



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

POND

CODE 378

(no)

DEFINITION

A water impoundment made by constructing an embankment, excavating a dugout, or a combination of both.

In this standard, NRCS defines ponds constructed by the first method as embankment ponds and those constructed by the second method as excavated ponds. Ponds constructed using a combination of the excavation and embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more above the lowest original ground along the centerline of the embankment.

PURPOSE

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

- Store water for:
 - Livestock
 - Fish and wildlife
 - Recreational use
 - Fire control
 - Erosion control
 - Flow detention
- Improve water quality

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all excavated ponds. It also applies to embankment ponds that meet all criteria for low-hazard potential dams as listed below:

- The failure of the dam will not result in loss of life, damage to homes, commercial or industrial buildings, main highways, or railroads, or in interruption of the use or service of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000 acre-feet². Storage is the capacity of the reservoir in acre-feet below the elevation of the crest of the lowest auxiliary spillway or the elevation of the top of the dam if there is no open channel auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section taken on the centerline of the dam. If there is no open channel auxiliary spillway, use the lowest point on the top of the dam instead of the lowest open channel auxiliary spillway crest.
- The effective height of the dam is 35 feet or less.

CRITERIA

General Criteria Applicable to All Ponds

Plan, design, and construct the pond to comply with all Federal, State, and local laws and regulations. Notify landowners and/or contractor of their responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is also required to obtain all necessary permits for project installation prior to construction.

Design a minimum sediment storage capacity equal to the design life of the structure, or provide for periodic cleanout. Protect the drainage area above the pond to prevent sedimentation from adversely affecting the design life.

Design measures necessary to prevent serious injury or loss of life according to the requirements of NRCS National Engineering Manual (NEM) (Title 210), Part 503, "Safety."

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in NRCS Conservation Practice Standard (CPS) Critical Area Planting (Code 342). When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in NRCS CPS Mulching (Code 484) to install inorganic cover material such as gravel.

Cultural resources

Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Site conditions

Select or modify the site to allow runoff from the design storm to safely pass through a natural or constructed auxiliary spillway, a combination of a principal spillway and an auxiliary spillway, or a principal spillway.

Select a site that has an adequate supply of water for the intended purpose through surface runoff, ground water, or a supplemental water source. Water quality must be suitable for its intended use.

Select a site with a drainage area large enough that the 50 percent chance annual yield from surface runoff exceeds the reservoir permanent water storage needs for all purposes unless an alternate water source exists to serve this purpose.

Reservoir

Provide adequate storage volume to meet user demands for all intended purposes. Account for sedimentation, season of use, evaporation loss, and seepage loss when computing the storage volume.

Conduct a detailed survey at the site to determine the extent of planned surface and subsurface water levels near property boundaries. Obtain a signed written agreement, easement, or permit prior to construction if the water levels associated with the pond adversely affect adjacent properties or other water users.

If unable to obtain permission to impound water on adjacent properties, set the reservoir permanent water level a minimum of 12 inches below the lowest adjacent property boundary elevation to prevent saturation of the soils on adjacent property unless a detailed hydrologic evaluation shows there will be no negative impacts at higher water levels.

Additional Criteria for Embankment Ponds

Geological investigations

Use pits, trenches, borings, and reviews of existing data or other suitable means of investigation to characterize materials within the embankment foundation, auxiliary spillway, and borrow areas. Classify

soil materials using ASTM D2487-17e1, “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).” Determine from the investigations if problem soils exist at the embankment pond site for defensive design measures. Problem soils, include but are not limited to dispersive clays, collapsible soils, soft clays, expansive clays, low internal erosion resistance soils, loose coarse-grained soils, high soluble content soils, and caliche soils.

Complete indicator tests for dispersive clays (Crumb Test) for all embankment dam sites prior to the final design preparation. Sites located west of the Missouri River may require further laboratory evaluations.

Stripping

Strip foundations to a minimum depth of 0.5 foot or to the depth of significant root development, whichever is greater. Scarify the stripped area prior to placing earthfill.

