

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

STREAM CROSSING

(No.)

CODE 578

DEFINITION

A stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles.

PURPOSE

- Improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream.
- Reduce streambank and streambed erosion.
- Provide crossing for access to another land unit.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where an intermittent or perennial watercourse exists and a ford, bridge, or culvert type crossing is desired for livestock, people, and /or equipment.

CRITERIA

Location. Stream crossings shall be located in areas where the streambed is stable or where grade control can be provided to create a stable condition. Avoid sites where channel grade or alignment changes abruptly, excessive seepage or instability is evident, overfalls exist, or large tributaries enter the stream. Wetland areas shall be avoided if possible.

Locate crossings, where possible, out of shady riparian areas to discourage cattle loafing time in the stream.

Stream crossings shall provide a way for

normal passage of water, fish and other aquatic animals within the channel throughout the year.

To the extent possible, crossings should be installed perpendicular to the direction of the stream flow. Culverts shall be installed parallel to the stream flow. Stream crossings shall not be installed in a newly located or constructed channel.

Access Roads. Where high rates of erosion of the adjacent roadways that slope towards the crossing threaten to deliver an excessive amount of sediment to the drainage, install measures to minimize erosion of the roadside ditch, road surface, and/or cut slopes. Where the stream crossing is installed as part of a roadway, the crossing shall be sized in accordance with Virginia Conservation Practice Standard *Access Road (Code 560)*.

Width. The stream crossing shall provide an adequate travel-way width for the intended use. A multi-use stream crossing shall have a travel-way no less than 12 feet wide. "Livestock only" crossings shall be no less than 8 feet wide. Width shall be measured from the upstream end to the downstream end of the stream crossing and shall not include the side slopes.

Side Slopes. All cuts and fills for the stream crossing shall have side slopes that are stable for the soil involved. Side slopes of earth cuts or fills shall be no steeper than 2 horizontal to 1 vertical. Rock cuts or fills shall be no steeper than 1.5 horizontal to 1 vertical.

Stream Approaches. Approaches to the stream crossing shall blend with existing site conditions where possible, and shall not be steeper than 6 horizontal to 1 vertical. Unless

the foundation geology is otherwise acceptable, the approaches shall be stable, have a gradual ascent or descent grade, and be underlain with suitable material, as necessary, to withstand repeated and long term use.

The minimum width of the approaches shall be equal to the width of the crossing surface. When the stream crossing is used in conjunction with Virginia Conservation Standard *Animal Trails and Walkways (Code 575)*, any transition in width from a walkway to the stream crossing shall be accomplished before entering the stream crossing approaches (ramps).

Surface runoff shall be diverted around the approaches to prevent erosion of the approaches. Roadside ditches shall be directed into a diversion or away from the crossing surface.

Rock. All rock shall be chosen to withstand exposure to air, water, freezing and thawing. When rock is used, it shall be sufficiently large and dense so that it is not mobilized by design flood flows.

Fencing. Areas adjacent to the stream crossing shall be permanently fenced or otherwise excluded as needed to manage livestock access to the crossing.

Cross-stream fencing at fords shall be constructed with breakaway wire, swinging floodgates, hanging electrified chain or other devices to allow the passage of floodwater debris during high flows.

All fencing shall be designed and constructed in accordance with Virginia Conservation Practice Standard *Fence (Code 382)*.

Vegetation. All areas to be vegetated shall be planted as soon as practical after construction. When necessary, use of Virginia Conservation Practice Standard *Critical Area Planting (Code 342)* shall be considered where vegetation is unlikely to become established by natural regeneration, or acceleration of the recovery of vegetation is desired.

In areas where vegetation may not survive, the Virginia Conservation Practice Standard *Heavy Use Area Protection (Code 561)* shall be used to protect the soil from erosion.

Environmental Concerns. The policy on threatened and endangered species of plants and animals will be used to determine if listed species are present and if contact with the Virginia Division of Natural Heritage and/or Virginia Department of Game and Inland Fisheries is required.

Permits. *Clean Water Act.* If a stream crossing is installed according to this standard and conditions a, b and c below apply, an exemption to the requirements of the Clean Water Act (on file at the State Office) allows construction and no further permits are required. If one or more of these conditions do not apply, an individual local-state-federal joint permit is required. The landowner is responsible for acquiring all needed permits and for all agency contacts.

