

**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 carry surface water at a non-erosive velocity to a stable outlet.

**PURPOSE**

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

**CONDITIONS WHERE PRACTICE APPLIES**

In areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff.

This practice is not applicable where its construction would destroy important woody wildlife cover or wetlands and the present watercourse is not seriously eroding.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Plan, design, and construct grassed waterways to comply with all Federal, State, and local laws and regulations.

**Capacity.** The minimum capacity shall convey the peak runoff expected from the 10-year frequency, 24-hour duration storm. Capacity shall be increased as needed to account for potential volume of sediment expected to accumulate in the waterway between planned maintenance activities.

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 minimum capacity of the grassed waterway in such cases shall contain the peak runoff from the 2-year, 24-hour storm. At a minimum, the design capacity shall remove the water before crops are damaged.

For watersheds where natural drainage systems are well defined, the peak runoff rate for the desired frequency storm shall be computed using methods outlined in Chapter 2 of the Engineering Field Handbook (EFH). For watersheds in north central Iowa where natural surface drainage systems are poorly defined and many potholes exist, the runoff for the portion of the drainage area with poorly defined surface drainage may be computed using the appropriate drainage curve. This peak runoff shall be added to the runoff from the remainder of the drainage area to obtain a design discharge for the waterway.

**Urban Waterways.** Waterways in urban or developing areas shall be designed so that:

- All floors of dwelling units and commercial buildings will be free of water during passage of a 100-year - 24-hour storm.
- No water will enter basement openings of non-dwelling units during passage of a 50-year - 24-hour storm. This storm shall not have any adverse effect on any dwelling unit.
- Streets shall remain usable during passage of a 10-year - 24-hour storm.

**Stability.** Determine the minimum depth and width requirements for stability of the grassed waterway using the procedures in the NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways; Agricultural Research Service (ARS) Agriculture Handbook 667,

Stability Design of Grass-Lined Open Channels; or other equivalent method.

The minimum velocity of the waterway after vegetation is established shall be 1.5 feet per second (fps) for a 10-year, 24-hour peak runoff event. The minimum velocity may be disregarded for waterways with a drainage area of less than 30 acres.

**Width.** Keep the bottom width of trapezoidal waterways less than 100 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

Trapezoidal waterways shall have a minimum bottom width of 10 feet and parabolic waterways shall have a minimum top width of 30 feet if they will be crossed with farm equipment. These dimensions are not required for small drainage areas meeting the criteria for the Special Treatment Areas described below.

**Side slopes.** Keep the side slopes flatter than a ratio of two horizontal to one vertical. Accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway in the designed width.

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

Provide freeboard above the designed depth when flow must be contained to prevent damage. Provide freeboard above the designed depth when the vegetation has the maximum expected retardance.

The minimum design depth of a waterway shall be 1.0 foot.

**Drainage.** When needed to help or keep vegetation established on sites having prolonged flows, high water tables, or seepage problems, include Subsurface Drains (606), Underground Outlets (620), stone center waterways or other suitable measures in waterway designs.

**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.** Grassed waterways shall be vegetated according to NRCS Conservation Practice Standard Critical Area Planting (342). Species selected shall be suited to the current site conditions and intended uses. Selected species will have the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the waterway.

Establish vegetation as soon as conditions permit. Use mulch anchoring, nurse crop, rock, straw or hay bale dikes, fabric checks, filter fences, or runoff diversion to protect the vegetation until it is established. Planting of a close growing crop, e.g. small grains or millet, on the contributing watershed prior to construction of the grassed waterway can also significantly reduce the flow through the waterway during establishment.

**Runoff Diversion.** The designer shall ensure that runoff from adjacent areas will enter the waterway by directing spoil placement or other measures such as diversions. See NRCS Conservation Practice Standard 362, Diversion, for design criteria.

Temporary earth side dikes may be installed, when required, to protect a new waterway from erosion due to runoff from adjacent areas. These dikes shall be shown on the drawings as 1 foot or less in height unless design calculations indicate dikes of greater height are needed. All temporary dikes over 1 foot in height shall be designated on the drawings and documentation for the higher dike recorded in the design file. Temporary dikes shall be removed when vegetation in the waterway becomes established. Place spoil from removed temporary diversions in a manner that ensures runoff from adjacent areas will enter the waterway.

Special Treatment Areas. Areas meeting the following criteria may be shaped to a parabolic cross-section with a minimum top width of 20 feet and minimum depth of 0.75 feet. The area will be seeded the same as any grassed waterway. The 10-year, 24-hour capacity will not need to be calculated for these areas.

- The drainage area at the outlet is less than 6 acres.

- The vegetated area begins within 250 feet of the top of the watershed area and extends for no more than 500 feet downslope.
- The grade is between 3 percent and 10 percent; however, the grade may exceed 10 percent when the drainage area is less than 3 acres.
- The outlet for the area is stable (i.e. a level or gently sloping area, joins the flowline of a waterway, or other structural measure, etc.).
- The area does not serve as an outlet for a diversion or terrace.

### CONSIDERATIONS

Small areas within cropland and areas upslope from a grassed waterway may need to be shaped and seeded to control minor gully erosion. Areas treated in this manner will normally be small furrow sized ephemeral gullies. Large gullies usually indicate the need for more extensive design considerations.

If minimum velocities cannot be maintained, consider using NRCS Conservation Practice Standard 607, Surface Drainage, Field Ditch, or 608, Surface Drainage, Main or Lateral.

A side slope steeper than 6:1 may be difficult to cross.

Establish an appropriate width of vegetation on one or both sides of the waterway or add other sediment control measures above the waterway such as residue management to improve water quality and reduce sediment deposition in the waterway. 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 the waterway when trapping sediment in this manner.

Avoid areas where unsuitable subsurface, subsoil, substratum material that limits plant growth 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 ameliorating 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 species of vegetation 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.

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

Add width of appropriate vegetation to the sides of the waterway for wildlife habitat.

Consider including diverse legumes or other forbs that provide pollen and nectar for native bees. 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.

### 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 the plans and specifications shall 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.
- Vegetative establishment requirements.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for each specific project. The list includes most, but may not contain all, of the specifications needed for a specific project:

- IA-5           Pollution Control
- IA-46         Tile Drains for Land Drainage
- IA-412        Grassed Waterways
- IA-620        Underground Outlets

### **OPERATION AND MAINTENANCE**

Provide an operation and maintenance plan to review with the landowner. Specified actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance). 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.
- Protect waterway from concentrated flow by using diversion of runoff or mechanical means of stabilization such as silt fences, mulching, haybale barriers, etc. to stabilize grade during vegetation establishment.

- 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 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.
- Avoid tillage and planting operations parallel to the grassed waterway. Parallel operations may divert runoff water from the grassed waterway and lead to the formation of gullies adjacent to the waterway.

### **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.