NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

DAM

(No. and Ac-Ft.)

CODE 402

DEFINITION

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

PURPOSE

- 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, develop renewable energy systems or recreational uses.
- Create or improve habitat for fish and wildlife.

CONDITION WHERE PRACTICE APPLIES

This practice applies only to sites meeting all the following criteria:

1. Topographic, geologic, hydrologic and soil conditions at the proposed site are satisfactory for constructing a dam and reservoir.
2. The watershed 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.

Federal, State and Local Laws and Permits

Design, construction, operation and maintenance activities shall comply with all federal, state, and local laws, rules, and regulations governing activities in or along streams, floodplains or wetlands as well as pollution abatement, health, safety or utility activities.

Permits may be required from the following agencies as well as others:

1. ***US Army Corps of Engineers (USACE)***
2. ***West Virginia Department of Environmental Protection (WV DEP) – Division of Water and Waste Management (DWWM)***
   a. ***Dam Safety (Non-Coal)***
   b. ***Stormwater Program***
3. ***WV Department of Natural Resources (WVDNR) – Public Land Corporation (PLC) – Stream Access Application***
4. ***US Fish and Wildlife Service (USFWS)***
5. ***WV Division of Forestry***
6. ***Local, state and county ordinances***

Agricultural dams constructed and used primarily for agricultural purposes including, but not limited to, livestock watering systems, irrigation, retention of agricultural waste, or fish culture; and having no potential for loss of human life and meeting the criteria for a WVDEP Hazard Class 3 (Low Hazard) or Class 4 (Negligible Hazard) are generally exempt from the WV Dam Control and Safety Act and the WV Dam Safety Rules. Current WV

Dam Safety Code and Rules may be accessed at the WV DEP-DWWM website.

The owner or operator is responsible for securing all permits or approvals and for performing in accordance with such laws and regulations. ***NRCS employees do not procure permits, rights, or approvals, or enforce laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required rights (or approvals) to construct, operate, and maintain the practice.***

All required permits shall be acquired before construction implementation.

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 ***NRCS WV*** Conservation Practice Standard 342, Critical Area Planting.

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 **such as *the WV Dam Control and Safety Act and the WV Dam Safety Rules*** as appropriate for the site-specific conditions

Design criteria for all dams ***and appurtenances*** are contained in TR-60, with the exception that low hazard potential earth dams and appurtenances may be designed to the criteria in ***NRCS WV*** Conservation Practice Standard 378, Pond, when:

1. Failure of the dam will not result in loss of life; damage to homes, commercial or industrial buildings, main highways, or railroads; or interruption of the use or service of public utilities.
2. ***Dams are located in a rural or agricultural area where failure may cause minor damage to nonresidential buildings and normally unoccupied buildings, or rural or agricultural land. Failure would only cause loss of the dam itself and a loss of property use, with little additional damage to adjacent property.***
3. 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; and
4. The effective height of the dam is 35 feet or less.

All dam embankment heights greater than 20 feet and less than 35 feet shall be approved by the State Conservation Engineer.

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.
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.

The capacity of the principal spillway shall be adequate to discharge, in 10 days or less, the floodwater storage needed to provide the desired level of protection to the downstream benefited area. Storage provided primarily for reducing the

frequency of use of the emergency spillway need not be included in the 10-day drawdown limitation. Longer release times may be used if warranted by downstream conditions. The discharge through gated outlets shall not be considered in determining the emptying time of the floodwater retarding pool. However, in the event of a deficiency, a gated conduit must be able to discharge 90% of the normal reservoir volume in 10 days or less.

The elevation of the crest of the lowest stage of the principal spillway shall be set at the elevation of the sediment pool. For dry dams, the riser shall be designed to permit design discharge at the sediment pool elevation with provisions for discharging water at lower elevations to satisfy the functional requirements of the structure.

All parts of the principal spillway, except attached gates and trash racks, shall have an expected service life equal to or greater than the design life of the structure or provisions made for replacement.

Principal spillways in structures having a design life of 50 years or more shall meet the requirements with respect to materials contained in TR-60.

