DRAFT 07/01/09

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(No.)

CODE 313

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

- Where the storage facility is a component of a planned agricultural waste management system
- Where temporary storage is needed for organic wastes generated by agricultural production or processing
- Where the storage facility can be constructed, operated and maintained without polluting air or water resources
- Where site conditions are suitable for construction of the facility
- To facilities utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or township and country roads.
- To fabricated structures including tanks, stacking facilities, and pond appurtenances.

CRITERIA

General Criteria Applicable to All Waste Storage Facilities.

Laws and Regulations. Waste storage facilities ***(WSF)*** must be planned, designed, and constructed to meet all federal, state, and local laws and regulations. ***governing structures and activities in or along streams, pollution abatement, health, and safety. The owner or operator shall secure all permits and approvals and is responsible for performing all planned work in accordance with such laws and regulations. NRCS employees shall not procure permits, rights, or approvals, nor shall they enforce laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required permits, rights or approvals to construct, operate, and maintain the practice.***

Additional permits may be required from the following agencies:

1. ***West Virginia Department of Health***
2. ***West Virginia Department of Agriculture***
3. ***West Virginia Department of Environmental Protection.***
4. ***US Environmental Protection Agency***

Location. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from

a 25-year flood event, or larger if required by laws, rules, and regulations. Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect aesthetic values.

Waste storage ponds should not be located any closer than 1,000 feet from neighboring residences or obtain a written easement or written permission from the neighbors. Reference CP 642-Water Well (642) for the minimum setback distances as well as the WV Dept. of Health and Human resources.

CNMP. WSF's shall be planned in accordance with a Comprehensive Nutrient Management Plan (CNMP) and associated conservation practices.

The CNMP describes and documents a "conservation system" within the conservation plan that is unique to animal feeding operations. A CNMP shall be developed before a WSF is designed and will include the producer's decisions as to how to manage animal waste products, movement, loafing areas, etc.

NRCS conservation practice (CP) standards Critical Area Planting (342); Fencing (382); Prescribed Grazing (528); Filter Strip (393); Roofed Runoff (558); Animal Trails and Walkways (575); Manure Transfer (634); Waste Storage Facility (313); Vegetated Treatment Area (635); Watering Facilities (614); Windbreak /Shelterbelt Establishment (380); Heavy Use Area Protection (562); or Access Control (472) shall be used as companion practices, when needed, to meet the intended purpose of the heavy use area protection.

Storage Period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be based on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and federal regulations ***(not less than 90 days unless approved by the State Conservation Engineer). Refer to the CNMP and document minimum number of storage days required and the WSF The***

A Engineers Report shall be prepared for the proposed installation. Refer to WV ENGWS 313-A Engineers Report for a Waste Management System. As a minimum the report must include

- ***the existing method of management (number of animals, how the manure and waste is stored, etc.,***
- ***location of associated areas where animals travel, are maintained and or confined***
- ***the number and type of animals from which manures, associated waste and waste water will be stored***
- ***the design storage duration and Design Storage Volume (see below) assumptions.***
- ***information about soils, geological considerations, natural resource concerns (stream, runoff, erosion, etc.), adjacent property boundaries, well locations, homes, prevailing wind direction, flood plain data, etc.,***

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

(a) Manure, wastewater, and other wastes ***(bedding, feed additives, silage, silage waste, wasted feed, sand, etc.)*** accumulated during the storage period

(b) Normal precipitation less evaporation on the ***pond*** surface area (at the design storage volume level) of the facility during the storage period (***WV does not account for evaporation on the WSF surface).***

(c) Normal runoff from the facility's drainage area during the storage period

(d) 25-year, 24-hour precipitation on the surface (at the required design storage volume level) of the facility

(e) 25-year, 24-hour runoff from the facility's drainage area

(f) Residual solids after liquids have been removed. A minimum of 6 inches shall be provided for ***tanks and ponds***

(g) Additional storage as may be required to meet management goals or regulatory requirements.

(h) A minimum 1.0-foot freeboard shall be provided on all WSF's storing liquid waste.

(i) Include dilution water necessary to maintain consistency (slurry or liquid) required by manure transfer system.

Daily manure waste volume shall be based on actual solid and liquid waste production from the source, the milking parlor and milk house, bedding materials and all other waste or amendments added to the waste stream.

Reference Chapter 4 Agricultural Waste Characteristics of the Agricultural Waste Management Field Handbook (AWMFH) or the Table A for livestock manure volumes (CF).

