NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

POND

(No.)

CODE 378

DEFINITION

A water impoundment made by constructing an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the 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.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, fire control, develop renewable energy systems, and other related uses, and to maintain or improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

This standard establishes the minimum acceptable quality for the design and construction of low-hazard ponds where:

- 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. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no auxiliary spillway, the top of the dam is the upper limit.
- The effective height of the dam is 35 feet or less.

CRITERIA

General Criteria Applicable to All Ponds

All federal, state and local requirements shall be addressed in the design.

This practice standard only applies to non-jurisdictional dams as defined by the State in NMAC 19.25.12.7.D(1)(b). This definition and other key laws or rules of the State are provided in the considerations section of this standard.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in conservation practice standard 342, Critical Area Planting.

Site conditions. Site conditions shall be such that runoff from the design storm can be safely passed through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Drainage area. The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater will provide an adequate supply of water for the intended purpose unless an alternate water source exists to serve this purpose. The quality shall be suitable for the water's intended use.

Reservoir area. The topography and geology of the site shall permit storage of water at a depth and volume that will ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the

primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable.

All ***excavated*** stock water ponds shall have a minimum effective depth of 12.0 feet over a minimum area of 200 square feet. A minimum depth of 7.0 feet will be acceptable where physical factors such as rock, gravel, or sand make it impracticable to complete the structure as designed.

All ***embankment*** ponds shall have a minimum effective depth of 9.0 feet over a minimum area of 200 square feet.

Design Criteria for Embankment Ponds

Geological Investigations. Pits, trenches, borings, review of existing data or other suitable means of investigation shall be conducted to characterize materials within the embankment foundation, auxiliary spillway and borrow areas. Soil materials shall be classified using the Unified Soil Classification System.

The local soil survey provides typical engineering properties. Policy for geological investigations is located in Part 531 of the NEM and part 631 of the NEH. For geological investigations, dams covered by this practice are Group II dams.

Foundation cutoff. A cutoff of relatively impervious material shall be provided under the dam if necessary to reduce seepage through the foundation. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control. Seepage control is to be included if (1) pervious layers are not intercepted by the cutoff, (2) seepage could create swamping downstream, (3) such control is needed to insure a stable embankment, or (4) special problems require drainage for a stable dam. Seepage may be controlled by (1) foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Embankment. The minimum top width for a dam is shown in table 1. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority. For dams less than 20 feet in 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 dams

Total height of embankment	Top width
feet	*feet*
Less than 10	10
10 – 19.9	12
20 – 29.9	14
30 – 40	16

Side Slopes. The combined upstream and downstream side slopes of the settled embankments shall not be less than five horizontal to one vertical. The downstream slope shall not be steeper than two horizontal to one vertical, and the upstream slope shall not be steeper than 3 horizontal to 1 vertical. All slopes must be designed to be stable, even if flatter side slopes are required. Downstream or upstream berms can be used to help achieve stable embankment sections

Slope Protection. If needed to protect the slopes of the dam from erosion, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided (Technical Releases 56, “A guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments” and 69, “Riprap for Slope Protection Against Wave Action” contain design guidance).

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 foot above the water surface in the reservoir with the auxiliary spillway flowing at design depth. The minimum difference in elevation between the crest of the auxiliary spillway and the settled top of the dam shall be 2 feet for all dams having more than a 20-acre drainage area or more than 20 feet in effective height.

Settlement. The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam

equals or exceeds the design height. This increase shall not be less than 10 percent of the height of the dam, except where detailed soil testing and laboratory analyses or experience in the area show that a lesser amount is adequate.

Principal spillway. A pipe conduit, 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 the rate and duration of flow can be safely handled by a vegetated or earth spillway.

For dams with a drainage area of 20 acres or less, the principal spillway crest elevation shall not be less than 0.5 feet below the auxiliary spillway crest elevation. For dams with a drainage area over 20 acres, this difference shall not be less than 1.0 feet.

When design discharge of the principal spillway is considered in calculating peak outflow through the auxiliary spillway, the crest elevation of the inlet shall be such that the design discharge will be generated in the conduit before there is discharge through the auxiliary spillway.

Inlets and outlets shall be structurally sound and made of materials compatible with the pipe.