Conditions

- a. The watershed area is less than five square miles.
- b. There are no special environmental concerns identified in the Environmental Evaluation (Form VA-1).
- c. The Virginia Department of Game and Inland Fisheries (VDGIF) has been notified of the proposed work and site locations for all trout waters. If a site visit is requested by VDGIF, this visit will be conducted prior to construction.

COE Nationwide Permit 18. Under this permit, dredging below the plane of the ordinary high water mark shall not exceed 25 cubic yards. If installation of the stream crossing will require removal of more than 25 cubic yards of material, an individual permit is required.

Criteria for Culvert and Bridge Crossings

Design of culverts and bridges shall be consistent with sound engineering principles and shall be adequate for the use, type of road, or class of vehicle. If used in conjunction with Virginia Conservation Practice Standard *Access Road (Code 560)*, the *Access Road Standard* shall be used to determine the design storm frequency. Culverts and bridges shall have sufficient capacity to convey the

design flow without appreciably altering the stream flow characteristics.

Culverts shall be sized to handle at least the bankfull flow or the peak runoff from the 2-year, 24-hour peak discharge, whichever is less. Crossings shall be adequately protected so that out-of-bank flows safely bypass without structure or streambank damage, or erosion of the crossing fill. Additional culverts may be used at various higher elevations to maintain terrace or floodplain hydraulics. At least one culvert pipe shall be placed with its entire length set six inches below the existing stream bottom.

The drainage area and land use shall be determined for each site. For drainage areas greater than 50 acres or where the dominant land use is not agricultural or forestry, the culvert size(s) shall be selected based on the calculated discharge at the site but shall not be smaller than 24 inches.

For drainage areas equal to or less than 50 acres with a dominant land use of agriculture or forestry, a minimum pipe size can be used based upon the site location. Virginia Engineering Design Note #578 – Stream Crossings contains a map delineating the physiographic regions of the State. If the site is located in the Northern or Southern Piedmont regions, a minimum pipe size of 30" is required. In other regions, a minimum pipe size of 24" is required. As an alternative, a calculated discharge can be also used to size the culvert for drainage areas less than or equal to 50 acres but the selected pipe shall be no smaller than 24".

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes plus one foot on each side.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, new or used high quality steel and other materials approved by the engineer.

A minimum of one foot of cover shall be placed over the culvert.

Acceptable bridge materials include concrete, steel, and wood.

Criteria for Ford Crossings

When ford crossings are used, the cross-sectional area of the crossing shall not be less

than the natural channel cross-sectional area. A portion of the crossing shall be depressed at or below the average stream bottom elevation when needed to keep base flows or low flows concentrated.

Cutoff walls shall be provided at the upstream and downstream edges of ford-type stream crossings when needed to protect against undercutting.

The finished top surface of the ford-type stream crossing in the bottom of the watercourse shall be no higher than the original stream bottom at the upstream edge of the ford crossing. If the downstream edge of the ford crossing is above the original stream bottom, the ford crossing shall be stabilized in accordance with Virginia Conservation Practice Standard *Stream Channel Stabilization (Code 584)*.

Where rock is used for ford-type stream crossings for livestock, use a hoof contact zone or alternative surfacing method over the surfacing rock.

Concrete Fords

Concrete ford crossings shall be used only where the foundation of the stream crossing is determined to have adequate bearing strength.

Concrete shall have a minimum compressive strength of 3,000 psi at 28 days. Concrete ford crossings shall have a minimum thickness of placed concrete of 5 inches with minimum reinforcement of 6-inch by 6-inch, 6 gauge welded wire fabric. The concrete slab shall be poured on a minimum 4-inch thick rock base, unless the foundation is otherwise acceptable.

Flowing water in the stream shall be diverted away from the concrete until the concrete has cured for 24 hours.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Precast concrete units shall comply with American Concrete Institute, ACI 533R-93, Guide for Precast Concrete Wall Panels, or as otherwise acceptable for local conditions.

When heavy equipment loads are anticipated, the concrete slab shall be designed using an appropriate procedure as described in American Concrete Institute, ACI 360R-92, Design of Slabs on Grade.

Geocell and/or Rock Ford Crossings

Ford crossings made of stabilizing material such as rock riprap are often used in steep areas subject to flash flooding, where normal flow is shallow or intermittent. Rock ford crossings with geotextile shall be used when the site has a soft or unstable subgrade.