If bedding enters the WSF or production area, the total manure production shall be increased by the documented volume of the bedding, or by 30 percent of the total accumulation of waste, if bedding volume is unknown. Document the volume of bedding added to the waste stream, and determine if waste becomes a semi-solid or slurry with high solid content. Separate solids from the waste stream (especially sand, fibrous material, etc. and store solids in a separate WSF, Do not solids, simi-solids or slurry with a high content solid an above slurry ground tank or facility not accessible by front end loader tractor for cleanout.

Wash water, hose rinse down of lanes, and other wastes from milking parlor and milk house shall be measured and documented to determine an accurate volume of water used. Winter and summer values should be compared and the larger of the two selected for design.

The type of manure, volume of manure, wastes and bedding, percent of solids and the relative handling characteristics of the waste product shall be documented. When handling the manure, the characteristics are very important. Depending on the type of waste and the concentration of solids, manure may have characteristics of a slurry while another would be considered semi-solid according to the AWMFH, Chapter 9 AWMS, figure 9-1. Table B outlines the type of manure and percent total solids for guidance.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, freeze damage and ultraviolet ray deterioration while incorporating erosion protection as necessary.

Pipe inlets may be steel, concrete, PVC or aluminum as required by WV Conservation Practice Standard (PS) 378-Ponds for the various depths of cover. If corrugated steel pipe is used, it will be protected by Class B (fully bituminous coated) or Class P (polymer coated) as specified in ASTM A849. When coating P is used, coating on inside only may be used if the outside of the pipe will not be in direct contact with wastes; otherwise coating on both sides will be used. Corrugated steel pipe with a smooth PVC liner is also acceptable and Schedule 40 PVC or SDR 26 PVC pipe shall meet the minimum requirements provided they are UV protected.

Depth of fill over PVC pipe shall not exceed 10 feet. The diameter of PVC pipes shall not exceed 18 inches.

All pipes will be designed to carry the required flow. Liquid and slurry manure can be moved by gravity if sufficient elevation differenced are available and minimum of 4 feet of elevation head should exist between the top of the collection pit or hopper and the surface of the material in storage. Gravity flow pipes shall be designed to minimize changes in grade or direction and the pipe slope should range from 4% to 15%, with 7 to 8% preferable. Straw or hay bedding should be separated if not chopped, due to potential clogging.

Inlets for liquids may outlet at or above the design volume elevation with a protected outlet by paving or by extending the pipe outlet to a point where discharge will not fall on the slope. Pipes will be UV protected and supported on piers of

pressure-treated wood, steel, concrete or masonry and anchored to prevent dislodging by ice, wind or floating.

Smooth pipes can routinely handle a liquid or slurry (liquid and small percent of solids). Gravity flow pipes are typically 18 inches to 30 inches, but can be a minimum of 8 inches if there are less than 3% solids. Otherwise a maximum of 30 inch diameter smooth pipe shall be used for slurries (see Table B), with an optimal solids content of no more than less than 5% to 8%.

Pumped inlets shall be sized to meet the requirements of the pumping equipment.

Large diameter gravity loading pipes for solids and liquids shall outlet at the bottom on the structure, and the effective head (vertical difference between top of drop inlet and design volume elevations) shall be no less than four (4) feet. Alignment and grade shall be as straight as possible and no alignment change will be greater than 45 degrees. Drop structures for these type inlets shall be wide enough to accommodate the scraping equipment and shall have a volume equal to or greater than the waste production for one half day. A solid or grated cover adequate to support the required loads shall be provided on drop structures. Drop structures in series may be used to accommodate cleaning operations. If wash water is to enter the system through the drop structure, it should be added through the uppermost drop structure.

Emptying Component. Some type of component shall be provided for emptying storage facilities. It may be a facility such as a gate, pipe, dock, wet well, pumping platform, retaining wall, or ramp. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary. ***Refer to PS Manure Transfer (634) for guidance.***

Accumulated Solids Removal. 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, ***and the signed operation and maintenance agreement (by operator or landowner),*** particularly in determining the configuration of ponds and type of seal, if any.

Liquids and slurries may be pumped to a Waste Storage Facility (WSF). The type of facility (liquid, slurry, or solid) depends on the animal manure, type of unloading equipment the operator has available, the ability of the agitation and pumping unit

in addition to the percent concentration of solids.

Dairy manure shall be diluted to 8% or less when pumped. WSF that anticipate loadings of 3% or more of solids shall have a concrete loading/access ramp for solid cleanout with curb as detailed on WV-Eng 53 Concrete Details.