Pipe conduits designed for pressure flow must have adequate anti-vortex devices. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the auxiliary spillways. The diameter of the principal spillway pipe shall not be less than 4 inches. Pipe conduits used solely as a supply pipe through the dam for watering troughs and other appurtenances shall not be less than 1-1/4 inches in diameter.

If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Pipe conduits shall be ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (pre-cast or site-cast), or plastic. Pipe conduits through dams of less than 20 feet total height may also be cast iron or unreinforced concrete.

Pipe conduits shall be designed and installed to withstand all external and internal loads without yielding, buckling, or cracking. Rigid pipe shall be designed for a positive projecting condition. Flexible pipe shall be designed for a maximum deflection of 5 percent. The modulus of elasticity for PVC pipe shall be assumed as one-third of the amount designated by the compound cell classification to account for long-term reduction in modulus of elasticity. Different reductions in modulus may be appropriate for other plastic pipe materials.

The minimum thickness of flexible pipe shall be SDR 26, Schedule 40, Class 100, or 16 gage as appropriate for the particular pipe material. Connections of flexible pipe to rigid pipe or other structures shall be designed to accommodate differential movements and stress concentrations.

Table 2 and Table 3 provide the minimum SDR, schedule, or gauge for certain pipe. In addition to the pipe presented, other pipe may be used if the strength and other requirements of the standard are met. The maximum height of fill over any steel or aluminum pipe must not exceed 25 feet.

Table 2
Acceptable PVC Pipe for use in Ponds[1]

Nominal Pipe Size 'Inches'	Schedule for Standard Dimension Ratio (SDR)	Maximum Height of Fill Over Pipe 'Feet'
4 or less	Schedule 40	15
	Schedule 80	20
	SDR 26	10
6, 8, 10, 12	Schedule 40	10
	Schedule 80	15
	SDR 26	10

[1]Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ASTM D-1785 or ASTM D-2241.

Table 3
Minimum gage for corrugated metal pipe [2-2/3-in x ½-in corrugations][1]

Fill Height	Minimum Gage for Steel Pipe with a Nominal Diameter (in) of:					
(ft)	≤21	24	30	36	42	48
1–15	16	16	16	14	12	10
15–20	16	16	16	14	12	10
20-25	16	16	14	12	10	10

Fill Height (ft)	Minimum Thickness (in) of Aluminum Pipe[2] with a Nominal Diameter (in) of:			
	≤21	24	30	36
1 - 15	0.06	0.06	0.075	0.075
15 - 20	0.06	0.075	0.105	0.105
20 - 25	0.06	0.105	0.105	----[3]

[1] Pipe with 6-, 8-, and 10in diameters has 1 ½ in x ¼ - in corrugations.
[2] Riveted or helical fabrication.
[3] Not permitted.

All pipe conduits shall be designed and installed to be water tight by means of couplings, gaskets, caulking, waterstops, or welding. Joints shall be designed to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

Pipe conduits shall have a concrete cradle or bedding if needed to provide improved support for the pipe to reduce or limit structural loading on pipe to allowable levels.

Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a Saint Anthony Falls stilling basin or an impact basin may be used to provide a safe outlet.

All steel pipe and couplings shall have protective coatings in areas that have traditionally experienced pipe corrosion, or in embankments with saturated soil resistivity less than 4000 ohms-cm or soil pH less than 5. Protective coatings shall be asphalt, polymer over galvanizing, aluminized coating or coal tar enamel as appropriate for the pipe type. Plastic pipe that will be exposed to direct sunlight shall be ultraviolet-resistant and protected with a coating or shielding, or provisions provided for replacement as necessary

Renewable Energy. For detailed criteria where the purpose is to develop renewable energy systems refer to interim conservation practice standard Renewable Energy Production (716).

Cathodic Protection. Cathodic protection is to be provided 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 cathodic protection is not provided for in the original design and installation, electrical continuity in the form of joint-bridging straps should be considered on pipes that have protective coatings. Cathodic protection should be added later if monitoring indicates the need.

For metal pipe and fittings, conservation practice standard 430, Irrigation Pipeline, provides criteria for corrosion protection.

Seepage Control. Seepage control along a pipe conduit spillway shall be provided if any of the following conditions exist:

- The effective height of dam is greater than 15 feet.
- The conduit is of smooth pipe larger than 8 inches in diameter.
- The conduit is of corrugated pipe larger than 12 inches in diameter.

