United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

CHANNEL BED STABILIZATION

Code 584

(Ft.)

INITIAL REVIEW – Comments and Responses

Drafted technical standard text (as sent for Initial Review) is in black and blue fonts. National minimum requirements are in black font; Wisconsin specific criteria is denoted with blue font.

Comments are in red, preceded by comment number (**C#**). To find a specific comment number, search for that number using "Ctrl + F" (Windows) or "Command + F" (Mac).

Responses to comments are in green italics.

Changes to standard text are in tracked changes.

DEFINITION

Measure(s) used to stabilize the bed or bottom of a channel.

C1: How far up the bank does this go? Is this just the flat part?

RESPONSE: The height depends on the type of channel bed stabilization structure. Artificial riffles, used in alluvial channels, would remain flush with the bottom. Concrete drop spillways, used in drainage ditches or irrigation canals, would have headwall to prevent flanking.

PURPOSE

This practice may support one or more of the following:

- Maintain or alter channel bed elevation or gradient
- Modify sediment transport or deposition
- Manage surface water and groundwater levels in floodplains, riparian areas, and wetlands

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to the beds of existing or newly constructed alluvial or threshold channels

undergoing damaging aggradation or degradation that cannot be feasibly controlled by clearing or snagging, establishment of vegetative protection, installation of bank protection, or installation of upstream water control measures.

C11: Does this chapter apply to Grassed waterways or Lined waterway enter streams?

RESPONSE: No, this practice will typically be installed in streams or drainage ditches.

This practice also applies to channels where the removal of barriers to aquatic organism passage would result in destabilization of the channel bed.

Refer to Open Channel (Code 582), Additional Criteria for Stream Restoration, when this practice is used in combination with other practices for stream restoration.

C2: Should Code 580 be referenced too?

RESPONSE: This standard may be used in combination with multiple standards. CPS 582 was called out because it is considered the primary practice in classic stream restoration work and it hosts the minimum site assessment criteria for modifying channels.

CRITERIA

Design and install measures according to a site-specific plan in accordance with all local, State, Tribal, and Federal laws and regulations. Apply measures that are compatible with improvements planned or being carried out by others.

Evaluate effects of channel work on existing structures such as culverts, bridges, buried cables, pipelines, and irrigation flumes to determine impact on their intended functions. Analyze the quantity and character of sediments entering the channel reach under consideration on the basis of both present and projected conditions caused by changes in land use or land treatment and upstream improvements or structural measures. Select measures that are compatible with the bank or shoreline materials, water chemistry, channel hydraulics, and slope characteristics, both above and below the waterline.

Conduct a site assessment to identify the causes of bed instability and the potential effects of a channel bed stabilization structure. At minimum, incorporate the following information into the design report:

C3: Suggest adding "…and prepare a design report" after "assessment".

RESPONSE: A design report is required in this section.

C4: Not quite sure what is meant by "structure" here. [Same comment applies to at least 5 usages elsewhere in Criteria of this standard, in blue text.]

RESPONSE: The word "structure", for the purpose of this standard, is used to refer to anything that is constructed to stabilize the channel bed. It is not specifically defined on purpose because it can mean a variety of things.

- Cause of channel bed instability such as advancing head cuts, replacement of culverts to a lower elevation, sudden watershed changes that may increase channel flows, extreme flood events, etc.
- Downstream hydraulic controls or restrictions that may generate backwater and affect the performance of a channel bed stabilization structure, e.g. culvert crossings, bridges, stream crossings, etc.
- Upstream pipe outlets, drainage ditch laterals, tributary streams, culvert crossings, or other hydraulic structures that could be impacted by sediment deposition or backwater resulting from the installation of a channel bed stabilization structure.

C12: Drainage ditches and field drainage tiles should be included.

RESPONSE: Pipe outlets are listed in the existing text and should cover field drainage tiles. Drainage ditch laterals or other tributaries has been added.

- Elevation of baseflow, bankfull discharge (i.e. channel-forming discharge or ordinary high water mark), and highest active floodplain bench.
- Description of channel evolutionary stage in natural streams, i.e. down-cutting, widening, aggrading, or stable. Refer to NRCS NEH Part 654.0305(c).

Design measures to—

- Withstand flow duration, depth of inundation, buoyancy, uplift, scour, angle of attack, stream velocity, and higher-flow conditions, based on acceptable risk.
- Maintain sufficient depth to provide adequate outlets for subsurface drains, tributary streams, ditches, or other channels.
- Maintain the appropriate sediment transport regime in order to avoid detrimental erosion or sedimentation upstream and downstream.
- Anticipate ice action, debris impact, and fluctuating water levels.
- Avoid adverse effects on endangered, threatened, proposed, and candidate species and their habitats.
- Avoid adverse effects on archaeological, historical, structural, and traditional cultural properties.
- Minimize safety hazards to boaters, swimmers, or people using the channel.

Measures must not—

- Impair the floodway or floodplain functions.
- Cause detrimental changes in water surface elevations when water surface elevations are a concern.
- Impede the upstream or downstream passage of aquatic organisms, unless the objective is to restrict invasive species access.

Refer to NRCS NEH 654, TS-14G, for grade stabilization techniques, including rock sills and artificial riffles.

Evaluate stability of the structure for all flows up to the 100-year flood. Estimate stream flows using the USGS Flood Frequency Characteristics of Wisconsin Streams or hydrologic models such as NRCS WinTR-20, WinTR-55, or USACOE HEC-HMS.

