USDA
NATURAL RESOURCES
CONSERVATION SERVICE

DELAWARE CONSERVATION
PRACTICE STANDARD

STREAM CROSSING

CODE 578
(Reported by No.)

DEFINITION

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

PURPOSES

- 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.

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.

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

- Effects on up-stream and down-stream 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.
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion.

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.

This practice has the potential to affect National Register listed cultural resources or eligible (significant) cultural resources. These may include archeological, historic, or traditional cultural properties. Care should be taken to avoid adverse impacts to these resources. Follow NRCS state policy for considering cultural resources during planning.

CRITERIA

Criteria Applicable to All Purposes

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 at all possible.

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

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 during all seasons of the year.

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 in accordance with NRCS Conservation Practice Standard 560 – Access Road.

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 10 feet wide. "Livestock only" crossings shall be no less than 6 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 4 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.

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 accomplished 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 NRCS Conservation Practice Standard 382 – Fence.

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

Additional 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. 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 elevations to maintain terrace or floodplain hydraulics.

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes. At least one culvert pipe shall be placed on or below grade with the existing stream bottom.

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

Acceptable bridge materials include concrete, steel, and wood.

Additional 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 NRCS Conservation Practice Standard 584, Stream Channel Stabilization.

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.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Precast concrete units shall comply with ACI 525 or 533, 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 360, Design of Slabs on Grade.

Geocell and/or Rock Ford Crossings. Rock ford crossings with geotextile shall be used when the site has a soft or unstable subgrade. 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.

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 and at least up to the 10-year, 24-hour peak discharge elevation.

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

SPECIFICATIONS

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice. Documentation shall be in accordance with the section "Supporting Data and Documentation" in this standard.

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.

SUPPORTING DATA FOR DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Location the practice on the conservation map.

2. Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom.

Field Data and Survey Notes

The following is a list of the minimum data needed:

1. Plan view sketch.

2. Site access.

3. Profile of existing ground along the proposed stream crossing.

4. Profile of the stream at the proposed stream crossing (100 ft. upstream and downstream).

5. Cross-sections (3) – 100 feet upstream and downstream and at crossing perpendicular to flow, extending 25 feet beyond the top of each bank.

6. Soil borings to determine foundation conditions.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see Chapter 5 of the Engineering Field Handbook - Part 650. The following is a list of the minimum required design data:

1. Determine the contributing drainage area.

2. Determine foundation soil classification and any special restrictions.

3. Determine 2-year, 24-hour peak runoff from the contributing drainage area for the required design storm in accordance with Chapter 2, Engineering Field Handbook – Part 650 or by other approved method.

4. Determine the bank full capacity of the stream using Manning's Equation or other appropriate method.

5. Determine the velocity of the design flow in the stream and select the type of crossing and the materials to be used based on this information.

6. Design the stream crossing alignment, cross section, and profile in accordance with the requirements of this practice standard.

7. Show the engineering job class on the plans. Show the location description and elevation of temporary benchmarks utilized in the design survey. Provide a location map, which indicates the job site.

8. Plan view sketch, profile of stream crossing, and cross-sections of the existing ground and proposed stream crossing with dimensions are to be shown on the construction plans.

9. Details of crossing surfacing, culverts, and outlet protection as well as other required structural components with dimensions and elevations and any special requirements noted.

10. Special safety requirements.

11. If the stream crossing will be utilized by livestock, include a fencing plan to manage livestock access to the stream.

12. Planting plan. This must meet the criteria, specifications, and documentation requirements of the conservation standard for Critical Area Planting (Code 342). Show on the plans.

13. Estimated quantities and cost estimate.

14. Written Operation and Maintenance Plan.

Utilities Notification

1. Forms ENG-5 and ENG-6 can be used to assist in tracking utility notifications.

2. Document on CPA-6 initial discussion about his or her responsibility to notify Miss Utility.

3. Document on CPA-6 any information from the landowner about the existence and location of known utilities.

4. Document on CPA-6 assurances from the landowner that Miss Utility has been notified, including staking by the utilities.

Construction Check Data/As-Built Plans

Record on survey notepaper, NRCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted in red on the as-built plans. Document approval by the designer of any changes from the drawings or specifications before implementation of the change.

The following is a list of minimum data needed for as-built documentation:

1. Documentation of site visits on CPA-6. The documentation shall include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom.

2. Check notes recorded during or after completion of construction showing dimensions and elevations of the components, as appropriate.

3. Statement on seeding and fencing.

4. Final quantities and documentation for quantity changes. Materials certifications as appropriate.

5. Sign and date check-notes and plans by someone with appropriate approval authority. Include statement that the practice was installed as designed, except as noted by redline changes, and meets or exceeds NRCS practice standards.

In addition, the as-built drawings shall include name of the installer, manufacturer, and date of completion. The as-built records shall also include any applicable "Statement of Conformance" presented or certified by suppliers of structures or equipment. The design folder, as-built drawings, certifications, and specifications shall be filed in the case file.