

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

OPEN CHANNEL

(Feet)

Code 582



DEFINITION

Constructing, improving, recreating, or restoring a channel in which water flows with a free surface. A channel can have a fixed boundary or a movable boundary. Changes in bed elevation or bank location are not expected to occur in fixed boundary channels. Movable boundary channel bed and banks consist of materials transported by the channel and changes in the bank location and bed elevation are expected to occur.

PURPOSE

This standard may be applied as part of a resource management system to support one or more of the following:

1. Re-establish or improve a channel to accommodate low flows, provide for riparian vegetation establishment and growth on the floodplain, reduce bank erosion, improve flood plain function and stability and modify sediment transport.
2. Provide improved water quality and habitat for aquatic species and improved riparian

habitat for upland species.

3. Provide needed discharge capacity required for design flow transport.
4. Maintain water surface elevation in floodplains, riparian areas, and wetlands.
5. Provide drainage of excess surface water.
6. Prevent the loss of land, damage to utilities, roads, buildings, or other facilities adjacent to the banks.
7. Restore the visual quality of the stream corridor.
8. Provide other authorized water management purposes.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to construction of new channels or modifications of existing channels.

It applies where stability requirements can be met, where the impacts of the proposed construction on movable boundary resource concerns are evaluated, and the techniques and measures necessary to overcome the undesirable effects are made part of any planned work.

This standard applies to Florida NRCS Conservation Practice Standard Surface Drainage, Main or Lateral, Code 608 having a drainage area in excess of one square mile.

This standard does not apply to Florida NRCS Conservation Practice Standards Diversion, Code 362, Grassed Waterway, Code 412, Irrigation Field Ditch, Code 388, Surface Drainage Field Ditch, Code 607, or Irrigation Canals or Laterals, Code 320.

This standard does not apply to short reaches

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

of streams that should be treated by using Florida NRCS Conservation Practice Standards, Streambank and Shoreline Protection, Code 580, or, Stream Channel Stabilization, Code 584.

CRITERIA

General Criteria Applicable to Fixed and Movable Boundary Channels

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Install measures according to a site specific plan and in accordance with all applicable local, state, and federal laws and regulations.

Measures to be applied shall be compatible with improvements planned or being carried out by others.

Integrate end sections with existing measures. Provide grade stabilization when there are excessive, undesirable differences in bed elevation.

Maintain sufficient depth to provide adequate outlets for subsurface drains, tributary ditches, or other channels.

Effect of channel work on existing structures including, but not limited to, culverts, bridges, buried cables, pipelines, irrigation flumes, and inlet structures for surface and subsurface drainage on the channel and laterals, thereto shall be evaluated to determine the need for modification or replacement.

Measures shall be compatible with the bank or shoreline materials, water chemistry, channel hydraulics, and slope characteristics both above and below the water line.

Designs will provide for protection from upslope runoff.

Provide internal drainage for bank seepage when needed. Use geotextile or filter bedding on structural measures where there is potential for migration of materials from behind the structure.

Design measures for anticipated debris impact and fluctuating water levels.

Alignment of channels undergoing modification shall not be changed to the extent that the stability of the channel or laterals thereto is endangered.

Protect all disturbed areas around measures from erosion. Protect disturbed areas that are not to be cultivated as soon as practical after construction. Select vegetation that is best suited for the soil moisture regime.

Capacity. Determine the capacity for open channels according to the procedures applicable to the purposes to be served and according to related engineering standards and guidelines in handbooks.

Determine the water surface profile or the hydraulic grade line for the design flow for channels. Base the roughness coefficient for aged channels on the expected vegetation, along with other retardance factors, considering the level of maintenance prescribed in the operation and maintenance plan prepared in cooperation with owners or sponsors.

Establish the required capacity by volume – duration rates, peak flow, design flow or a combination, as determined by the topography, landscape setting, channel type, purpose of the channel, desired level of protection, and economic feasibility.

Cross section. Determine the required channel cross section and grade by plan objectives, design capacity, materials in which the channel is to be constructed, vegetative establishment program, and requirements for operation and maintenance.

Urban and other high-value developments through which the channel is to be constructed must be considered in the design of the channel section. If a channel is deepened, grade control (Florida NRCS Conservation

Practice Standard, Stream Channel Stabilization, Code (584) will be required to prevent channel incision from extending upstream beyond the project site. Address dewatering of shallow aquifers to insure that riparian areas or wetlands are not negatively impacted and to avoid negative impacts to fish.

Channel Stability. Channels must be stable under conditions existing immediately after construction (as-built condition) and able to pass the design flow under conditions existing during effective design life (aged condition). Determine the channel stability for discharges under the following conditions:

1. As-built condition - Allowable as-built velocity (regardless of type of stability analysis) in the newly constructed channel may be increased by a maximum of 20 percent if:
 - a. The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion-controlling vegetation,
 - b. Species of erosion-controlling vegetation adapted to the area and proven methods of establishment are known.