Foundation cutoff

Design a cutoff of relatively impervious material under the dam and up the abutments as required for preventing seepage. Locate the cutoff at, or upstream from, the centerline of the dam. Extend the cutoff deep enough to intercept flow and connect with a relatively impervious layer. Minimum depth of cutoff is 2 feet from the original ground surface. Combine seepage control with the cutoff as needed. Use a cutoff bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Design cutoff side slopes no steeper than one horizontal to one vertical. Meet Occupational Safety and Health Administration (OHSA) regulations for all trenches.

Seepage control

Include seepage control if—

- Foundation cutoff does not intercept pervious layers.
- Seepage could create undesired wet areas.
- Embankment stability requires seepage control.
- Special problems require drainage for a stable dam.

Filter zones may be required in some embankment designs to address the problem of cracking and internal erosion of the embankment for sites with problematic conditions such as dispersive clays, steep abutments, and other issues.

Control seepage with—

- Foundation, abutment, or embankment filters and drains.
- Filter diaphragms.
- Reservoir bottom blanketing.
- A combination of these measures.

Top width

Table 1 provides the minimum top widths for dams of various total heights. Total height is the vertical distance between the settled top of the dam and the lowest elevation at the downstream toe.

Design a minimum width of 16 feet for one-way traffic and 26 feet for two-way traffic for the top of a dam used as a public road. Design guardrails or other safety measures where necessary and follow the requirements of the responsible road authority. For dams less than 20 feet in total height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in table 1.

Table 1. Minimum Top Width for a Dam.

Total Height of Dam (feet)	Top Width (feet)
Less than 10	6
10–14.9	8
15–19.9	10
20–24.9	12
25–35	15

Side slopes

Design upstream side slopes of the embankment with a ratio of 3 horizontal to 1 vertical or flatter. Design downstream side slopes of the embankment with a ratio of 2 horizontal to 1 vertical or flatter. As required, design benches or flatten side slopes to assure stability of all slopes for all loading conditions. Flatter slopes may be required for stability for some problematic embankment or foundation soils such as highly plastic embankment soils or very soft clays. Downstream or upstream berms can be used to help achieve stable embankment slopes.

Slope protection

Design special measures such as berms, riprap, sand-gravel, soil cement, or use special vegetation as needed to protect the slopes of the dam from erosion. Use NRCS Engineering Technical Release (TR) 210-56, "A Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments," and TR-210-69, "Riprap for Slope Protection against Wave Action," as applicable.

Specifically, on engineering job class 3 and above designs, counter the effect of wave action if either:

- The permanent pool surface area exceeds 10 acres and the permanent pool is deeper than 5 feet adjacent to the embankment; or
- The permanent pool surface area exceeds 5 acres, the wave heights exceed 0.5 feet when using TR-210-56 procedures, and the permanent pool is deeper than 5 feet adjacent to the embankment.

Freeboard

Design a minimum of 1 foot of freeboard between design high-water flow elevation in the auxiliary spillway and the top of the settled embankment. Design a minimum 2 feet of elevation difference between the crest of the auxiliary spillway and the top of the settled embankment when the dam has more than 20 acre drainage area or more than 20 feet in effective height. Design a minimum of 1.5 feet of freeboard above the peak elevation of the design hydrograph to the top of the settled embankment when the pond has no auxiliary spillway.

Settlement

Increase the height of the dam by the amount needed to ensure that the settled top elevation of the dam equals or exceeds the design top elevation. Design a minimum settlement allowance of 5 percent of the total height of the dam associated with each dam cross section, except where detailed laboratory soil testing and settlement analyses or experience in the area shows that a lesser amount is adequate.

Borrow Area

Strip the borrow area to remove all vegetation and material undesirable for fill. Stripped material may later be used as cover over the dam, spillway, or borrow area as needed for vegetation establishment.

Principal spillway

A pipe with needed appurtenances shall be placed under or through the dam, except where rock, concrete, or other types of lined spillways are used, or where a vegetated or earth spillway can safely handle the rate and duration of the design flow.

A pipe conduit is needed when any of the following conditions are present:

- Soils in the auxiliary spillway have high erodibility and/or will not support adequate vegetation;
- The volume of water storage, less sediment design storage, in the dam at the auxiliary spillway crest elevation is less than 50 percent of the 2-year frequency, 24-hour storm yield;
- The volume of water storage at the auxiliary spillway crest exceeds 100 acre-feet;
- The product of storage times effective height exceeds 2,000;
- Significant quantities of water from wells, springs, or seeps flow into the reservoir.