Safety. Design shall include appropriate safety features to minimize the hazards of the facility. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical or flatter. Those used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical or flatter unless special traction surfaces are provided. Warning signs, fences, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock. Ventilation and warning signs ***shall*** be provided for covered waste holding structures, ***above ground tanks and for systems with poor ventilation or blocked from natural wind patterns,*** as necessary, to prevent explosion, poisoning, or asphyxiation. ***The warning sign shall be posted at the most probable entrance or access location.*** Pipelines shall be provided with a water-sealed trap and vent, or similar device, if there is a potential, based on design configuration, for gases to enter buildings or other confined spaces. Ponds and uncovered fabricated structures for liquid or slurry waste with walls less than 5 feet above ground surface shall be fenced and warning signs posted to prevent children and others from using them for other than their intended purpose.

Erosion Protection. Embankments and disturbed areas surrounding the facility shall be treated to control erosion.

Roof drains shall be constructed on barns and other buildings to prevent runoff from becoming polluted. Maximum use shall be

made of diversions to intercept and divert surface runoff before it reaches the waste area. Measures used to divert runoff shall be designed to safely handle at least a 25-year, 5 minute storm or greater with proper outlet protection.

Liners. Liners shall meet or exceed the criteria in PS Pond Sealing or Lining (521).

Additional Criteria for Waste Storage Ponds

Soil and foundation. The pond shall be located in soils with an acceptable permeability that meets all applicable regulation, or the pond shall be lined. Information and guidance on controlling seepage from waste impoundments can be found in the Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

The pond shall have a bottom elevation that is a minimum of 2 feet above the seasonal high water table unless features of special design are incorporated that address buoyant forces, pond seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of perimeter drains, if feasible, to meet this requirement.

Maximum Operating Level. The maximum operating level for waste storage ponds shall be the pond level that provides for the required volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event plus the volume allowance for residual solids after liquids have been removed ***less the required freeboard.*** A permanent marker or recorder shall be installed at this maximum operating level to indicate when drawdown should begin. The marker or recorder shall be referenced and explained in the O&M plan.

Emptying Facilities

To minimize frequency of solids removal from wastewater and runoff storage ponds, direct the flow through a settling basin, a low velocity channel designed for solids removal or a solid separator to remove fibrous solids from the wastewater. Refer to WV PS 634- Manure Transfer for guidance on equipment and transfer of manure onto the field or off the farm.

WSF that are above ground systems shall be designed to store liquid and slurries with less than 10% solids. The estimated solid content shall be documented in the engineering report.

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

WSF Ponds With a Drainage Area

An auxiliary spillway, combination of spillways or additional storage shall be provided to protect the facility from overtopping during a 25-year, 24 hour storm occurring when the design volume is full. The crest elevation of all spillway combinations shall be set at the design volume elevation.

If an excavated auxiliary spillway is (refer to WV PS 378-Pond for additional design criteria) installed, it shall be constructed in undisturbed earth. The spillway shall have a minimum dimension of 1.0 foot in depth and 8 feet in width. Side slopes of the spillway shall be no steeper than 2 Horizontal to 1 Vertical. No additional freeboard is required.

WSF Ponds Without a Drainage Area

The facility shall be protected from overtopping by adding 1.0 foot to the design volume elevation to set the top of structure.

Pipe emergency spillways shall be 8 inches minimum diameter and equipped with trash racks, anti-vortex devices, and seepage control as provided in WV PS 378-Ponds. Pipes may be steel, aluminum, concrete or PVC as required by WV PS 378-Ponds for various depths of cover.

Embankments. The minimum elevation of the top of the settled embankment shall be 1 foot above the waste storage pond's required 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 widths are shown in Table 1. The combined side slopes of the settled embankment shall not be less than 5

horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical unless provisions are made to provide stability.

Excavations. Unless supported by a soil investigation, excavated side slopes shall be no steeper than 2 horizontal to 1 vertical.

Additional Criteria for Fabricated Structures

Foundation. The foundations of fabricated 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 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 2 ***(referenced from Table 1804.2 "Allowable Foundation and Lateral Pressure" Section 1804 of the International Building Code 2006" or the most current)***.

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

Foundations consisting of bedrock with joints, fractures, or solution channels shall be treated or a separation distance provided consisting of a minimum of 1 foot of impermeable soil between the floor slab and the bedrock or an alternative that will achieve equal protection.

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.

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 frost or ice pressure 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 3 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the following conditions:

- **Rigid frame or restrained wall *(At Rest).*** Use the values shown in Table 3 under the column
- "Frame tanks," which gives pressures comparable to the at-rest condition.
- **Flexible or yielding wall *(Active).*** Use the values shown in Table 3 under the column "Free-standing walls," 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 65 lb/ft^2 ***per foot*** where the stored waste is not protected from precipitation. A value of 60 lb/ft^2 ***per foot*** 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 two 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 Structures Due to Use, and in ASAE EP 393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon capacity shall be used.