Where an erosion control fabric is used on the channel bank, allowable as-built velocity may be increased by a percentage determined according to recommendations provided by the manufacture of the selected erosion control fabric.
2. Aged condition - Channel-forming flow or design discharge, whichever is larger, except that it is not necessary to check stability for discharge greater than the 100-year frequency.

The sediment transport characteristics shall be evaluated on a long-term basis as well as for different levels of flow to evaluate risk, to check floodplain interaction and to project future channel adjustments.

Appurtenant structures. Channel design shall include all structures required for proper functioning of the channel and its laterals, as well as travel-ways for operations and maintenance. Include inlets and structures

needed for entry of surface and subsurface flow into channels without significant erosion or degradation in the channel design.

The design also shall provide for necessary flood gates, water-level-control devices, bays used in connection with pumping plants, and any other appurtenances essential to the functioning of channels and contributing to attainment of the purposes for which they are built. If needed, use protective structures or treatment at junctions between channels to insure stability at these critical locations.

If culverts or bridges are removed, vertical stability of the channel must be analyzed to determine if the structures were acting as grade control. Capacity of some culverts and bridges may need to be increased above the design discharge to allow for debris movement or ice.

Disposition of spoil. Dispose of spoil material from clearing, grubbing, and channel excavation in a manner that will:

1. Not raise the level of the regulated floodplain, thereby decreasing the accessibility during flood flows.
2. Not negatively impact wetland/riparian areas.
3. Not confine or direct flows so as to cause instability when the discharge overtops the channel banks.
4. Provide for the free flow of water between channel and flood plain unless the valley routing and water surface profiles are based on continuous dikes being installed.
5. Not hinder the development of travel-ways for maintenance on fixed boundary channels.
6. Leave the riparian area or right-of-way in the best condition feasible, consistent with the project purposes and adjacent land uses.
7. Direct water accumulating on or behind spoil areas to protected outlets.
8. Maintain or improve the visual quality of the site to the extent feasible.

Safety. Open channels can create a safety hazard. Appropriate safety features and devices should be installed to protect people

and animals from accidents such as falling or drowning.

Additional Criteria For Fixed Boundary Channels

Use NRCS National Engineering Technical Release 25 (TR - 25) in providing direction for surveys, planning, and site investigations for channel work. Follow design criteria in TR – 25 using the procedure best adapted to site conditions. Appropriate efforts will be made to classify and characterize the volume and timing of sediment movement in both the present and future conditions.

Channel stability. When evaluating the as-built condition the 10-year frequency flow will be used.

Maintenance Access. Provide a travel-way on either side of large fixed boundary channels where necessary for use of maintenance equipment to reach the center of the channel. Travel-ways must be adequate for movement and operation of maintenance equipment. The travel-way may be located adjacent to the channel on a berm or on the spread spoil. In some places the channel itself may be used as the travel-way. The travel-way, including access points, must blend into the topography, the landscape, and adjacent land uses.

Additional Criteria For Movable Boundary Channels

Channel changes must maintain or improve habitat for aquatic species. Changes in the riparian corridor must maintain or improve both aquatic and upland wildlife species. Remove stumps, fallen trees, debris, and bars within the channel if they are causing, or may cause, detrimental impacts to the stream system. Retain or replace habitat forming elements that provide cover, food, pools and water turbulence to the extent possible.

Channel construction, improvement, recreation or restoration shall be according to an approved plan prepared for the site by an interdisciplinary team. Classify the channel segment according to at least Rosgen Level II channel classification or other comparable classification system approved by the Florida Department of Environmental Protection (DEP)

as stated in Rule 62C-16.0051, Florida Administrative Code (F.A.C.). Refer to the National Engineering Handbook, Part 654, Stream Restoration Design, Chapter 11, for the Rosgen Geomorphic Channel Design procedure.

The plan must fit all the various elements of the channel design into a system that allows geomorphic, hydraulic and hydrologic functions to occur that do not cause permanent changes in bed elevation or channel width. The geomorphic, hydraulic and hydrologic functions shall also result in rates of erosion and deposition that do not require annual maintenance, repair or replacement.

The plan must include channel design elements and the channel location that maintain or improve the overall landscape character and any prominent views.

The plan must include maintaining or establishing appropriate riparian corridor vegetation since the vegetation helps maintain the channel dimension, pattern and form and helps maintain an acceptable rate of lateral migration. Lateral migration is the geomorphic process that builds and destroys floodplains. It involves bank erosion at the outside edge of channel bends and deposition at the inside edge of bends.

Capacity. The required capacity is the channel-forming flow. Any excess flow will be allowed to go out of bank and spread out on a floodplain. The required capacity can exceed the channel-forming flow if the boundary materials for that type of channel can withstand the increased depth and tractive stress of the flows that remain within the bank.

Geomorphic, hydraulic and hydrologic analyses are required to determine the water surface profile and hydraulic grade line.

The sediment transport characteristics of a project reach should be evaluated on a long term as well as design event basis.

Cross Section. The cross section will be symmetrical (parabolic or rectangular shaped) in that portion of the channel where the thalweg crosses from one side of the channel to the other.