For dams requiring a principal spillway, contain the design storm between the crests of the principal spillway and auxiliary spillway when flood routed. Table 2 shows the required design storm.

Table 2. Minimum principal spillway capacity

Product of Height times Storage at the Auxiliary Spillway Crest (Acre-Feet X Feet) ^{1/}	Minimum Design Storm	
	Frequency (Years)	Min. Duration (Hours)
Less than 2,000	2	24
2,000 to 2,499	5	24
2,500 to 2,999	10	24
^{1/} As defined under “Conditions Where Practice Applies.”		

Design a minimum of 6-inches difference between the crest elevation of the auxiliary spillway and the crest elevation of the principal spillway when the dam has a drainage area of 20 acres or less. Design a minimum of 1 foot difference when the dam has a drainage area of over 20 acres.

Provide an anti-vortex device to handle pressure flow in the principal spillway pipe. Design the inlet and outlet to function for the full range of flow and hydraulic head anticipated.

Design adequate pipe capacity to discharge long-duration, continuous, or frequent flows without causing flow through the auxiliary spillway. Design a principal spillway pipe with a minimum inside diameter of 8 inches. Design pipe with a minimum inside diameter of 1-1/4 inches for water supply pipes or for pipes used for any other purpose.

Design pipe using ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (precast or site-cast), or plastic. Do not use cast iron or unreinforced concrete pipe if the dam is 20 feet or greater in total height.

Design and install pipe to withstand all external and internal loads without yielding, buckling, or cracking. Design rigid pipe for a positive projecting condition. Design flexible pipe according to the requirements of NRCS National Engineering Handbook (NEH) (Title 210), Part 636, Chapter 52, “Structural Design of Flexible Conduits.”

Design information concerning the acceptable height of earth fill over various pipe materials used in earthen embankments is shown in Table 3 and 4 below. Deviation from these tables requires analysis according to NEH 210-636 Chapter 52.

Table 3. Acceptable plastic pipe for use in earth embankments.

Pipe Material	Testing Method Designation	SDR / Pressure rating and/or Schedule	Applicable Pipe Diameters (Inches)	Maximum Fill Height Above Pipe (Feet)
PVC 1120/1220 Plastic Irrigation Pipe (PIP)	ASTM D2241	SDR 26 - 160 PSI	8, 10, 12, 14, 15, 18, 21, 24, 27	10
		SDR 21 - 200 PSI	(15)	18
PVC and ABS 1120/1220/2120 Iron Pipe Size (SDR-PR (IPS))	ASTM D2241	SDR 26 - 160 PSI	8, 10, 12, 14, 16, 18, 20, 24, 30, 36	10
		SDR 21 - 200 PSI	8, 10, (12, 14, 16, 18, 20, 24, 30, 36)	18
		SDR 17 - 250 PSI	(8, 10, 12, 14, 16, 18, 20, 24, 30, 36)	30
PVC Schedule 40 & 80	ASTM D1785	Schedule 40 - SDR Varies with Diameter	8, 10, 12, (14, 16, 18)	8
			(20, 24)	6 *
		Schedule 80 - SDR Varies with Diameter	8	28
			10	26
			12, (14)	24
			(16, 18)	22
			(20, 24)	20
PVC Plastic Pipe Iron Pipe Size (IPS)	AWWA C900	DR 25 - 165 PSI	8, 10, 12, 14, 16, 18, 20, 24, (30, 36)	10
		DR 21 - 200 PSI	14, 16, 18, 20, 24, (30, 36)	14
		DR 18 - 235 PSI	8, 10, 12, 14, 16, 18, 20, 24, (30, 36)	20
		DR 14 - 305 PSI	8, 10, 12, 14, 16, 18, 20, 24, (30, 36)	25
Type PSM PVC Pipe (Sewer Pipe)	ASTM D3034	SDR 26	8, 10, 12, 15	10 *
PE Schedule 40 Plastic Pipe	ASTM D2447	Schedule 40 - SDR Varies with Diameter	(8)	5 *
			(10)	4 *
Polyethylene Plastic Pipe (SDR-PR) O.D. Dia. Controlled (IPS)	ASTM D3408, D3306, D3406, D2306, D2406, D2305, & D1404	SDR 26 - Pressure Rating Varies with Material	8, 10, 12, 14, 16, 18, 20, 22, 24	4 *
		SDR 21 - Pressure Rating Varies with Material	8, 10, 12, 14, 16, 18, 20, 22, 24	8
		SDR 17 - Pressure Rating Varies with Material	8, 10, 12, 14, 16, 18, 20, 22, 24	10
		SDR 15.5 - Pressure Rating Varies with Material	8, 10, 12, 14, 16, 18, 20, 22, 24	14