For soft or unstable subgrades, the bed of the channel shall be excavated to the necessary depth and width and covered with geotextile material. The geotextile material shall be installed on the excavated surface of the ford and shall extend across the bottom of the stream.

Where stream channels are composed of stable coarse rock material or solid bedrock, no geotextile or armor is required on the stream bottom. Geotextile material shall be installed on the excavated surfaces of the ford.

The geotextile material shall be covered with at least 6 inches of crushed rock. If using geocells, the cells shall be at least 6 inches deep. All geosynthetic material shall be suitably durable and shall be installed in accordance with the manufacturer's recommendations, including the use of staples, clips and anchor pins.

At minimum, all ford stream crossings shall be designed to remain stable during the 10-year, 24-hour peak discharge.

CONSIDERATIONS

Avoid or minimize stream crossings, when possible, through evaluation of alternative trail or travel-way locations.

Ford crossings have the least detrimental impact on water quality when crossing is infrequent. Ford crossings are adapted for crossing wide, shallow watercourses with firm streambeds. This type of crossing typically has fewer maintenance requirements and is less likely to incur damages during heavy flows.

Stream crossings should be located where adverse environmental impacts will be minimized and considering the following:

- Effects on upstream and downstream flow conditions that could result in increases in erosion, deposition, or flooding
- Short term and construction-related effects on water quality
- Effects on fish passage and wildlife habitats
- Effects on cultural resources
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion

Timing of installation shall also be considered.

Where stream crossings are used, evaluate the need for safety measures such as guardrails at culvert or bridge crossing, or water depth signage at ford crossings.

When stream crossings are located in pasture fields, gates should be installed at the entrances of the crossing to prevent continuous livestock access to the crossing.

PLANS AND SPECIFICATIONS

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

Record all required information in an engineer field book, on a plan sheet or design computation sheet, or in another appropriate location.

DESIGN DATA

1. Completed Environmental Evaluation (Form VA-EE-1) and subsequent requirements.
2. Soils investigation.
3. Survey and plot data: profile, cross-sections, topography, as needed.
 - a. Survey and plot profile along centerline of stream (distance should be sufficient to determine channel slope).
 - b. Survey and plot cross-section, perpendicular to flow, extending 25 feet beyond the ends of the planned ramps.

4. Design computations, including purpose of practice and references used.
 - a. Sketch of area to indicate stream meandering and limits of stream protection, if needed.
 - b. Determine drainage area, land use, and, if applicable, design flows and design velocities.
 - c. For ramp crossings, design ramp to best fit the section, and meet the design criteria. For culvert crossings, show culvert design calculations.
 - d. Add construction sequence to include stream channel diversion and sediment control measures.
 - e. Document landowner/VDGIF contact concerning the proposed stream crossing. Record date, contact person, and outcome of site visit, if one occurred.
5. Plan view of site with existing and planned features, including dimensions, distances, etc.
6. Standard Cover Sheet (VA-SO-100A).
7. Materials and quantities needed. Identify borrow material and/or spoil area, as needed.
8. Vegetation and/or ground cover requirements.
9. Identification of needed Erosion & Sediment Control measures.
10. Supplemental practices required.
11. Virginia Conservation Practice Specifications (700 Series).
12. Operation and Maintenance Plan

Note: Regulatory agencies may request spot checks of stream crossings to ensure permit conditions are being followed.

CHECK DATA

1. As-built surveys.
 - a. Cross-section of completed crossing.
 - b. Profile of stream channel to show crossing and stream are on a uniform grade.
2. As-built plans including dimensions, types and quantities of materials installed, and variations from design. Include justification for variations.
3. Locations of appurtenant practices.
4. Adequacy of vegetation and/or ground cover.
5. Complete as-built section of Cover Sheet.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and implemented for the life of the practice.

The stream crossing, appurtenances, and associated fence should be inspected after each major storm event, with repairs made as needed.

REFERENCES

Virginia NRCS FOTG, Section IV

Virginia Engineering Design Note #578 – Stream Crossing

Virginia Standard Drawings

American Concrete Institute, ACI 360R-92, Design of Slabs on Grade

American Concrete Institute, ACI 533R-93, Guide for Precast Concrete Wall Panels (Reapproved 2004)

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