

**NATURAL RESOURCES CONSERVATION SERVICE**  
**VIRGINIA CONSERVATION PRACTICE STANDARD**

**DAM**

(No. and Ac-Ft.)

**CODE 402**

**DEFINITION**

An artificial barrier that can impound water for one or more beneficial purposes.

**PURPOSES**

- Reduce downstream flood damage.
- Provide permanent water storage for one or more beneficial uses such as irrigation or livestock supply, fire control, municipal or industrial uses, or recreational uses.
- Create or improve habitat for fish and wildlife.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to the design and construction of dams where:

1. Topographic, geologic, hydrologic and soil conditions at the proposed site are satisfactory for constructing a dam and reservoir.
2. The watershed above the dam is protected from erosion to the extent that the sediment yield will not significantly shorten the planned life of the reservoir.
3. Water is available in sufficient quantity and adequate quality to satisfy the intended purposes.

**CRITERIA**

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

All dams designed under this standard shall comply with applicable local, state, and federal laws, rules and regulations. All required permits must be obtained before construction begins. All dams must meet the requirements of the Virginia Impounding Structure Regulations.

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 Virginia Conservation Practice Standard *Critical Area Planting (Code 342)*.

Dams shall be classified as a low, significant or high hazard potential in accordance with NRCS Technical Release 60, Earth Dams and Reservoirs (TR-60), and other references as appropriate for the site-specific conditions.

Design criteria for all dams are contained in TR-60, with the exception that low hazard potential earth dams and appurtenances may be designed to the criteria in Virginia Conservation Practice Standard *Pond (Code 378)*, when they meet the conditions of that standard.

A principal and auxiliary spillway(s) with needed appurtenances shall be provided, except where the rate and duration of flow can be safely handled by a single spillway for all intended purposes.

The outlet works shall have adequate capacity to release the flow resulting from the combined demands at any time.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

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Additional outlets may be required to satisfy the supply for downstream water uses such as livestock water, irrigation, or fish and wildlife needs.

### ADDITIONAL CRITERIA TO REDUCE DOWNSTREAM FLOOD DAMAGE

Flood control storage may be designed into the permanent storage volume if provisions are made to operate the reservoir for this purpose.

The flood retarding storage capacity requirements shall be sufficient to contain the runoff expected to occur at a frequency consistent with the level of protection to be provided to the downstream benefited area, with proper allowance for discharge through the principal spillway. The flood-retarding storage capacity shall be sufficient to limit the use of the auxiliary spillway to a permissible frequency and duration based upon consideration of the erosion resistance of the spillway material and vegetative protection to be provided.

### ADDITIONAL CRITERIA FOR PERMANENT WATER STORAGE USES

The reservoir shall include adequate storage volume to meet user demands for all intended purposes of the reservoir. Seasonal variations in demand and the expected losses from seepage and evaporation must be considered to determine the permanent storage volume required for the intended use(s).

The methods, materials, location and capacity of spillways and outlet works shall be selected to safely pass flood discharges and address all functional requirements necessary to facilitate the use of the stored water for the intended purpose(s).

Spillways and other outlet works shall be fenced or otherwise secured to limit human access as necessary to provide for public safety and prevent their use for other than the intended purposes.

If permanent storage is provided for irrigation, the dam and appurtenances shall meet all applicable requirements of Virginia Conservation Practice Standard *Irrigation Storage Reservoir (Code 436)*.

Site-specific design criteria shall be developed that reflect the functional requirements of the

reservoir, dam and appurtenances for the intended recreational benefits.

### ADDITIONAL CRITERIA FOR WILDLIFE HABITAT CREATION OR IMPROVEMENT

Site-specific design criteria shall be developed that reflect the functional requirements of the reservoir, dam and appurtenances for the intended wildlife benefits.

## CONSIDERATIONS

The plan should consider the potential for changes in the form or function of the watercourse and associated riparian corridor resulting from installation of the dam. Unacceptable negative impacts to natural resources or other uses of the water or areas affected should be mitigated by the design or by imposed operation requirements of the dam.

### VISUAL RESOURCE DESIGN

The visual design of dams and the reservoir area 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 reservoir 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, both submerged and exposed (above normal water elevation) islands may be added for visual interest and to attract wildlife.

### CULTURAL RESOURCES

Dam installation results in significant ground disturbance. Consider the potential to affect cultural resources in the project area.

Consider conservation and stabilization of archeological, historic, structural and traditional cultural properties when appropriate.

## WATER QUANTITY

There will be some effects on downstream flows and impacts to the environment such as wetlands and aquifers, and also social and economic impacts to downstream uses or users.

Evaluate the potential for depletion of downstream surface water resources resulting from runoff storage, evaporation from the reservoir surface and seepage from the pool bottom or lake bed.

Consider the potential for increases in surface water volume during normal low flow periods caused by prolonged duration of reservoir releases.

There may be an increase in deep percolation to the ground water resulting from seepage from the reservoir sides and bottom.

