

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
GRASSED WATERWAY

(Ac.)

CODE 412

DEFINITION

A shaped or graded channel that is established with suitable vegetation to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet.

PURPOSE

- To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
- To prevent gully formation.
- To protect/improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applied in areas where added water conveyance capacity and vegetative protection are needed to prevent erosion and improve runoff water quality resulting from concentrated surface flow.

CRITERIA**General Criteria Applicable to All Purposes**

Plan, design, and construct grassed waterways to comply with all federal, state, and local laws and regulations.

Grassed waterways shall be designed by the most applicable of the following 3 methods: 1) individual waterway design, 2) minimum waterway design, or 3) ephemeral shaping.

Individual waterway design shall be used in all instances that do not meet minimum design, or ephemeral shaping conditions.

Individual waterway design may be used at any time at the designer's discretion.

Capacity. Design the waterway to convey the peak runoff expected from the 10-year frequency, 24-hour duration storm.

When the waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. The bottom width shall be as designed to convey the 10 year peak runoff, but the

constructed depth may be decreased where out of bank flow is considered in the design. Ensure that the design capacity, at a minimum, will remove the water before crops are damaged.

Stability. Minimum depth and width requirements for stability of the grassed waterway shall be determined using the procedures in the NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways or Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels.

Ensure that the vegetation species selected are suited to the current site conditions and intended uses. Select species that have the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the waterway.

Width. Bottom widths of trapezoidal waterways shall be less than 40 feet unless measures are taken to limit meandering of low flows, such as multiple or divided waterways or other means.

Side slopes. Side slopes shall be flatter than a ratio of 2½ horizontal to one vertical and shall accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway. Side slopes shall not be steeper than 6H:1V if the waterway will be crossed with tillage/harvesting or other equipment.

Depth. The capacity of the waterway must be large enough so that the water surface of the waterway, at design capacity, is below the water surface of the tributary channel, terrace, or diversion that flows into the waterway at design flow.

Provide 0.5 foot freeboard above the designed depth, at maximum retardance, when flow must be contained to prevent damage.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [Field Office Technical Guide](#).

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Drainage. When needed to establish or maintain vegetation on sites having prolonged flows, high water tables, or seepage problems, use Subsurface Drain (606) or other suitable measures in waterway designs.

Where drainage practices are not practicable or sufficient to solve these seepage problems, use conservation practice Lined Waterway or Outlet (468) in place of Grassed Waterway (412).

Outlets. Provide a stable outlet with adequate capacity. The outlet can be another vegetated channel, an earthen ditch, a grade-stabilization structure, filter strip or other suitable outlet.

Vegetative Establishment. Establish vegetation as soon as possible using the criteria listed under "Establishment of Vegetation" in the conservation practice standard Critical Area Planting (342) and/or the state planting guide.

Immediately after waterway construction, at least one of the following measures will be used to protect against erosion until permanent vegetation has been established.

- Waterway shall be seeded and all seeded areas will be mulched with native or brome hay, or wheat or oat straw.
- Fabric checks shall be placed across the channel at spacing not greater than 100 feet.
- Waterway shall be seeded with a cover crop according to NRCS Conservation Practice Standard Cover Crop (340). Cover crops may only be used when construction is completed outside of appropriate seeding dates for the planned grass mixture.
- A companion crop shall be added to the seed mixture according to NRCS Conservation Practice Standard Critical Area Planting (342). When companion crops are used, the seeding rate of the grass mix shall not be decreased.
- Construct side dikes along both sides of the waterway to exclude overland flow, or flow from other conservation practices. Dikes shall be removed as soon as practical after vegetation has been established.

Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation.

Minimum Waterway Design. Minimum waterway designs developed will vary for individual counties, soil types, and slope ranges. Minimum waterway designs may be used when site conditions, drainage area, soils, slope, and other design considerations are verified on-site, and on-site conditions are similar to those used in the development of minimum designs. Minimum waterway designs must meet or exceed the design required when using individual design criteria. Documentation for minimum waterway designs must be available to ensure that individual waterway design criteria are met or exceeded.

Ephemeral Shaping. Ephemeral shaping may be used on drainage areas less than 7 acres where small ephemeral gullies are a problem. The ephemeral area shall be shaped to blend into the original topography and to define a waterway channel cross section. The cross section of this channel may be slightly irregular in shape, width, and depth. The following criteria shall also apply:

- Shaping shall begin at least 20 feet upslope from the beginning of the ephemeral gully.
- Ephemeral shaping areas shall not be used as outlets for other constructed practices such as terraces, diversions, etc.
- Ephemeral shaping areas shall end at a stable outlet.
- Cross sections for ephemeral shaping areas shall be wide enough to ensure that surface runoff properly drains into the waterway and is safely conveyed to the next reach, but shall not be less than 20 feet wide.
- Ephemeral shaping areas must be seeded to grass according to criteria in the vegetation section of this standard.

