properties and construction quality. Ensure that the material used for a fabricated structure is compatible with the waste product to be stored. Generally, agricultural waste storage facilities are not classified as hydraulic or environmental structures.

Tanks may be designed with or without a cover. Covers, beams, or braces that are integral to structural performance must be indicated on the design drawings. Design openings in a covered tank to accommodate equipment for loading, agitating, and emptying. Design tank covers to withstand both dead and live loads. Equip these openings with fencing, grills or secure covers for safety, and for odor and vector control as necessary.

Roof structures must be designed and certified by a Professional Engineer licensed in the State of New York. Roof structures must be designed to prevent waste located under the roof from becoming a pollution problem. Structural practices for collecting roof runoff must follow criteria outlined in NRCS CPS Roof Runoff Structure (Code 367). All outside surface water must be diverted from the roofed area.

Roof structures must be underlain by free draining material or must have a footing located below the anticipated frost depth.

Sensitive Environmental Settings

Where liquid-storage is to be provided in sensitive environmental settings, as warranted by the geologic investigation report (i.e., tanks in areas with shallow wells in surface aquifers, high-risk karst topography, or other site-specific concerns), classify and design the storage structure as a reinforced concrete hydraulic or environmental structure according to NRCS NEM, Part 536, Structural Design. Alternatively, use a flexible liner membrane, designed and constructed in accordance with standard engineering and industry practice, to provide secondary liquid containment for structures constructed with other methods described in NRCS NEM, Part 536, Structural Design.

Additional Criteria - Stacking Facilities

A stacking facility may be open, covered, or roofed and is used for wastes which behave primarily as solid. Determine the wall height using the anticipated stacking angle of the waste material. Construct a stacking facility of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. Design the stacking facility with adequate safety factors to prevent failure due to internal or external

pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure.

Seepage

Prevent leachate by collecting and using the liquids in a safe manner. Prevent influent contributions in amounts that would infringe on designed storage capacity. Pad should have positive control of any leachate, such as roofs or tarps, and/or leachate collection systems to ensure that no leachate flows untreated from the stacking facility.

Internal Drainage

Make provisions for drainage of leachate, including rainfall from the stacking area (especially those without a roof). Collect leachate in a tank or waste storage facility, or properly treat in a vegetated treatment area (VTA) or recirculate. Use NRCS CPS Vegetated Treatment Area (Code 635) for design.

Poultry Litter Stacking Facility

To reduce the potential for spontaneous combustion damage to wood walled facilities, design the height of the litter stack not to exceed 7 feet, with litter to wood contact limited to 5 feet.

CONSIDERATIONS

For exposed liners utilizing HDPE or similar materials that are slippery when wet, consider the use of textured liners or addition of features such as tire ladders that would allow for escape from the waste storage structure.

Consider solid/liquid separation of runoff or wastewater entering impoundments to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

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

Since the economics and risks associated with waste storage facilities are quite high, consider providing the operator with a cost estimate to close the facility. A cost estimate should include removal of the planned sludge accumulation volume and the waste stored at the maximum operating volume.

When possible, install sump areas, up to two feet lower than the design bottom, to facilitate complete emptying of the facility.

Considerations for Siting

Consider the following factors in selecting a site for waste storage facilities:

- Proximity of the waste storage facility to the source of waste.
- Access to other facilities.
- Ease of loading and unloading waste.
- Compatibility with the existing landforms and vegetation, including building arrangement, to minimize odors and adverse impacts on visual resources.
- Enough space to operate, load, and unload equipment.
- Potential contamination of ground water.

Considerations for Minimizing the Potential for and Impacts of Sudden Breach of Embankment or Accidental Release from the Waste Storage Facility

Consider features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to minimize or mitigate impact of this type of failure when any of the categories listed below might be significantly affected.

Potential impact categories from breach of embankment or accidental release include—

- Surface water bodies—perennial streams, lakes, wetlands, and estuaries.
- Critical habitat for threatened and endangered species.
- Riparian areas.
- Farmstead, or other areas of habitation.
- Off-farm property
- Historical and archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

Consider the following either alone or combined to minimize the potential of or the consequences of sudden breach of embankments:

- An auxiliary (emergency) spillway.
- Additional freeboard.
- Storage for wet year rather than normal year precipitation.
- Reinforced embankment— such as, additional top width, flattened downstream side slopes with or without armoring.
- Secondary containment.
- Double liners.

Consider the following, alone or combined to minimize the potential for accidental release from the waste storage facility through gravity outlets:

- Outlet gate locks or locked gate housing.
- Secondary containment.
- Alarm system.
- Another non-gravity means of emptying the waste storage facility.