## WATER QUALITY

Consider the potential for improving downstream surface water quality resulting from trapping of suspended sediments, bedload material, and associated nutrients and pesticides in the pool area.

The channel bed and banks may have increased instability. Water discharged from the dam will have reduced sediment content and therefore will have increased sediment transport capacity in the reach downstream from the dam when compared to the pre-dam condition.

During construction, degradation of surface water quality by sediments, fuels, oils, and other chemicals may occur.

Consider the potential influence of the low water outlet elevation on the amount of absorbed nutrients and pesticides in deposited sediments and the potential for their discharge from the reservoir.

There may be changes in downstream water temperatures and dissolved oxygen content that could result from the design of the outlet structure. Adverse changes should be mitigated if possible in the design of the structure. Where dissolved oxygen may be reduced by outlet placement, plan some means of causing rapid dissolved oxygen recovery.

Evaluate the potential for increases in soluble nutrients, pesticides, and other contaminants in deep percolating waters caused by seepage through reservoir sides and bottom. Natural or human-induced contaminants may originate from those used in the structure and reservoir area, or may be dissolved in waters from the watershed area.

Determine how wetlands and water-related wildlife habitats will be affected.

Changes on water levels may affect soil nutrient processes such as plant nitrogen use or denitrification.

Consider the potential to uncover or redistribute toxic materials such as saline soils at the dam site and borrow areas as a result of earth moving operations.

## FISH AND WILDLIFE HABITAT

Where fish and wildlife habitat creation or enhancement is not a primary purpose of the structure, the plan should still consider maintaining habitat for fish and wildlife and the potential effects of installing the dam such as:

- 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, 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 Virginia Conservation Practice Standard *Fishpond Management (Code 399)*.

Consider the potential for altering fish and wildlife habitat resulting from changes in the quality, quantity, timing, or duration of streamflows after installation of the dam.

Evaluate the potential for creating a competitive advantage for non-native or undesirable animals or plants resulting from changes in the quality, quantity, timing, or duration of streamflows after installation of the dam.

## PLANS AND SPECIFICATIONS

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

Plans and specifications shall be prepared to show site specifics.

### DESIGN DATA

The following information shall be included in the design:

1. Soils and geologic investigation reports, including suitability of soils for fill.
2. Water quality and quantity.
3. Purpose(s) of structure.
4. Site map.
5. Engineering surveys.
6. Cross-sections of embankments and excavations.
7. Applicable drainage details.
8. Piping and spillway requirements.
9. Seeding requirements.
10. Monumentation of the site.
11. Hazard classification.
12. Breach analysis.
13. Land use and anticipated sediment storage needs.
14. Mitigation requirements, as applicable.
15. Construction and Materials Specifications.
16. Cost estimate.
17. Operation and Maintenance Requirements.
18. Environmental Evaluation Form VA-EE-1.

### CHECK DATA

1. As-built drawings.
2. Certification of completion.
3. Certification of components supplied by others.
4. Quantities of materials.
5. Certification of vegetative establishment.

## OPERATION AND MAINTENANCE

Site specific Operation and Maintenance Requirements must be prepared and reviewed with the landowner or operator. All dams must be adequately maintained if their purposes are to be realized throughout the expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the dam.

An emergency action plan shall be prepared when required by local or Virginia Impounding Structure Regulations, and for all high hazard class structures. As a minimum, a breach inundation map shall be prepared for all low and significant hazard class structures.

The dam should be inspected at least annually, and especially after heavy rains, to determine whether it is functioning properly or if repairs are needed.

Appurtenances such as trash racks, outlet structures and gates shall be kept free of trash and replaced when needed.

Erosion on the slopes of the dam and in the earth spillway shall be filled with suitable soil, compacted, and fertilized as needed. Should the upstream face of the dam erode due to wave action, protection such as riprap may be needed. If seepage through or under the dam occurs, proper corrective measures shall be taken immediately.

The vegetative cover of the dam and earth spillway shall be maintained by mowing and fertilizing when needed. Trees can cause leaks and safety hazards and should not be permitted on the embankment or in the auxiliary spillway. When needed, fencing and water troughs will be

provided to protect the reservoir and vegetation from livestock.

## REFERENCES

1. NRCS, Technical Release 60.
2. Virginia Impounding Structure Regulations.
3. NRCS, Virginia Field Office Technical Guide, Section IV.

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**DAM**

**Approved Practice Narratives**

(No. and Ac-Ft.)

**CODE 402**

402 D1 Dam: A dam shall be installed to reduce downstream flood damage.

402 D2 Dam: A dam shall be installed to provide an adequate supply of water for livestock use.

402 D3 Dam: A dam shall be installed to provide an adequate supply of water for recreation.

402 D4 Dam: A dam shall be installed to provide an adequate supply of water for use in irrigating crops.

402 D5 Dam: A dam shall be installed to provide an adequate supply of water for municipal or industrial uses.

402 D6 Dam: A dam shall be installed to provide water for fish and wildlife habitat.

402 D7 Dam: A multipurpose dam shall be installed.

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