* Not recommended in areas with highly plastic CL or CH soils.

Note: Pipe with diameters listed within closed parentheses may have very limited availability or will only be available with large quantity special orders.

Table 4. Minimum thickness for corrugated metal pipe.

Pipe Diameter (Inches)	Fill Height Above Pipe (Feet)								
	<15	15-20	20-25	<15	15-20	20-25	<15	15-20	20-25
	Galvanized Steel with 2 2/3 in. X 1/2 in. Corrugations (Gage)			Galvanized Steel with 3 in. X 1 in. Corrugations (Gage)			Aluminum* with 2 2/3 in. X 1/2 in. Corrugations (Wall Thickness) (Inches)		
21 & Less	16	16	16	—	—	—	0.06	0.06	0.06
24	16	16	16	—	—	—	0.06	0.75	0.105
30	16	16	14	—	—	—	0.075	0.105	0.135
36	14	14	12	16	16	16	0.075	0.105	**
42	12	12	10	16	16	16	**	**	—
48	10	10	10	16	16	14	—	—	—
54	—	—	—	16	16	12	—	—	—
60	—	—	—	16	14	10	—	—	—
66	—	—	—	16	14	8	—	—	—
72	—	—	—	16	14	8	—	—	—
* Riveted or Helical Fabrication									
** No Permitted									

Design connections of flexible pipe to rigid pipe or other structures to accommodate differential movements and stress concentrations. Design and install all pipes to be watertight using couplings, gaskets, caulking, water stops, or welding. Design joints to remain watertight under all internal and external loading, including pipe elongation due to foundation settlement.

Design a concrete cradle or bedding for pipe if needed to reduce or limit structural loading on the pipe and improve support of the pipe.

Principal spillway pipe outlet

Design outlet structures, such as cantilever pipe outlet sections and impact basins, to dissipate energy as needed.

Where a SAF stilling basin, impact basin, flared outlet, or similar pipe outlet device is not used, place the principal spillway pipe outlets above the outlet channel water level, and at least 1 foot above the base grade of the outlet channel. When pipe supports are used, extend the outlet end of the pipe at least 5 feet beyond the point where the downstream slope of the embankment fill intersects the flow line of the outlet channel or waterway. When pipe supports are not used, extend the pipe at least 5 feet downstream of the intersection of the embankment fill and the bottom of the pipe.

Support and hold the pipe outlet firmly in position by pipe supports, earth or rock fill, or other means. Provide pipe supports for cantilever outlets with 24-inch or larger pipe diameter. Where pipe supports are used, extend the supports below expected frost depth to minimize frost heave.

For principal spillway pipes 18 inches in diameter or larger, do not exceed 5 percent for the cantilever outlet pipe slope except as designed by an engineer.

Design cantilever outlets to withstand full pipe cantilever load plus applicable external loads such as ice or snow.

Corrosion protection

Provide protective coatings for all steel pipe and couplings in areas that have traditionally experienced pipe corrosion or in embankments with saturated soil resistivity less than 4,000 ohm-cm or soil pH less

than 5. Protective coatings may include asphalt, polymer over galvanizing, aluminized coating, or coal tar enamel.

Ultraviolet protection

Use ultraviolet-resistant materials for all plastic pipe or provide coating or shielding to protect plastic pipe exposed to direct sunlight.