Evaluate water surface profiles with a model such as USACE HEC-RAS for the full range of channel flows with and without the channel bed stabilization structure. Evaluate the backwater effect on the bankfull elevation, base flood elevation, vegetation, channel crossings, pipe/ditch outlets, and other in-stream structures. Evaluate the effect of the structure on sediment transport (sediment competency) during bankfull flow.

Refer to NRCS NEH Part 654, TS-14B, to estimate scour depth immediately below the structure to ensure adequate keyway depth. Use a minimum keyway depth into the channel bed of 3 feet, or 1 foot below the calculated depth of scour, whichever is greater.

Key the structure at least 8 feet into the channel banks to prevent flanking caused by channel erosion or lateral migration. Increase the keyway length based on the anticipated channel migration over the design life, or design streambank protection to ensure stable banks.

C5: Could refer to 580 and/or 582.

RESPONSE: It was intentional to not refer to CPS 580 or 582 here. Some situations will dictate that only 584 is used. There are criteria for when 582 must be used.

Evaluate the potential for stream channel avulsions which could change the effect of the bed stabilization structure.

Evaluate the potential for soil piping or sand boils immediately downstream of the structure due to differential head pressure. Soil piping of streambed material can undermine the structure. Refer to NRCS NEH-11, Lane's Weighted Creep Method (page 4-14), or NRCS SM Note -5, Flow Net Construction and Use, or seepage analysis software to evaluate foundation pressures under the structure.

Dispose of spoil material from clearing, grubbing, and channel excavation in a manner that will not interfere with the function of the channel. Protect all disturbed areas around measures from erosion. Select vegetation or other measures that are best suited for the anticipated site conditions.

Clear the channel to remove stumps, fallen trees, debris, and sediment bars only when they are causing, or could cause, detrimental bank erosion, structural failure, or reduction of channel capacity that results in above-average overflows on adjacent floodplains. Retain or replace habitat-forming elements that provide cover, food, pools, and water turbulence to the extent possible.

CONSIDERATIONS

Assess channel stabilization needs in sufficient detail to identify the causes contributing to instability (e.g., watershed alterations resulting in significant modifications of discharge or sediment production). Due to the complexity of such an assessment, consider using an interdisciplinary team and watershed modeling.

C6: Should "bed" be inserted between "channel" and "stabilization"?

RESPONSE: This is national standard text and we cannot insert words in the manner you have described.

When designing protective measures—

- Conduct area-wide planning efforts for proper design, function, and management of protective measures if the design reach involves multiple stakeholders.
- Consider the changes that may occur in the watershed hydrology and sedimentation over the design life of the measure.
- Use woody material removed during construction in the overall practice design.
- Maintain or improve the habitat value for fish and wildlife, which includes providing cover, lowering or moderating water temperature, and improving water quality.
- Improve habitat for threatened, endangered, and other species of concern, where applicable.
- Maximize adjacent wetland functions and values and minimize adverse effects to existing wetland functions and values.
- Protect side channel inlets and outlets from erosion or sedimentation.

Plan for the type of human use and social and safety aspects when designing protective measures. Use construction materials, grading practices, vegetation, and other site-development elements that enhance aesthetics, recreational use, and maintain or complement existing landscape uses such as pedestrian paths, climate controls, and buffers. Avoid excessive disturbance and compaction of the site during installation.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for specific channel reaches and field sites that describe the requirements for applying the practice to achieve its intended purpose(s). At the minimum the plan will include:

- Topographic map

  C7: Suggest adding "…existing contours, proposed contours and proposed spot grades."

  RESPONSE: The intent of the national standard language was to include a topographic map for the purpose of delineating the drainage area to practice site.

- Drainage area
- Velocities
- Plan view showing the location, spacing, and overall dimensions

  C8: Suggest adding cross-sections.

  RESPONSE: Agreed; added as a separate item below.

- Profile view along the improved channel that extends at least 150 feet downstream of the structure. Include the thalweg, top of high bank, bankfull elevation, vertical extent (top and bottom) of each structure.

  C9: What does 150 feet downstream of the structure mean? Is this the area where something is constructed?

  RESPONSE: This additional profile survey provides assurance that a headcut is not working its way upstream to undermine the channel bed stabilization structure.

- Cross sections
- Structural detail drawings to describe components and construction requirements
- Construction and material specifications, e.g. rock gradation and soundness
- Work limits, including ingress and egress for construction equipment, restricted areas within the work limits, e.g. wetlands
- Borrow and spoil areas
- Pollution control, e.g. staged construction, floating silt curtains, silt fences, erosion control wattles or logs.

  C10: Suggest substituting "Sediment and Erosion Control" for "Pollution control".

  RESPONSE: Pollution control is a generic term used by regulatory agencies to cover everything that may impact water quality including oil, grease, and fuel discharge from equipment doing the work.

- Requirements for vegetative establishment and mulching

OPERATION AND MAINTENANCE

Prepare an Operation and Maintenance plan that provides specific instructions for operating and maintaining the system to ensure it functions properly. Provide for periodic inspections and promptly repair or replacement of damaged components.

REFERENCES

USDA, NRCS, Conservation Engineering Division, National Engineering Handbook, Part 653, Stream

Corridor Restoration.

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USDA, NRCS, Stream Restoration Planning and Design, Fluvial System Stabilization and Restoration Field Guide.

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