CONSIDERATIONS

Where environmentally-sensitive areas need to be protected from dissolved contaminants, pathogens, or sediment in runoff, consider establishment of an increased width of vegetation on the waterway above the flow area. Increasing the width of the waterway

above the flow area will increase filtering of sediment and pathogens as well as increase infiltration of runoff and increase nutrient removal. Where sediment control is the primary concern, consider using vegetation in the waterway which can withstand partial burial and adding sediment control measures above the waterway such as residue management. Consider increasing the channel depth and/or designing areas of increased width or decreased slope to trap and store sediment to reduce the amount of sediment that leaves a field. Be sure to provide for regular cleaning out of the waterway when trapping sediment in this manner.

Tillage and crop planting often takes place parallel to the waterway, resulting in preferential flow – and resulting erosion – along the edges of the waterway. Consider installation of measures that ensure that runoff from adjacent areas will enter the waterway. Measures such as directing spoil placement or small swales can direct this preferential flow into the grassed waterway.

Consider planting of a close growing crop, e.g. small grains or millet, on the contributing watershed prior to construction of the grassed waterway to reduce flows in the waterway during establishment of vegetation.

Avoid areas where unsuitable plant growth limiting subsoil and/or substratum material such as salts, acidity, root restrictions, etc. may be exposed during implementation of the practice. Where areas cannot be avoided, seek recommendations from a soil scientist for improving the condition or, if not feasible consider over-cutting the waterway and add topsoil over the cut area to facilitate vegetative establishment.

Avoid or protect, if possible, important wildlife habitat, such as woody cover or wetlands when determining the location of the grassed waterway. If trees and shrubs are incorporated, they should be retained or planted in the periphery of grassed waterways so they do not interfere with hydraulic functions. Medium or tall bunch grasses and perennial forbs may also be planted along waterway margins to improve wildlife habitat. Waterways with these wildlife features are more beneficial when connecting other habitat types; e.g., riparian areas, wooded tracts and wetlands. When possible, select plant species that can serve multiple purposes, such as

benefiting wildlife, while still meeting the basic criteria needed for providing a stable conveyance for runoff.

Water-tolerant vegetation may be an alternative to subsurface drains or stone center waterways on some wet sites.

Use irrigation in dry regions or supplemental irrigation as necessary to promote germination and vegetation establishment.

Wildlife habitat benefits can be provided by adding width of appropriate vegetation to the sides of the waterway. Care should be taken to avoid creating small isolated planting zones that could become population sinks where wildlife attracted to an area experience reproductive loss due to predation.

Consider including diverse legumes, forbs, and flowering plants such as milkweeds that provide pollen and nectar for native bees and other pollinators. In dry regions, these sites may be able to support flowering forbs with higher water requirements and thus provide bloom later in the summer

The construction of a grassed waterway can disturb large areas and potentially affect cultural resources. Be sure to follow state cultural resource protection policies before construction begins.

Consider using a companion crop in conjunction with fabric checks for additional erosion protection.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for grassed waterways that describe the requirements for applying the practice according to this standard. As a minimum include:

- A plan view of the layout of the grassed waterway.
- Typical cross sections of the grassed waterway(s).
- Profile(s) of the grassed waterway(s).
- Disposal requirements for excess soil material.
- Site specific construction specifications that describe in writing the installation of the grassed waterway. Include specification for control of concentrated flow during construction and vegetative establishment.

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- Vegetative establishment requirements.

OPERATION AND MAINTENANCE

Provide an operation and maintenance plan to review with the landowner. Include the following items and others as appropriate in the plan.

- Establish a maintenance program to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.
- Minimize damage to vegetation by excluding livestock whenever possible, especially during wet periods. Permit grazing in the waterway only when a controlled grazing system is being implemented.
- Inspect grassed waterways regularly, especially following heavy rains. Fill, compact, and reseed damaged areas immediately. Remove sediment deposits to maintain capacity of grassed waterway.
- Avoid use of herbicides that would be harmful to the vegetation or pollinating insects in and adjacent to the waterway area.

- Avoid using waterways as turn-rows during tillage and cultivation operations.
- Mow or periodically graze vegetation to maintain capacity and reduce sediment deposition. Mowing may be appropriate to enhance wildlife values, but must be conducted to avoid peak nesting seasons and reduced winter cover.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the waterway.
- Control noxious weeds.
- Do not use waterways as a field road. Avoid crossing with heavy equipment when wet.
- Lift tillage equipment off the waterway when crossing and turn off chemical application equipment.

REFERENCES

USDA, ARS. 1987. Stability design of grass-lined open channels. Agriculture Handbook 667.

USDA, NRCS. 2007. National Engineering Handbook, Part 650, Engineering Field Handbook, Chap. 7, Grassed waterways.