

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

GRASSED WATERWAY

(Acre)

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.

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.

Grassed waterways shall be planned, designed, and constructed to comply with all Federal, State, and local laws and regulations.

Capacity. The minimum capacity shall be that required to convey the peak runoff expected from a storm of 10-year frequency, 24-hour duration. When the grassed waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion or the velocity will not exceed 2 feet per second. The minimum in such cases shall be the capacity required to remove water before crops are damaged.

Runoff from graded terraces and graded diversion terraces shall be computed as 100 percent of the peak discharge for the drainage area. Runoff from level terraces and level diversion (closed or open-end) may be computed as 50 percent of the peak discharge of the drainage area.

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, or Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels; or other equivalent method.

The erodibility of the soil material may be estimated to fall into one of the following categories:

- Easily Eroded (very coarse sand, coarse sand, sand, fine sand, very fine sand, loamy coarse sand, loamy sand, loamy fine sand, loamy very fine sand, coarse sandy loam, sandy loam, fine sandy loam, and very fine sandy loam)
- Erodible (loam, silt loam, silt, silty clay loam, and sandy clay loam)
- Erosion Resistant (clay, silty clay, sandy clay, and clay loam)
- Very Erosion Resistant (based on the soil properties only - no soil texture defined)

Allowable effective stress is implied from the categories above. Soil allowable effective stress may also be determined directly from soil properties. The allowable effective stress is the maximum hydraulic stress that may be applied directly to the soil without the

occurrence of unacceptable erosion.

If the erodibility of the soil material is categorized as Easily Eroded, the grassed waterway permissible velocity shall not exceed 4 feet per second unless the grassed waterway is designed based on the allowable effective stress and/or approved by a Resource Engineer.

Grassed waterway construction areas where dispersive clays are present shall be avoided when possible. If dispersive clays are used in constructing a grassed waterway, internal erosion shall be controlled by treating the soil with 1.5 lbs of gypsum per square foot and incorporating the gypsum a minimum of 3 inches into the soil.

Width. The bottom width of trapezoidal grassed waterways shall not exceed 100 feet unless multiple or divided grassed waterways or other means are provided to control meandering of low flows.

Side Slopes. Side slopes shall not be steeper than a ratio of two horizontal to one vertical. They shall be designed to accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the grassed waterway.

Depth. The minimum depth of a grassed 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.

Freeboard above the designed depth shall be provided when flow must be contained to prevent damage. Freeboard shall be provided above the designed depth when the vegetation has the maximum expected retardance.

The depth shall be such that the terrace will drain properly and will enter the grassed waterway or outlet in a manner that will eliminate irregular and odd-shaped land patterns which are difficult to farm. A minimum of 0.4 foot freeboard shall be provided above the designed water surface elevation in the grassed waterway.

When dikes are constructed to confine the runoff, they shall have a minimum 4-foot top width at the designed height.

Drainage. Designs for sites having prolonged flows, a high water table, or seepage problems shall include Subsurface Drains (Oklahoma NRCS Conservation Practice Standard Code 606), Underground Outlets (Oklahoma NRCS Conservation Practice Standard Code 620), Stone Center Waterways or other suitable measures to avoid 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, filter strip or other suitable outlet.

Vegetative Establishment. Grassed waterways shall be vegetated according to Oklahoma 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 grassed waterway.

Apply soil amendments (e.g. lime, fertilizer, compost) at the rates necessary to insure grass stand establishment. Timing should be during seedbed preparation to be most effective. See the Oklahoma NRCS Conservation Practice Standard, Nutrient Management (590) for further guidance.

Schedule construction of grassed waterways to coincide with the proper seeding/sprigging season. The construction of all grassed waterways shall start no more than 30 days before the beginning of the proper seeding/sprigging season. The construction of all grassed waterways shall be complete at least 15 days before the end of the proper seeding/sprigging season.

If circumstances beyond the control of the producer/landowner (i.e. weather) prevent the construction of the grassed waterway to coincide with the proper seeding/sprigging season, as described previously, then protective action such as cover crop and/or mulch shall be implemented until the correct time for the next proper seeding/sprigging season. Refer to the Oklahoma NRCS Mulching (484) and/or Cover Crop (340) Conservation Practice Standards.

Grassed waterways or outlets on gentle slopes, usually less than 2 percent with a velocity of 3 feet per second or less, may be established to alfalfa as stated in the Oklahoma NRCS Conservation Practice Standard, Critical Area Planting (342).

Grassed waterways on slopes less than 1 percent and a velocity of 2 feet per second or less may be planted to a close spaced high residue crop.

Seedbed preparation, time of seeding, mixture rate, cover crop, mulching, or mechanical means of stabilizing, fertilizer, and lime requirements shall be specified for each applicable area.

The most critical time in successfully installing a grassed waterway is when the vegetation is being established. Establish vegetation as soon as conditions permit. Use mulch anchoring, cover crop, rock, straw or hay bale dikes, 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 grassed waterway during establishment.

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 shall be avoided. Where areas cannot be avoided, seek technical recommendations for improving the condition or, if not feasible over-cut the grassed waterway and add topsoil over the cut area to facilitate vegetative establishment.

When a grassed waterway is the stable outlet for an existing terrace system, the runoff drainage from the terrace system shall not be allowed to enter the grassed waterway until proper vegetation is established.

CONSIDERATIONS

Vegetative Establishment. The vegetation should be well established before large flows are permitted in the channel.

If a grassed waterway is proposed to be constructed in a field that has an established terrace system conveying runoff drainage to

the proposed location of the grassed waterway and this drainage is planned to be diverted or blocked from entering the grassed waterway, then careful planning should be implemented to prevent excessive erosion from occurring in the area adjacent to the newly constructed grassed waterway until vegetation is properly established. Examples of some planning implementation options are:

- Breach the contributing terraces to a width equivalent to the top width of the proposed grassed waterway in a staggered pattern, so that a gully will not form through the terrace system.
- Remove all terraces in the contributing terrace system. Refer to the Oklahoma NRCS Conservation Practice Standard, Terrace (600).

The importance of implementing an erosion control method in the contributing drainage area prior to the establishment of adequate vegetation in a newly constructed grassed waterway is even more critical when the land slope exceeds 5%.

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

Water-tolerant vegetation may be an alternative on some wet sites.

Wildlife. Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when siting 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. Mid- or tall bunch grasses and perennial forbs may also be planted along grassed waterway margins to improve wildlife habitat. Grassed 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

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

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

Establish filter strips on each side of the grassed waterway to improve water quality.

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). 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.

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 grassed waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, livestock traffic, or erosion must be repaired promptly.
- All vegetative treatment types 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 waterway.
- Landowners should be advised to avoid areas where forbs have been established when applying herbicides.
- Avoid using grassed 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 or periodically graze vegetation to maintain capacity and reduce sediment deposition.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the grassed waterway.
- Control noxious weeds.
- Do not use as a field road. Avoid crossing with heavy equipment when wet.

REFERENCES

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

USDA, Agricultural Research Service. 1987. Agricultural Handbook 667, Stability Design of Grass-lined Open Channels