Considerations for Minimizing the Potential of Waste Storage Pond Liner Failure

Avoid sites with categories listed in table 5 unless no reasonable alternative exists. Under those circumstances, consideration providing an additional measure of safety from pond seepage when any of the potential impact categories listed in table 5 may be significantly affected.

Table 5 -Potential Impact Categories for Liner Failure

1. Any underlying aquifer is at a shallow depth and not confined.
2. The vadose zone is rock.
3. The aquifer is a domestic water supply or ecologically vital water supply.
4. The site is located in an area of water soluble bedrock such as limestone or gypsum.

For a site with one or more of these site conditions, consider providing:

- a leak detection system in conjunction with the planned liner
- 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 1×10^{-6} cm/sec
- a flexible membrane liner over a clay liner
- a concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness

Considerations for Stacking Facilities

Internal seepage collection within a stacking facility can be accomplished by use of a timber wall with the boards installed vertically, leaving 3/4-inch cracks. The timber wall drainage section may be included in a concrete or masonry block wall. Use the design criteria for timber walls.

Considerations for Organic Producers

For any facility that is an organic producer or that sells manure to organic producers, consider using rot-resistant or treated lumber that meets the requirements for organic production. The producer should consult with the organic certifier as to the use and acceptability of treated lumber for waste storage.

Considerations for Improving Air Quality

Liquid manure storage may result in emissions of volatile organic compounds, ammonia, hydrogen sulfide, methane, nitrous oxide, and carbon dioxide. Solid manure storage may result in emissions of particulate matter, as well as the gasses above.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, particulate matter and odor, other NRCS CPSs such as Anaerobic Digester (Code 366), Roofs and Covers (Code 367), Waste Treatment (Code 629), Amendments for Treatment of Agricultural Waste (Code 591), Composting Facility (Code 317), and Air Filtration and Scrubbing (Code 371) can be added to the waste management system.

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied. Refer to NRCS CPS Nutrient Management (Code 590).

Some fabric and organic covers have been shown to be effective in reducing odors.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use. The following must be in the engineering plans and specifications:

- Plan view of system layout, show as applicable: access road to facility, setback distances from water bodies, streams, sensitive areas, property line, etc.
- Pertinent elevations of the facility.
- Structural details of all components, including reinforcing steel, type of materials, thickness, anchorage requirements, lift thickness.
- Locations, sizes, and type of pipelines and appurtenances.
- Requirements for foundation and preparation and treatment.
- Vegetative requirements.
- Material quantities and specifications.
- Approximate location of utilities and notification requirements.
- Safety features.
- Construction Inspection Plan.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. At a minimum, the plan will contain where appropriate:

Discuss the operational and maintenance needs with the landowner or operator who is responsible for the practice. Before construction begins, provide copies of the O&M plan to the owner/operator. Have the owner/operator sign the O&M plan to indicate an understanding of its requirements and a commitment to operation and maintenance of the waste storage facility.

Include the operational requirements for emptying the storage facility including the expected storage period. Begin removal of the liquid storage facility as soon as practical after the maximum operating level has been reached. Also include the requirement that waste be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan.

For impoundments and other liquid storages include an explanation of the staff gauge or other permanent marker to indicate the maximum operating level. For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste.

Include a provision for emergency removal and disposition of liquid waste in the event of an unusual storm event that may cause the waste storage structure to fill to capacity prematurely.

Include instructions as needed for ventilating confined spaces according to ASABE standard S607, Venting Manure Storages to Reduce Entry Risk.

Develop asite-specific Emergency Action Plan for waste storage facilities where there is a potential for significant impact from breach or accidental release. Include site-specific provisions for emergency actions that will minimize these impacts.

Include a description of the routine maintenance needed for each component of the facility.

Include provisions for maintenance that may be needed as a result of waste removal or material deterioration.

REFERENCES

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Extreme Precipitation in New York and New England precip.net