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 If the facility is to have a roof, snow and wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads or ***ASCE 7 Minimum Design Loads for Buildings and Other Structures (latest edition).***

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 requirements shall be indicated on standard plans ***or in the design report (if a WV approved standard drawing is used).***

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.

All structures shall be underlain by free draining material or shall have a footing located below the anticipated frost depth. Fabricated structures shall be designed according to the criteria in the following references as appropriate:

Steel: "Manual of Steel Construction", American Institute of Steel Construction.

Timber: "National Design Specifications for Wood Construction", American Forest and Paper Association.

Concrete: "Building Code Requirements for Reinforced Concrete, ACI 3318", American Concrete Institute.

Masonry: "Building Code Requirements for Masonry Structures, ACI 530", American Concrete Institute.

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 subgrade is uniform and dense, the minimum slab thickness shall be 4 inches with a maximum joint spacing of 10 feet ***(not recommended on clay, silt or high water table soils).*** Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. 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".

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.

CONSIDERATIONS

Waste storage facilities should be located as close to the source of waste and polluted runoff as practicable.

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

Freeboard for waste storage tanks should be considered.

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

Considerations for Minimizing the Potential for and Impacts of Sudden Breach of Embankment or Accidental Release from the Required Volume.

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 should be considered when any of the categories listed in Table 4 might be significantly affected.

The following should be considered either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. An auxiliary (emergency) spillway
2. Additional freeboard
3. Storage for wet year rather than normal year precipitation
4. Reinforced embankment -- such as, additional top width, flattened and/or armored downstream side slopes
5. Secondary containment

Table 4 - Potential Impact Categories from Breach of Embankment or Accidental Release

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

The following options should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. Outlet gate locks or locked gate housing
2. Secondary containment
3. Alarm system
4. Another means of emptying the required volume

Considerations for Minimizing the Potential of Waste Storage Pond Liner Failure.

Sites with categories listed in Table 5 should be avoided unless no reasonable alternative exists. Under those circumstances, consideration should be given to 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 solutionized bedrock such as limestone or gypsum.

Should any of the potential impact categories listed in Table 5 be affected, consideration should be given to 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 1×10^{-6} cm/sec
2. A flexible membrane liner over a clay liner
3. A geosynthetic clay liner (GCL) flexible membrane liner

4. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness

Considerations for Improving Air Quality

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, and odor, other practices such as Anaerobic Digester – Ambient Temperature (365), Anaerobic Digester – Controlled Temperature (366), Waste Facility Cover (367), and Composting Facility (317) 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 (see Waste Utilization, 633).

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

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.

Specifications may be developed from NEH 20 Series, the 700 Series or other applicable reference material.

Plans must show all pertinent features such as dimensions, access points, manure transfer location and location in reference to other structures, watershed, setback requirements, details of inlet and outlet structures, sub-surface drain outlets and field location.

Applicable WV engineering standards and specifications shall apply to components of the system.

All planning and designing shall be developed with the assistance from an engineer.

OPERATION 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 in accordance with the overall waste management system plan.

In addition, for ponds, the plan shall include an explanation of the permanent marker or recorder installed to indicate the maximum operating level.

The plan shall include a strategy for removal and disposition of waste with the least environmental damage during the normal storage period to the extent necessary to insure the pond's safe operation. This strategy is for the removal of the contribution of unusual storm events that may cause the pond to fill to capacity prematurely with subsequent design inflow and usual precipitation prior to the end of the normal storage period.

Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from breach or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.

A management plan will be prepared by the NRCS conservationist for the operator to follow using the guidelines in Chapter 18 of the Agricultural Waste Management Field Handbook and the following:

Waste Storage Pond

Remove solids from the settling basin, pond or tank at frequent intervals to maintain storage.

The minimum number of times per year the liquid, solid or liquid and solid waste is emptied from the WSF shall be documented.

Mosquito breeding can be controlled by adding larvicides.

Agitation of gravity unloading systems frequency.

