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

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

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.

CRITERIA

Apply this standard in accordance with all local, State, Tribal, and Federal regulations, including flood plain regulations and flowage easements.

Aquatic Organisms. Design the stream crossing to accommodate passage of all life stages of aquatic organisms, in accordance with the species' requirements. Design criteria are available in NEH Part 654, Technical Supplement 14N, Fish Passage and Screening Design.

Use NRCS Conservation Practice Standard, Aquatic Organism Passage, Code 390, where a stream crossing is installed to remove an existing barrier to the passage of aquatic organisms.

Identify significant cultural resources or threatened or endangered species that could be affected by the implementation of the practice.

Location. Locate stream crossings in areas where the streambed is stable or where it can be stabilized (see NRCS Conservation Practice Standard, Channel Bed Stabilization, Code 584). Do not place crossings where channel grade or alignment changes abruptly, excessive seepage or instability is evident, overfalls exist (evidence of incision and bed instability), where large tributaries enter the stream, or within 300 feet of known spawning areas of listed species. Avoid wetland areas if at all possible.

Discourage livestock loafing in the stream by locating crossings, where possible, out of shady riparian areas or by including gates in the design. Where feasible, use existing roads.

Install stream crossings perpendicular to the direction of stream flow where possible. Fully consider the natural lateral migration pattern of the stream in the design. Avoid skews on all but the smallest streams.

Access Roads. Where the stream crossing is installed as part of a roadway, size the crossing according to the intended road usage, and according to NRCS Conservation Practice Standard, Access Road, Code 560.

Width. Provide an adequate travel-way width for the intended use. Make the travel-way for a multi-use stream crossing no less than 10 feet wide and no more than 30 feet wide. Make "livestock- only" crossings no less than 6 feet wide and no more than 30 feet wide. Measure the width from the upstream end to the downstream end of the stream crossing and do not include the side slopes.

Side Slopes. Make all side slope cuts and fills stable for the channel materials involved. Make the side slopes of cuts or fills in soil materials no steeper than 2 horizontal to 1

vertical. Make rock cuts or fills no steeper than 1.5 horizontal to 1 vertical.

Stream Approaches. Blend approaches to the stream crossing with existing site conditions, where possible, and not steeper than 4 horizontal to 1 vertical. Use streambank soil bioengineering practices as appropriate and feasible. Make the approaches stable, with gradual ascent and descent grades, and of suitable material to withstand repeated and long term use. Make the minimum width of the approaches equal to the width of the crossing surface.

Divert surface runoff around the approaches to prevent erosion. Direct roadside ditches into a diversion or away from the crossing surface.

Configure the crossing approaches (gradient and curves) to properly accommodate the length and turning radii of vehicles using the crossing.

Rock. All rock must be able to withstand exposure to air, water, freezing, and thawing. Use rock of sufficient size and density to resist mobilization by design flood flows.

Use appropriate rock sizes to accommodate the intended traffic without damage to the livestock, people, or vehicles using the crossing.

Fencing. Exclude livestock access to the crossing through the use of fence and gates, as needed.

Install cross-stream fencing at fords with breakaway wire, swinging floodgates, hanging electrified chain, or other devices to allow the passage of floodwater and large woody material during high flows.

Design and construct all fencing in accordance with NRCS Conservation Practice Standard, Fence, Code 382.

Vegetation. Plant all areas to be vegetated as soon as practical after construction. If construction completion does not coincide with appropriate planting dates for permanent cover, use a cover of temporary vegetation to protect the site until permanent cover can be established. Native or functioning-as-native plant species are preferred. Use NRCS Conservation Practice Standard, Critical Area Planting, Code 342, where acceleration of the recovery of vegetation is desired.

In areas where the vegetation may not survive, use NRCS Conservation Practice Standard, Heavy Use Area Protection, Code 561.

Culvert and Bridge Crossings

Design culverts and bridges consistent with sound engineering principles and adequate for the use, type of road, or class of vehicle. Design culverts and bridges with sufficient capacity to convey the design flow and transported material without appreciably altering the stream flow characteristics.

Vehicle and pedestrian bridges must be designed in accordance with the current American Association of State Highway and Transportation Official Load and Resistance Factor Design (LRFD) bridge design specifications.

Do not use culverts where large flows of sediment or large woody material are expected, or where the channel gradient exceeds 6 percent (100 horizontal to 6 vertical).

Evaluate the need for safety measures such as guardrails at culvert or bridge crossings.

Size culverts to convey flows without overtopping the crossing, or the 2-yr, 24-hr peak discharge, whichever is less. Crossings shall be adequately protected so that out-of-bank flows safely bypass without damaging the structure or eroding the streambanks or the crossing fill. Additional culverts may be used at various elevations to maintain terrace or floodplain hydraulics and water surface elevations.

Make the barrel length of the culvert adequate to extend the full width of the crossing, including side slopes, and inlet or outlet extensions.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, new or used high quality steel and any other materials that meet the requirements of NRCS Conservation Practice Standard, Structure for Water Control, Code 587.

Acceptable bridge materials include concrete, steel, and wood.

Ford Crossings

For a ford crossing, make the cross-sectional area of the crossing equal to or greater than the natural channel cross-sectional area. Make a portion of the crossing depressed at or below the average stream bottom elevation when needed to keep base flows or low flows concentrated.