Seepage along pipes extending through the embankment shall be controlled by use of a drainage diaphragm.

Drainage Diaphragm. The drainage diaphragm shall function both as a filter for adjacent base soils and a drain for seepage that it intercepts. The drainage diaphragm shall consist of sand meeting the requirements of ASTM C-33, for fine aggregate. If unusual soil conditions exist such that this material may not meet the required filter or capacity requirements, a special design analysis shall be made.

The drainage diaphragm shall be a minimum of 2 feet thick and extend vertically upward and horizontally at least three times the outside pipe diameter, and vertically downward at least 18 inches beneath the conduit invert. The drainage diaphragm shall be located immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the cutoff is upstream of the centerline.

The drainage diaphragm shall be outletted at the embankment downstream toe using a drain backfill envelope continuously along the pipe to where it exits the embankment. Drain fill shall be protected from surface erosion.

Trash Guard. To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser unless the watershed does not contain trash or debris that could clog the conduit.

Other Outlets. A pipe with a suitable valve shall be provided to drain the pool area if needed for proper pond management or if

required by State law. The principal spillway conduit may be used as a pond drain if it is located where it can perform this function.

Auxiliary spillways. Auxiliary spillways convey large flood flows safely past earth embankments and have historically been referred to as "Emergency Spillways".

An auxiliary spillway must be provided for each dam, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The following are minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway: a conduit with a cross-sectional area of 3 ft^2 or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

The minimum capacity of a natural or constructed auxiliary spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 4, less any reduction creditable to conduit discharge and detention storage.

Table 4
Minimum auxiliary spillway capacity

			Minimum design storm[2]	
Drainage area (Ac.)	Effective height of dam[1] (Ft.)	Storage (Ac-Ft)	Frequency (Years)	Minimum duration (Hours)
20 or less	20 or less	< than 50	10	24
20 or less	> than 20	< than 50	25	24
> than 20		< than 50	25	24
All others			50	24

[1] As defined under "Conditions where Practice Applies".
[2] Select rain distribution based on climatological region.

The hydraulic design of the auxiliary spillway may be determined using Chart 4-N-16495, which is Exhibit NM-11-1 of Chapter 11 of the NRCS Engineering Field Manual (210-650.11). The critical velocity V_c shall not exceed 8 feet per second, unless the spillway is excavated into massive rock.

Peak auxiliary spillway flow shall be computed using "Peak Rates of Discharge for Small Watershed" (NRCS Engineering Field Manual, Chapter 2; Revised for NM 10/73 and updated 2/85), or NRCS TR55, (Urban Hydrology for Small Watersheds).

The auxiliary spillway shall safely pass the peak flow, or the storm runoff shall be routed through the reservoir. The routing shall start either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days' drawdown, whichever is higher. The 10-day drawdown shall be computed from the crest of the auxiliary spillway or from the elevation that would be attained if the entire design storm were impounded, whichever is lower. Auxiliary spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed auxiliary spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be trapezoidal and shall be located in undisturbed or compacted earth or in-situ rock. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having an effective height exceeding 20 feet, the auxiliary spillway shall have a bottom width of not less than 10 feet.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed auxiliary spillway shall fall within the range established by discharge requirements and permissible velocities.

Structural auxiliary spillways. If chutes or drops are used for principal spillways or auxiliary spillways, they shall be designed according to the principles set forth in the Part 650, Engineering Field Handbook and the National Engineering Handbook, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in table 4, less any reduction creditable to conduit discharge and detention storage.

Downstream Impacted Area. The area downstream of the dam that would be affected by the dam's failure shall be defined qualitatively using simple analysis.

Criteria for Excavated Ponds

Runoff. Provisions shall be made for a pipe and auxiliary spillway, if needed, that will meet the capacity requirements of Table 2. Runoff flow patterns shall be considered when locating the excavated pond and placing the spoil.

Side slopes. Side slopes of excavated ponds shall be stable and shall not be steeper than two horizontal to one vertical. If livestock will water directly from the pond, a watering ramp of ample width shall be provided. The ramp shall extend to the anticipated low water elevation at a slope no steeper than four horizontal to one vertical.