Figure 1: 90% Precipitation Value for Storage Period Planned October through May

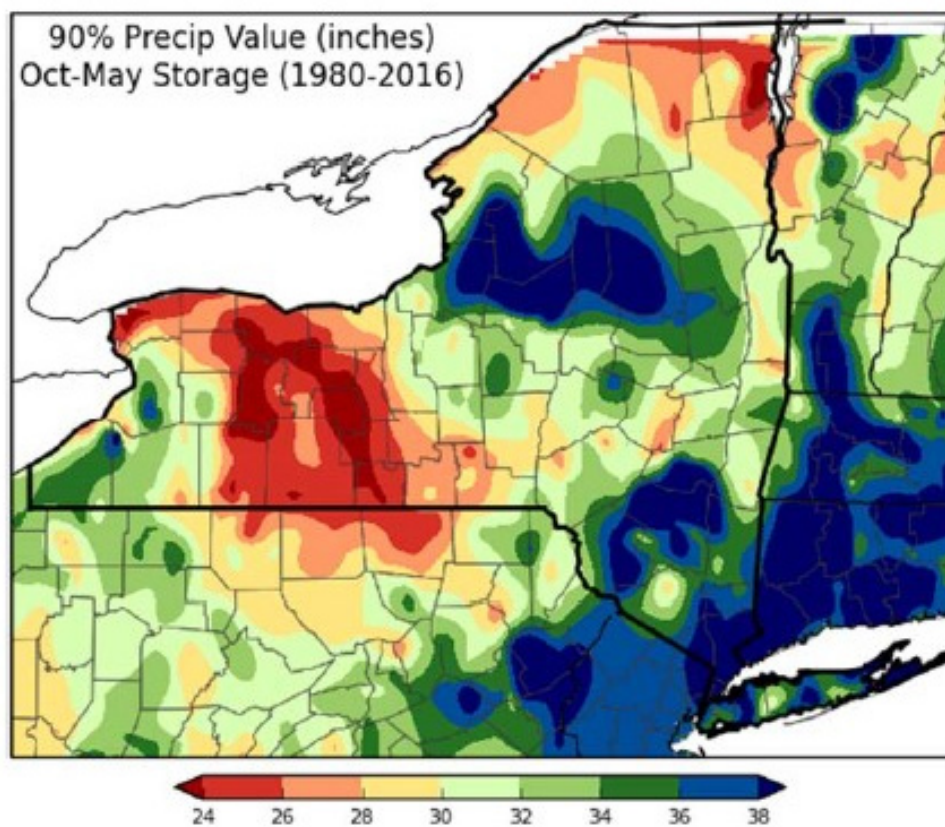
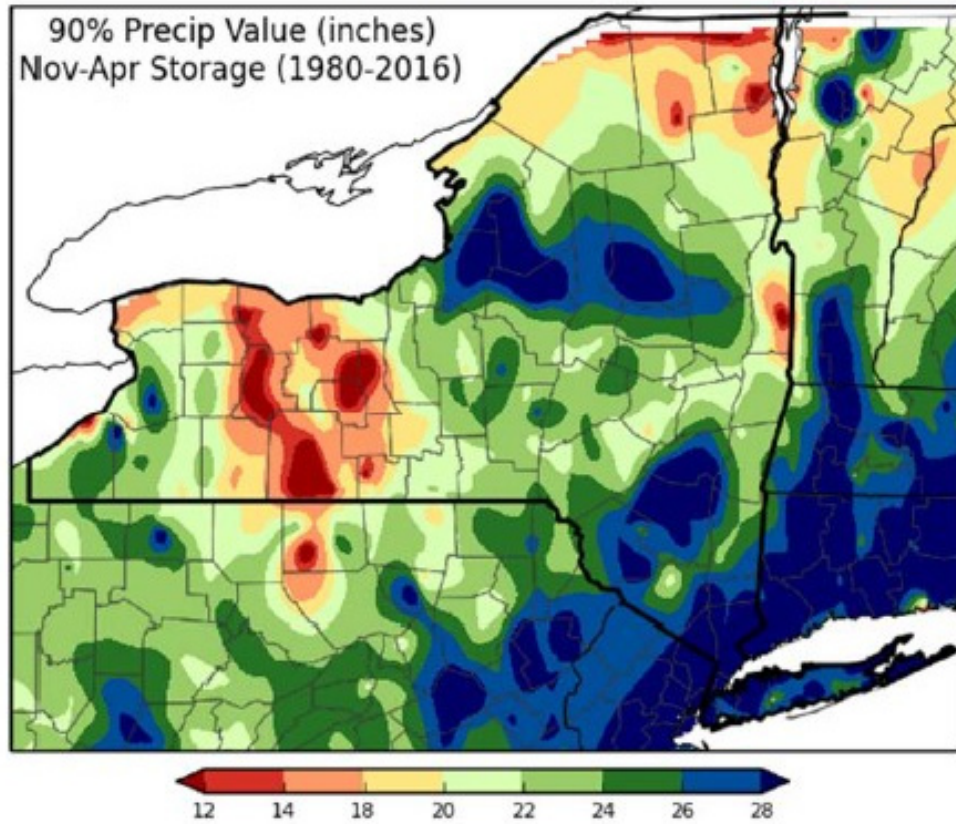


Figure 2: 90% Precipitation Value for Storage Period Planned November through April



Precip.net Reference