Cathodic protection

Provide cathodic protection for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating and where the need and importance of the structure warrant additional protection and longevity. If the original design and installation did not include cathodic protection, consider establishing electrical continuity in the form of joint-bridging straps on pipes that have protective coatings. Add cathodic protection later if monitoring indicates the need.

Internal erosion

Install filter diaphragms for internal erosion control or anti-seep collars to reduce hydraulic gradient along the pipe extending through the embankment with inverts below the peak elevation of the routed hydrograph when the effective height of the dam is 15 feet or greater. Use a filter diaphragm if any of the Crumb Tests have an indicator of 2 or greater, which indicates that the soils have dispersive properties.

Filter diaphragms

Design the filter diaphragm according to the requirements of 210-NEH, Part 628, Chapter 45, "Filter Diaphragms." Locate the filter diaphragm immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the foundation cutoff is upstream of the centerline or if there is no cutoff trench.

To improve filter diaphragm performance, provide a drain outlet for the filter diaphragm at the downstream toe of the embankment. Protect the outlet from surface erosion and animal intrusion.

Ensure that the filter diaphragm functions both as a filter for adjacent base soils and as a drain to intercept seepage. Materials for the filter diaphragm must meet the requirements of 210-NEH-Part 633, Chapter 26, "Gradation Design of Sand and Gravel Filters".

Anti-seep collars can be used where the following soil and site conditions apply:

- Embankment soils are documented to be non-dispersive by crumb testing or evidence that the site is located in geologic formations that are known to be non-dispersive
- Soils tests show that embankment soils have a plasticity index (PI) equal to or greater than 15.
- The water content of the soils at the time of construction is such that a 1/8-inch diameter thread 1/2-inch long may be rolled out on a flat surface without breaking or falling apart.
- Natural or excavated ground slopes transverse to the embankment centerline in the vicinity of the conduit are no steeper than 2 horizontal to 1 vertical.
- Laboratory or field tests show that the foundation soils left in-place under the embankment and principal spillway are medium to very stiff in saturated consistency or medium dense to very dense depending on if these soils are cohesive or cohesionless, respectively.

When using anti-seep collars in lieu of a filter diaphragm, ensure a watertight connection to the pipe. Limit the maximum spacing of the anti-seep collars to 14 times the minimum projection of the collar measured perpendicular to the pipe, or 25 feet, whichever is less. Locate anti-seep collars no closer than 10 feet apart. Use a collar material that is compatible with the pipe material.

Design the collars to increase the seepage path along the pipe within the fill by at least 15 percent.

Trash guard

Install a trash guard at the riser inlet to prevent clogging of the pipe, unless the watershed does not contain trash or debris that could clog the pipe.

Pool drain

Provide a pipe with a suitable valve to drain the pool area if needed for proper pond management or if required by State law. The designer may use the principal spillway pipe as a pond drain if it is located where it can perform this function.

Auxiliary spillways

A dam must have an open channel auxiliary spillway, unless the principal spillway is large enough to pass the peak discharge from the design hydrograph and the trash that comes to it without overtopping the dam. The minimum criteria for acceptable use of a closed pipe principal spillway without an auxiliary spillway consists of a pipe with a cross-sectional area of 3 square feet or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

Design the minimum capacity of a natural or constructed auxiliary spillway to pass the peak flow expected from a total design storm of the frequency and duration shown in table 5, less any reduction creditable to the principal spillway discharge and detention storage.

Design the auxiliary spillway to safely pass the peak flow through the auxiliary spillway, or route the storm runoff through the reservoir. Start the routing either with the water surface at the elevation of the crest of the principal spillway or at the water surface after a 10-day drawdown, whichever is higher. Compute the 10-day drawdown from the crest of the auxiliary spillway or from the elevation attained from impounding the entire design storm, whichever is lower. Design the auxiliary spillway to pass the design flow at a safe velocity to a point downstream where the flow will not endanger the dam.

A constructed auxiliary spillway consists of an inlet channel, a control section, and an exit channel. Design the auxiliary spillway with a trapezoidal cross-section. Locate the auxiliary spillway in undisturbed earth or in-situ rock. Design stable side slopes for the material in which the spillway is to be constructed. Design a minimum bottom width of 20 feet for dams having an effective height of 20 feet or more.