Inlet protection. If surface water enters the pond in a natural or excavated channel, the side slope of the pond shall be protected against erosion.

Excavated material. The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and it will not be washed back into the pond by rainfall. It shall be disposed of 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 placed or shaped reasonably well, with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the pond but not less than 12 feet from the edge of the pond.
- Shaped to a designed form that blends visually with the landscape.
- Used for low embankment construction and leveling of surrounding landscape.
- Hauled away.

Additional Criteria for Livestock Water

All stock-watering facilities will ordinarily be spaced on rangeland to provide a travel distance of 0.75 to 1.0 mile on level or rolling topography. Patterns of fencing, natural barriers, and very rough, mountainous terrain may increase the number of watering places needed. See National Range and Pasture Handbook (190-600).

Additional Criteria for Fish and Wildlife or Wetland

When ponds are to be developed as a wetland, wildlife habitat, or fish habitat, refer to standards and specifications for Aquaculture Ponds (397), Wetland Wildlife Habitat Management (644), Wetland Restoration (657), Wetland Creation (658), or Wetland Enhancement (659), as appropriate. Pond design, which deviates from these standards, will be approved in writing by the area engineer and state biologist. Written approval will be noted directly on the pond design so as to indicate the modification.

For sites where water temperature and quality are anticipated to meet requirements for trout, refer to N.M. Animal Guide – Pond Management for Rainbow Trout.

For sites where water temperatures and quality are anticipated to meet requirements for warm water fish species (largemouth bass, bluegill sunfish, redear sunfish, channel catfish or minnow), refer to NM Animal Guides – Pond Management for Largemouth Bass and Bluegill Sunfish; and Pond Management for Channel Catfish.

Where site potential exists for developing shallow wetlands in and around the pond borders, and the landowner decides to incorporate wetland wildlife habitat into the pond, the pond will be designed and constructed to reflect this feature. Construct the basic pond to meet the design criteria for the selected type of fish production. Design additional shallow water areas to have a water depth of less than 3 feet and side slopes flatter than 3:1.

For ponds to be managed for fishing by the periodic stocking of trout fingerlings, which will be dependent upon naturally produced food and have a production objective of 50-100 pounds of trout per surface acre, utilize the following requirements:

- Water source may or may not supply a continuous flow through.
- The pond will be at least 0.25 surface acre at anticipated seasonal low water level.

Where water sources are of superior temperature and quality or supply a reliable sustained flow, construct the trout pond with an average depth of at least 6 feet over at least 25 percent of the surface area at anticipated seasonal low water level.

Where water sources are of good quality and temperature or the supply is unreliable,

construct a trout pond with an average depth of at least 10 feet over at least 25 percent of the surface area at anticipated seasonal low water level.

For trout ponds to be managed for fishing by the annual stocking of fingerlings, which are to be regularly fed with a production level of commercial fish food and where the production objective is for 1,000 or more pounds per surface acre, the:

- Water source must supply a reliable sustained flow. The trout pond size and average depth and the planned fish production will be based upon the available volume of flow.
- Minimum surface area of the trout pond will be at least 0.1 acre, with an average depth of at least 6 feet over at least 25 percent of the surface area at anticipated seasonal low water level.

For ponds to be managed to provide fishing for largemouth bass when stocked with bluegill sunfish, redear sunfish, channel catfish, or a species of minnow, and there will be no regular feeding, the:

- Water sources may or may not supply a continuous flow through.
- Pond shall be at least 0.5 acres with an average depth of at least 6 feet over at least 25 percent of the surface area at anticipated seasonal low water level.

For ponds to be managed for channel catfish to provide fishing through annual stocking of fry or fingerlings, and regular feeding with a production level of commercial fish food, and where the production objective is 1,000 or more pounds of channel catfish per surface acre, the:

- Water sources may or may not supply a continuous flow through. The size, average depth, and planned level of fish production will depend upon the availability and reliability of the water supply.
- Minimum surface area of the pond will be at least 0.1 acre, with an average depth of at least 6 feet over at least 25 percent of the surface area at anticipated seasonal low water level.