Provide cutoff walls at the upstream and downstream edges of ford-type stream crossings when needed to protect against undercutting.

Evaluate the need for water depth signage at ford crossings.

Finish the top surface of the ford type stream crossing in the bottom of the watercourse no higher than 0.5 foot above the original stream bottom at the upstream edge of the ford crossing.

Make the downstream edge of the ford crossing with a low-flow hydraulic drop less than 0.5 foot above the original stream bottom. Do not create a low-flow drop that impedes the passage of relevant aquatic organisms.

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

Concrete Fords

Use concrete ford crossings only where the foundation of the stream crossing is determined to have adequate bearing strength.

Use concrete with a minimum compressive strength of 3,000 psi at 28 days, with a ratio of water to cementitious materials of 0.50 or less. Use coarse aggregate of 0.75 to 1 inch nominal size. If designed for freezing conditions, use concrete with 4 to 8 percent air-entrainment.

Use a minimum thickness of 5 inches of placed concrete. Pour the concrete slab on a minimum 4-inch thick gravel base, unless the foundation is otherwise acceptable.

Construct toe-walls at the upstream and downstream ends of the crossing. Make the toe-walls a minimum of 6 inches thick and 18 inches deep. Extend the toe-walls in the stream approaches at least to the water surface elevation predicted for the design storm (minimum 10-yr, 24-hr) or to the bankfull elevation, whichever is less. Bankfull flow is the discharge that fills the channel up to the elevation at which flow begins to spill onto the floodplain.

Dewatering of the site and toe-walls will be required during placement of the concrete to maintain the proper water/cement ratio. Flowing water will erode concrete that is not sufficiently hardened. The stream must be diverted or retained from flowing over the concrete for at least 12 hours after placement of the concrete.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Use concrete units that have adequate reinforcement for transportation and placement. Precast concrete units shall comply with ACI 525 or 533, or as otherwise acceptable for local conditions.

During construction, aquatic species must be removed from the construction area according to state protocols.

Geosynthetics and Rock Used in Ford Crossings

Coarse aggregate or crushed rock ford crossings are often used in steep areas subject to flash flooding and where normal flow is shallow or intermittent. When the site has a soft or unstable subgrade, use geotextiles in the design of rock ford crossings.

Dewater and excavate the bed of the channel to the necessary depth and width and cover with geotextile material. Install the geotextile material on the excavated surface of the ford, and extend it across the bottom of the stream and at least up to the 10-yr, 24-hr peak discharge elevation or to the bankfull elevation, whichever is less. Where stream channels are composed of stable coarse rock material or solid bedrock, the requirement to extend the geotextile across the channel bottom may be waived upon written approval of the area engineer.

Cover the geotextile material with at least 6 inches of crushed rock. Use minimum 6-inch deep geocells, if geocells are used. Use durable geosynthetic materials and install them according to the manufacturer's recommendations, including the use of staples, clips, and anchor pins. Washed stone

or gravel shall be used in streams designated as NC Designated Public Mountain Trout Waters and their upper tributaries.

Design all rock ford stream crossings to remain stable during the 10-yr, 24-hr peak discharge. Compute channel velocities and choose rock size using procedures in NEH650, NEH654 TS14N, and EFH Chapter 16, Appendix 16A.

CONSIDERATIONS

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

Increase crossing width or span to accommodate transport of large woody material in the flow.

Ford crossings have the least detrimental impact on water quality when crossing is to be used infrequently. Ford crossings are adapted for crossing wide, shallow watercourses with firm streambeds.

If the stream crossing is to be used frequently, or daily, as in a dairy operation, then consider a culvert or curbed bridge, rather than a ford crossing.

Locate stream crossings to avoid adverse environmental impacts and consider 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.
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion.
- Effects of large woody material on the operation and overall design of the crossing.

Consider adding a rock riprap apron on the downstream edge of concrete crossings to dissipate flow energy.

Because of the potential for damage resulting from the excessive velocities, ford crossings should not be placed immediately downstream of a pipe or culvert.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for stream crossings in keeping with this standard. The plans and specifications must clearly describe the requirements for applying the practice to achieve its intended purpose.

As a minimum, include the following in plans and specifications:

- Location of stream crossing.
- Stream crossing width and length with profile and typical cross sections.
- Design grades or slopes of stream approaches.
- Design flow calculations.
- Thickness, gradation, quantities and type of rock or stone.
- Type, dimensions and anchoring requirements of geotextile.
- Thickness, compressive strength, reinforcement, and other special requirements for concrete, if used.
- Vegetative requirements that include seed and plant materials to be used, establishment rates, and season of planting.
- Location, type, and extent of fencing required.
- Method of surface water diversion and dewatering during construction.
- Location of utilities and notification requirements.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan and implement it for the life of the practice.

Include the following items in the operation and maintenance plan, as a minimum:

- Inspect the stream crossing, appurtenances, and associated fence after each major storm event and make repairs if needed.
- Remove any accumulation of sediment or debris.
- Replace surfacing stone used for livestock crossing as needed.

REFERENCES

American Association of State Highway and Transportation Official Load and Resistance Factor Design (LRFD) bridge design specifications

NEH Part 650, Engineering Field Handbook, Chapter 16, Streambank and Shoreline Protection

NEH Part 654, Technical Supplement 14N, Fish Passage and Screening Design.