Design a level inlet channel upstream from the control section for the distance needed to protect and maintain the crest elevation of the spillway (at least 30 feet in earth materials). If necessary, curve the inlet channel upstream of the level section to fit existing topography. Design the exit channel grade according to 210-NEH-628, Chapter 50, "Earth Spillway Design," or with equivalent procedures. 210-NEH-628, Chapter 50 uses methods outlined in Agricultural Handbook Number 667 and employed by the SITES computer program to determine the stability and integrity of the auxiliary spillway. This method requires a soils investigation to establish the soil parameters.

An optional method for the design for the auxiliary spillway is to use NEH Part 650, Engineering Field Handbook (EFH) Chapter 11, Section 650.1107. The auxiliary spillway is sized based on the discharge requirements, vegetal retardance, allowable velocities in the exit channel, and the length of crest.

For auxiliary spillways without a constructed exit channel downstream of the control section, design the spillway to have less than 5 feet per second velocity of water through the inlet section and upstream of the crest.

For all auxiliary spillways, evaluate the natural exit channel for long-term stability and maintenance requirements.

Structural auxiliary spillways

Design chute spillways or drop spillways according to the principles set forth in 210-NEH, Part 650, "Engineering Field Handbook"; and 210-NEH, Section 5, "Hydraulics"; Section 11, "Drop Spillways"; and Section 14, "Chute Spillways." Design a structural spillway with the minimum capacity required to pass the peak flow expected from a total design storm of the frequency and duration shown in table 5, less any reduction creditable to the pipe discharge and detention storage.

Table 5. Minimum auxiliary spillway capacity

Drainage area (<i>acre</i>)	Effective height of dam ¹ (<i>feet</i>)	Detention storage (<i>acre-feet</i>)	Minimum design storm ²	
			Frequency (<i>years</i>)	Minimum duration (<i>hours</i>)
20 or less	20 or less	< 50	10	24
20 or less	> 20	< 50	25	24
> 20	all	< 50	25	24
All others	all	all	50	24
¹ . Defined above in "Conditions where Practice Applies." ² . Select rain distribution based on climatological region.				

Additional Criteria for Excavated Ponds**Runoff**

Design a minimum of 1 foot of freeboard above the peak elevation of the design hydrograph. Design a pipe and auxiliary spillway that meets the capacity requirements of table 5. Consider runoff flow patterns when locating the excavated pond and placing the spoil.

Side Slopes

In the excavated area, design side slopes that are no steeper than one horizontal to one vertical.

Inlet Protection

Protect the side slopes from erosion where surface water enters the pond in a natural or constructed channel.

Excavated material

Place the material excavated from the pond so that its weight does not endanger the stability of the pond side slopes and so that the soil will not wash back into the pond by rainfall. Dispose of excavated material in one of the following ways:

- Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
- Uniformly place and with side slopes assuming a natural angle of repose. Place excavated material at a distance equal to the depth of the pond, but not less than 12 feet from the edge of the pond.
- Shape to a designed form that blends visually with the landscape.
- Provide for low embankment construction and leveling of surrounding landscape.
- Haul material offsite.

Seed the excavated pond or dugout spoil piles and areas disturbed during construction using the criteria in NRCS CPS Critical Area Planting (Code 342).

Additional Criteria for Livestock Water

For embankment ponds, the minimum storage for livestock shall be:

- 10 feet deep for ponds east of the Missouri River.
- 12 feet deep for ponds west of the Missouri River.

For excavated ponds, the minimum storage for livestock shall be:

- 10 feet deep for ponds east of the Missouri River that are not influence by normal seasonal groundwater.
- 12 feet deep for ponds west of the Missouri River that are not influenced by normal seasonal

groundwater.

- 6 feet deep for ponds that are influenced by normal seasonal groundwater.

Additional Criteria for Recreation and Fire Control

For recreation consider excluding livestock from the pond shoreline. For water contact recreation, exclude livestock. For recreation ponds, provide 50 feet or wider perennial grass buffers between the pond and cropland or barron areas.

For fire control, deep water (over 15 feet) located near the withdrawal location is most desirable.