The minimum diameter of the conduit used as a principal spillway shall be 10 inches.

The storage volume shall not be less than the sediment accumulation expected during the design life of the structure.

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 NRCS ***WV*** Conservation Practice Standard 436, Irrigation Storage Reservoir.

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.

When feasible, existing habitat structure or features shall be retained, such as trees in the upper reaches of the reservoir or stumps in the pool area. Upper reaches of the reservoir can be shaped to provide shallow areas, aquatic bed, emergent or scrub-shrub wetland habitat.

If fish are to be stocked, see criteria and guidance in ***NRCS WV Conservation*** Practice Standard 399, Fishpond Management. Also see ***NRCS WV Conservation*** Practice Standard 644, Wetland Wildlife Habitat Management for criteria related to wildlife habitat.

Additional Criteria For Renewable Energy

For detailed criteria where the purpose is to develop renewable energy systems refer to ***NRCS*** Interim Conservation Practice Standard 716, Renewable ***Resource*** Energy Production.

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.

Water Quantity. Consider the potential 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.

Consider 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.

Consider the potential for 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, bed-load material, and associated nutrients and pesticides in the pool area.

Consider the potential for increased instability of channel bed and banks. 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.

Consider the potential for degradation of surface water quality during construction by sediments, fuels, oils, and other chemicals.

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.

Consider the potential for 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.

Consider 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.

Consider the potential effects on wetlands and water-related wildlife habitats.

Consider the potential effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.

Consider the potential effects of soil water level control on the salinity of soils, soil water, or downstream water.

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 **NRCS *WV Conservation*** Practice Standard 299, Fishpond Management.

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.

Consider 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.

OPERATION AND MAINTENANCE

Provisions shall be made as necessary for operation and maintenance requirements and may include a formal plan for larger, more complex dams. The operation and maintenance plan should include an emergency action plan when required by local or state regulations, and for all high hazard class structures.

The operation and maintenance plan shall be prepared in conformance with Title 180 – National Operation and Maintenance Manual, Part 500 – Subpart D – Operation and Maintenance Plan.

REFERENCES

NRCS National Engineering Policy
http://policy.nrcs.usda.gov/

Associated Practice Standards and Scope of Work such as WV Conservation Practice Channel Bank Vegetation (322), Critical Area Planting (342),Diversion (362), Fence (382), Open Channel (582), Land Clearing (460), Pipeline (516), Pumping Plant (533), Streambank and Shoreline Protection (580), Structure for Water Control (587), Subsurface Drain (606), Underground Outlet (620)and others located in WV e-FOTG Section IV- at http://www.nrcs.usda.gov/technical/efotg/ (click on WV from the US map)

NRCS National and State Utility Safety Policy – Title 210 – National Engineering Manual (NEM):
Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities
http://policy.nrcs.usda.gov/

Miss Utility of West Virginia (MUWV); Call Before you Dig, 1-800-245-4848 - http://www.muwv.org/

USDA-NRCS Title 210 – Engineering National Engineering Manual
501 Authorizations
503 Safety
Part 505 Non-NRCS Engineering Services
Part 531 Geology
Part 511 Design National Engineering Handbook (NEH):
Section 5 Hydraulics
Section 6 Structural Design
Section 8 Engineering Geology
Section 19 Construction Inspection
Part 628 Dams
Part 629 Air Quality
Part 630 – Hydrology
Part 631-Geology
Part 642 Specifications for Construction Contracts or WV "700" Series Specifications
Part 650 Engineering Field Handbook
WV5 – Engineering Field Handbook, Appendix A- Quick Reference Design and Construction Support Data for Conservation Practices
Chapter 3 Hydraulics
Chapter 9 Diversions
Chapter 11 Ponds and Reservoirs
Chapter 13 Wetland Restoration, Enhancement or Creation
Chapter 16 Streambank and Shoreline Protection
State Environmental Laws Affecting West Virginia Agriculture,
http://www.nasda.org/nasda/nasda/Foundation/state/WestVirginia.pdf