REFERENCES

West Virginia Department of Health

West Virginia Department of Agriculture

West Virginia Department of Environmental Protection

U.S. Environmental Protection Agency (EPA)

WV Department of Health and Human Resources; 64CSR46, TITLE 64, Interpretive Rule Department of Health, Series 46

Refer to WV DEP or EPA website for additional guidance on CAFO's.

http://cfpub.epa.gov/npdes/home.cfm?program_id=7;

http://www.wv.gov/Offsite.aspx?u=http://www.wvdep.org

210-VI-EFH Amend. 45, WV5 Preparation of Engineering Plans

210-V-NEM Part 505 – Non-NRCS Engineering Services

WV NRCS Engineering Field Handbook

WV CP Water Well (642)

ASTM C33; Standard Specifications for Concrete Aggregates

AASHTO M43: Standard Specification for Sizes of Aggregate for Road and Bridge Construction

National Pollutant Discharge Elimination System (NPDES)

National Clean Water Act (CWA) Section 502(14]

The Midwest Plan Service (MWPS)- 6; Beef, MWPS-18 Section 2; Manure Storages 2001

Housing and Equipment Handbook 4th Ed. 1987

Table A	
Daily Manure and Waste Production	
Type of Animal	***Volume (Cubic Feet)/day per 1000 pound weight***
Dairy Cattle (100 lb/day milk production)	***1.9 (Feces and Urine)***
Beef Growing Calf (450 #-750# range)	***1.2 (Feces and Urine)***
Beef Finish Cattle	***1.1 (Feces and Urine)***
Beef Brood Cows	***1.2 (Feces and Urine)***
Beef Cow- confinement*	***1.5 (Feces and Urine)***
Poultry-Layer	***1.0 (Feces and Urine)***
Poultry-Broiler	***1.4 (Feces and Urine)***
Turkey*	***0.6 (Feces and Urine)***
Sheep	***0.7 (Feces and Urine)***
Immature Swine	***1.4 (Feces and Urine)***
Horse	***0.9 (Feces and Urine)***
Milk House & Milk Parlor	***0.6***
Milk House, Milk Parlor Holding Area	***1.4***
Reference Chapter 4 Agricultural Waste Characteristics of the (AWMFH), MWPS-18, Section 2*	

Table B			
Relative Handling Characteristics of Manure verses % solids-AWMFH (from figure 9-1)			
Type of Manure	***Liquid- Max % Solid***	***Slurry – Max % Solid***	***Maximum Allowable % Solids in Piped Slurry***
Swine	***4%***	***22%***	***18%***
Poultry	***3.5%***	***20%***	***16%***
Beef (feeders)	***2.5%***	***15%***	***12%***
Dairy Cows	***2.0%***	***14%***	***10%***

Table 1 – Minimum Top Widths	
Total embankment *Height, ft.	Top Width, ft.
Less than 15	***10*****
15 – less than 20	***12***
20 to less than 25	***14***
25 to less than 35	***15***
****Total embankment height is the difference in elevation between the original channel bottom at the centerline of the embankment and the top of the settled embankment. **If the embankment will be used as a farm or one-way access road, then the minimum top width is 12 feet.***	

TABLE 2 – ALLOWABLE FOUNDATION AND LATERAL PRESSURE[A]		
CLASS OF MATERIALS	*ALLOWABLE FOUNDATION PRESSURE LB./FT²*	*LATERAL BEARING (PSF/FT BELOW NATURAL GRADE)[B]*
Crystalline bedrock	*12,000*	*1,200*
Sedimentary and foliated rock	*4,000*	*400*
Sandy gravel and/or gravel (GW and GP)	*3,000*	*200*
Sand, silty sand, clayey sand, silty gravel, clayey gravel (SW, SP, SM, SC, GM and GC)	*2,000*	*150*
Clay, sandy clay, silty clay, clayey silt and sandy silt (CL, ML, MH and CH)	*1,500[D]*	*100*

[A] Reference Table 1804.2 "Allowable Foundation and Lateral Pressure" section 1804 2006 IBC .

[B] Pounds per Sq. Ft per foot below natural ground (do not account for fill material) and A above.

[C] Where the subsurface investigation determines that in-place soils have an allowable bearing capacity of less than 1,500 psf, the allowable bearing capacity shall be determined by a geological sub-surface investigation.

TABLE 3 - LATERAL EARTH PRESSURE VALUES[1]		Equivalent fluid pressure (lb/ft^2/ft of depth)			
Soil		Above seasonal high water table[2]		Below seasonal high water table[3]	
Description[4]	Unified Classification[4]	Free-standing walls	Frame tanks	Free-standing walls	Frame tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines)[5]	GP, GW, SP, SW	30	50	80	90
Gravel, sand, silt and clay mixtures (less than 50% fines) Coarse sands with silt and and/or clay (less than 50% fines)	All gravel sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	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	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL, ML, CL-ML	65	85	95	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.