The cross section will be asymmetrical in channel bends where the thalweg is confined

to one side of the channel. The cross section depth will be greatest at the outside edge of the bend in the thalweg and the bottom will be sloped to meet the elevation of the water surface for the channel-forming flow at the inside edge of the bend.

Channel Stability. A geomorphic analysis for stability shall include, but not be limited to: channel gradient, sinuosity, width to depth ratio, meander belt width, radius of curvature, bank material, height and slope, pool/riffle or step/pool ratios, riparian vegetation appropriate for ecological site, access to a floodplain, sediment transport, bed material, and channel and floodplain roughness.

CONSIDERATIONS

Consider effects on components of the water budget, especially on volumes and rates of runoff and infiltration.

Consider effects on shallow aquifers.

Consider effects of erosion and the movement of sediment and soluble and sediment-attached substances in runoff during and immediately after construction.

Consider incorporating large woody debris removed from the channel bed, banks or riparian area into the overall design.

Consider effects of the use of chemicals during vegetation control.

Consider effects of changes in channel vegetation on downstream water temperature.

Assess potential for temporary and long-term effects on the visual quality of downstream waters.

Stockpile topsoil and re-spread to improve planting success unless the seed bank contains an excessive amount of noxious weeds.

When designing protective measures, consider the changes that may occur in the watershed hydrology and sedimentation over the design life of the measure.

Consider the type of human use and the social and safety aspects when designing the protective measure. Use construction materials, grading practices, vegetation, and other site development elements that enhance

aesthetics and maintain or compliment existing landscape uses such as pedestrian paths, climate controls, buffers, etc. Avoid excessive disturbance and compaction of the site during installation and stockpile topsoil to be used for vegetation re-establishment.

Consider using vegetative species that are native to the local ecosystems. Do not use invasive, noxious, or exotic species that could become nuisances. Consider species that have multiple values such as those suited for biomass, wildlife food, wildlife cover, and aesthetics. Avoid species that may be alternate hosts to disease or undesirable pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

Vegetative measures should be considered on slopes above the elevation where structural measures are required. Use natural fiber fabric when needed for short-term stabilization rather than grass seeding if possible.

Livestock exclusion should be considered during establishment of vegetative measures and appropriate grazing practices applied after establishment to maintain plant community integrity. Wildlife may also need to be controlled during establishment of vegetative measures. Temporary and local population control methods should be used with caution and within state and local regulations.

Measures that promote beneficial sediment deposition and the filtering of sediment, sediment-attached, and dissolved substances should be considered adjacent to, or within the riparian corridor.

Consider maintaining or improving the habitat value for fish and wildlife, which includes lowering or moderating water temperature, and improving water quality and connectivity to adjacent habitats.

Consider maximizing adjacent wetland functions and values with the project design.

Measures should be designed to minimize safety hazards to boaters, swimmers, or people using the shoreline or streambank.

Protective measures should be self-sustaining or require minimum maintenance.

Consider the critical low flow (7-day annual low flow) in the stability analysis if maintaining aquatic habitat is a concern. Sediment transport rates at low flows may not impact channel stability, but sediment deposits could cover critical habitat.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing open channels shall be in keeping with this standard.

On streams where fish are a concern, limit construction of any work within the water portion of the stream to periods of the year when fish migration is not occurring and there are no eggs in the substrate. Perform in-stream work in accordance with all permit requirements.

Limit work within channel or banks of streams to the work actually needed. Unless otherwise specified, work in the water portion of the stream shall not be performed during critical periods for aquatic species.

As a minimum, plans and specifications shall include:

- Location map,
- Typical cross sections,
- Details of appurtenant structures discharging into or out of the channel,
- Profile of the channel,
- Channel bank stabilization details, if required, and;
- Details of spoil placement.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan must be prepared for use by the landowner or operator responsible for operation and maintenance of an open channel system. The O&M plan shall provide specific instructions for operating and maintaining the channels to insure they function properly. It shall also provide specific instructions pertaining to the intensity of management activities in the stream channel and riparian area. The O&M plan shall describe the anticipated time frame for changes and adjustments in the plan form

and profile, and the appropriate operation and maintenance response to these adjustments. Permits and/or consultation may be required for operation and maintenance. Minimum requirements to be addressed in the O&M plan are:

1. Prompt repair or replacement of damaged components if necessary.
2. Remove foreign materials and vegetation that are interfering with proper operation only when necessary.
3. Maintain vigorous vegetative growth in riparian areas and for erosion control.
4. Maintain travel-ways for operation and maintenance access.

REFERENCES

Cultural Resources Handbook, Part 601,
Subpart C
GM 190 ECS-410
GM 420 Part 401
NRCS Conservation Practice Standard:
Surface Drainage, Main or Lateral, Code 608
NRCS National Engineering Technical
Release 25 (TR 25)
NEH, Part 654, Stream Restoration Design,
Chapter 11, Rosgen Geomorphic Channel
Design
Florida DEP, Rule 62C-16.0051 F.A.C.,
Reclamation and Restoration Standards