

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**GRASSED WATERWAY**

(Acre)

CODE 412

**DEFINITION**

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

**PURPOSES**

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- 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 and where such control can be achieved by using this practice alone or combined with other conservation practices.

**CRITERIA**

**General Criteria Applicable to All Purposes**

**Laws, rules, and regulations.** This practice shall conform to all federal, state, and local laws, rules, and regulations. Laws, rules, and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

**Capacity.** The minimum capacity shall be that required to convey the peak discharge expected from a storm of 10-year frequency, 24-hour duration, when the vegetation has the maximum expected retardance.

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 design criteria in such cases shall be the capacity required to remove the water before crops are damaged.

**Velocity.** Design velocities shall not exceed those obtained by using the procedures, Manning's equation roughness coefficient "n" values, and recommendations in Chapter 7 of the National Engineering Handbook Part 650 (NEH 650), *Engineering Field Handbook*, or Agricultural Research Service (ARS) Agricultural Handbook 667, *Stability Design of Grass-Lined Open Channels*.

Design velocities shall not exceed the values shown in Table 1 below. Design velocity for waterways shall be determined by using the 10-year frequency, 24-hour duration peak discharge.

Design velocity should be maintained or slightly increased for each succeeding downstream design reach of the waterway having similar cover. Design velocity can only be decreased for succeeding downstream reaches if a 100-foot transition zone is provided, and excessive sediment deposition is not expected. Reduction in velocity from one reach to the next shall not exceed 25 percent.

Annually vegetated waterways may be considered on gentle slopes of 0.6 percent or less. Velocity for an annually vegetated waterway shall be determined by using Retardance E.

**Table 1 - Permissible velocities <sup>1/</sup>**

Soil Description			Permissible Velocity (feet/second)		
			Retardance E	Retardance D	
Unified Soil Classification System Symbol	Plasticity	Soil Texture	Annually Vegetated	Grade $\leq$ 3%	Grade $>$ 3%
SP, SW, SM, ML	Non-plastic to low plasticity PI $\leq$ 10	Sand, silt, sandy loam, silt loam	1.5	4.0 <sup>2/</sup>	3.5 <sup>2/</sup>
CL, SC, MH, CH	Moderate to high plasticity PI $>$ 10	Silty clay loam, sandy clay loam, silty clay, clay	2.5	5.0 <sup>2/</sup>	4.5 <sup>2/</sup>

<sup>1/</sup> Reduce velocity 10 percent if a long duration flow is expected (such as from a pond or spring). Reduce velocity 20 percent if it is difficult to establish or maintain good grass cover (80% minimum cover over the area) throughout the waterway.

<sup>2/</sup> Perennial grass sod must be established. Water must be diverted out of the waterway during the establishment period if field conditions allow.

**Width.** Average top width of a waterway shall not be less than 20 feet. The bottom width of trapezoidal waterways shall not exceed 100 feet unless multiple or divided waterways or other means are provided to control the meandering of low flows.

In urban settings, the top width of the waterway may be less than 20 feet

**Cross section.** Where farm equipment must cross the waterway during farming operations, side slopes of 6:1 or flatter are recommended, but in no case shall side slopes be steeper than 4:1. Waterways may be parabolic or trapezoidal. All excavated material should be spread out away from the waterway in order to provide for free drainage into the waterway.

**Depth.** The minimum depth of a waterway that receives water from terraces, diversions, or other tributary channels shall be that required to keep the design water surface elevation at or below the design water surface elevation in the tributary channel at their junction when both are flowing at design depth. The minimum recommended depth is 1.0 foot. In urban settings, the waterway depth shall not be less than 0.5 foot.

Freeboard above the designed depth shall be provided when increased capacity is needed to prevent damage. Freeboard shall be provided above the design when the vegetation has the maximum expected retardance.

When the design depth includes a permanent berm to complete the cross section, the total constructed depth shall be increased to include a minimum of 0.5 foot of freeboard added to the hydraulic design depth.

**Drainage.** A design for a site having prolonged flows, a high water table, or seepage problems shall include subsurface drains (Conservation Practice Standard 606, Subsurface Drain), underground outlets (Conservation Practice Standard 620, Underground Outlet), stone center waterways, or other suitable measures to avoid damage caused by saturated conditions.

**Outlets.** All grassed waterways shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. The outlet can be another vegetated channel, an earthen ditch, a grade stabilization structure, a filter strip, or other suitable outlet.

**Vegetative establishment.** Grassed waterways shall be vegetated according to

Conservation Practice Standard 342, Critical Area Planting.

Where subsoil will be exposed, the best available soil will be stockpiled for spreading on the waterway after grading as specified in the construction details.

Establish vegetation as soon as conditions permit. Use mulch anchoring, nurse crop, rock, straw or hay bale dikes, filter fences, or runoff diversion to protect the vegetation until it is established.

Temporary berms may be placed alongside of the waterway to prevent runoff from entering the waterway until adequate vegetative cover is established. When the vegetation is established, the berms shall be removed in accordance with the operation and maintenance (O&M) plan; and the earthfill material blended in the field so that free drainage into the waterway is provided.

## CONSIDERATIONS

Permanent berms along the waterway are permitted as part of the design depth and desirable when the waterway serves as an outlet for terraces or diversions to blend in with the ridge height.

Special consideration should be given to waterways that are being rebuilt or reshaped so the depth of the waterway is compatible with the existing terrace system.

Waterway designs may require the constructed bottom elevation to meet a specific elevation. Examples of this are waterways draining into or receiving flow from structures or waterways used as outlets for terraces or diversions to facilitate their improved alignment or paralleling. In these types of situations, construction tolerances for the flow line elevations shall be specified in the construction details.

Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when determining the location of the grassed waterway. If trees and shrubs are part of the vegetation plan, they should be retained or planted in the periphery of grassed waterways so they do not interfere with hydraulic functions. Mid- 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 (for example riparian areas, wooded tracts, and wetlands).

Water-tolerant vegetation may be considered for use on wet sites.

Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation. Refer to Conservation Practice Standard 560, Access Road.

Filter strips may be established on each side of the waterway to improve water quality. Refer to Conservation Practice Standard 393, Filter Strip.

Additional seeding width of appropriate vegetation may be included on the sides of the waterway for wildlife habitat. Refer to Conservation Practice Standard 645, Wildlife Upland Habitat Management.

## PLANS AND SPECIFICATIONS

Plans and specifications for grassed waterways shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s).

## OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate:

- A maintenance program shall be established to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly. Erosion or silt deposition on annually vegetated waterways may be corrected by removing the excess material and changing the vegetative cover.
- Seeding or planting shall be protected from concentrated flow and grazing until vegetation is established.
- Minimize damage to vegetation by excluding livestock whenever possible, especially during wet periods.

- Inspect grassed waterways regularly, especially following heavy rains. Damaged areas will be filled, compacted, and seeded immediately. Remove sediment deposits to maintain capacity of grassed waterways.
- Landowners should be advised to avoid areas where forbs have been established when applying herbicides. Avoid using waterways as turn-rows during tillage and cultivation operations. Prescribed burning and mowing may be appropriate to enhance wildlife values but must be conducted to avoid peak nesting seasons and reduced winter cover.
- Mow, hay, or periodically graze vegetation to maintain capacity and reduce sediment deposition.
- Control noxious weeds.
- Do not use as a field road. Avoid crossing with heavy equipment when wet.