CONSIDERATIONS

Key Laws and Rules of the State of New Mexico

Jurisdictional dam. A dam 25 feet or greater in height, which impounds more than 15 acre-feet of water or a dam that impounds 50 acre-feet or more of water and is 6 feet or greater in height. (19.25.12.7.D(1)(a) NMAC)

Non-jurisdictional dam. Any dam not meeting the height and storage requirements of a jurisdictional dam. The State engineer does not regulate the design, construction and operation of a non-jurisdictional dam unless the dam is unsafe and there is a threat to life or property, as determined by the state engineer. Waters impounded by a non-jurisdictional dam may not be exempt from water right permit requirements; therefore a separate state engineer water right permit for the water impounded in the reservoir created by a non-jurisdictional dam may be required. Non-jurisdictional dams shall meet the requirements of 19.26.2.15 NMAC unless otherwise exempt. The structures listed below are considered non-jurisdictional dams:

- **Levee or diversion dike:** A structure where water flows parallel to the length of the levee or diversion dike as determined by the state engineer.
- **Roadway embankment:** A structure across a watercourse designed for the sole purpose of supporting a roadbed or other means of conveyance for transportation as determined by the state engineer; where the area upstream has not been enlarged to increase flood storage; and where the embankment is provided with an uncontrolled conduit of sufficient capacity to satisfy requirements of the appropriate state or local transportation authority. If no transportation authority has jurisdiction over the structure, the current drainage design criteria of the New Mexico department of transportation shall apply. (19.25.12.7.D(1)(b) NMAC)

Section 72-5-32, NMSA 1997, gives the State Engineer jurisdiction of water impoundment structures that are over 10 feet high from the lowest natural ground surface elevation to the crest of the dam **or** embankment that impound more than 10 acre-feet of water.

A permit from OSE is required to build any stock dam, regardless of height or capacity, in

the Gila, San Francisco, or San Simon stream systems.

A pond to impound water for livestock purposes that is to be located off stream and requires a man-made diversion works in a watercourse, requires a permit from OSE, prior to the appropriation of water, regardless of the height or capacity of the embankment.

An erosion control dam, including grade stabilization structures and/or debris basins may be installed if it complies with the conditions set forth below.

- The outlet is ungated so that no water is retained in the reservoir.
- The dam is near active erosion or a damaging sediment deposition area whereby the purpose of the structure is obvious.
- The structure is sized only to accomplish its purpose and is not overbuilt.
- The grade stabilization structure may cause water to be routed from an actively eroding channel, provided the water so routed flows over only the area that would have naturally received water from prior to the need for the installation of the structure. The water should be routed in such a manner to prevent continued erosion only, and the flow should be returned substantially undiminished to the watercourse.
- Nothing should be constructed to spread the water in a manner that could be construed as irrigation of grasslands.
- A debris basin should be constructed solely to retain debris and should not impound or divert water for beneficial use.

All structures which will retain water for a period of 96 hours or longer must comply with New Mexico Regulations Governing Mosquito Abatement and Control. For the procedures to be followed, refer to GM-190, Part 410, paragraph NM410.21(f).

Visual resource design. The visual design of ponds should be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the pond may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife.

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

Fish and Wildlife. Project location and construction should minimize the impacts to existing fish and wildlife habitat.

When feasible, structure should be retained, such as trees in the upper reaches of the pond and stumps in the pool area. Upper reaches of the pond can be shaped to provide shallow areas and wetland habitat.

If fish are to be stocked, consider criteria and guidance in conservation practice standard 399, Fishpond Management.

Vegetation. Stockpiling topsoil for placement on disturbed areas can facilitate revegetation.

Consider placement and selection of vegetation to improve fish and wildlife habitat and species diversity.

Water Quantity. Consider effects upon 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 environment such as wetlands, aquifers, and; social and economic impacts to downstream uses or users.
- Potential for multiple purposes.

Water Quality.

- Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that are carried by runoff.

- Effects on the visual quality of onsite and downstream water resources.
- Short-term and construction-related effects of this practice on the quality of downstream water courses.
- Effects of water level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Effects on wetlands and water-related wildlife habitats.
- Effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Effects of soil water level control on the salinity of soils, soil water, or downstream water.
- Potential for earth moving to uncover or redistribute toxic materials such as saline soils.

PLANS AND SPECIFICATIONS

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

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and reviewed with the landowner or individual responsible for operation and maintenance.