Additional Criteria for for Wildlife

Assure the depth, duration of water presence, and shoreline slopes are adequate for the identified species habitat needs and the identified season of use. Design a minimum sediment storage capacity equal to the design life of the structure. Apply sediment storage to the lowest portion of the pond's volume. Design to meet the criteria of SD NRCS Biology Technical Note 18, Wetland Topographic Design and Sediment Removal, Table 2.

Plan wildlife ponds to address inadequate habitat for the resource concern and not to provide wildlife drinking water.

Exclude livestock from wildlife areas except for limited lanes for livestock water. Protect wildlife areas from vehicle travel and other intrusions.

CONSIDERATIONS

Visual Resource Design

Carefully consider the visual design of ponds in areas of high public visibility and those associated with recreation. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and function.

Shape the embankment to blend with the natural topography. Shape the edge of the pond so it is generally curvilinear rather than rectangular. Shape excavated material so the final form is smooth, flowing, and fitted to the adjacent landscape rather than angular geometric mounds. If feasible, add islands to provide visual interest and attract wildlife.

Fish and Wildlife

Locate and construct ponds to minimize the impacts to existing fish and wildlife habitat.

When feasible, retain trees in the upper reaches of the pond and stumps in the pool area. Shape upper reaches of the pond to provide shallow areas and wetland habitat.

If operations includes stocking fish, use NRCS CPS Fishpond Management (Code 399).

Exclude drainage areas with concentrated organic wastes or other pollution.

Exclude livestock from shoreline areas except for limited lanes for livestock water. Provide a buffer of perennial vegetation at least 50 feet wide between the pond and cropland or barren areas.

Trout pond. For constant cold (45° to 60°F) inflow, minimum depth is 15 feet over a minimum area of 0.1 acres, and minimum pond surface area is 0.5 acres. For intermittent inflow, minimum depth is 20 feet over minimum area of 0.3 acres, and minimum pond surface area is 1 acre.

Warm water fish pond. Minimum pond size is 1 surface acre. Minimum depth is 15 feet over a minimum area of 0.3 acres.

Watering ramp

When wildlife or livestock need access to stored water, use the criteria in NRCS CPS Watering Facility (Code 614) to design a watering ramp.

Vegetation

Stockpile topsoil for placement on disturbed areas to facilitate revegetation.

Consider selecting and placing vegetation to improve fish habitat, wildlife habitat, and species diversity.

Water Quantity

Consider effects on components of the water budget, especially—

- Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Variability of effects caused by seasonal or climatic changes.
- Effects on downstream flows and impacts to the environment such as wetlands, aquifers, and social and economic impacts to downstream uses or users.
- Consider limiting livestock travel between forage and dependable water to 1 mile in gentle relief and 1/2 mile in rough topographic relief.

Water Quality

Consider the effects of—

- Erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that runoff carries.
- Short-term and construction-related effects of this practice on the quality of downstream watercourses.
- Water level control on the temperature of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Wetlands and water-related wildlife habitats.
- Water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Soil water level control on the salinity of soils, soil water, or downstream water.
- Earth moving potentially uncovering or redistributing toxic materials.
- Livestock grazing adjacent to the pond. Consider fencing to prevent livestock activities having direct contact with the pond and dam.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include—

- A plan view of the layout of the pond and appurtenant features.
- Typical profiles and cross sections of the principal spillway, auxiliary spillway, dam, and appurtenant features, as needed.
- Structural drawings adequate to describe the construction requirements.
- Requirements for establishing vegetation or other ground surface protection, as needed.
- Safety features.
- Site-specific construction and material specifications.
- Utility location and notification requirements.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include—

- Periodically inspect all structures, earthen embankments, spillways, and other significant appurtenances.
- Promptly repair or replace damaged components.
- Promptly remove trash from pipe inlet and trash rack.
- Promptly remove sediment when it reaches predetermined storage elevations.
- Periodically remove trees, brush, and undesirable species.
- Periodically inspect safety components and immediately repair if necessary.
- Maintain vegetative protection and immediately seeding bare areas, as needed.
- Prevent the establishment of woody vegetation on constructed embankment fill and around spillway appurtenances.

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