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 in suitable vegetation for the stable conveyance of runoff.

PURPOSE

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

1. To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
2. To improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

All sites where added capacity, vegetative protection, or both are required 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. 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. Grassed waterways will be designed with methods consistent with the information contained in Chapter 7 of the Engineering Field Handbook (EFH) (Part 650 of the National Engineering Handbook (NEH) Series).

Legal. All waterways shall comply with the Iowa Drainage Code and any other 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 waterway slope is 1 percent or less, 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.

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.

Drainage Area Reductions. The drainage area controlled by storage type terraces may be omitted from the drainage area when computing the design discharge. The design discharge shall be increased to account for the controlled flow from terrace underground outlets that drain into the waterway. The controlled flow may be considered to be 0.05 cfs per acre of terraced area.

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

1. All floors of dwelling units and commercial buildings will be free of water during passage of a 100-year - 24-hour storm.
2. 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.
3. Streets shall remain usable during passage of a 10-year - 24-hour storm.

Velocity. Design velocities shall be determined by using the procedures, "n" values, and recommendations in Chapter 7 of the Engineering Field Handbook (EFH).

Retardance D shall be used to determine the stability of the waterway. Retardance B (for waterways which are not mowed) or C (for waterways which are regularly mowed) shall be used to determine that the design capacity is adequate.

The maximum velocity of the waterway shall be limited to the velocities as shown in Engineering Field Handbook (EFH) Exhibit 7-3 (pages 7-19), except that the velocity shall not exceed 6 feet per second (fps) unless a geotextile lined vegetated design is used (see Engineering Field Handbook (EFH) page IA7-16). This maximum velocity is for the flow condition based on a 10-year - 24-hour storm and D retardance.

The minimum velocity of the waterway shall be 1.5 feet per second (fps) for a 10-year - 24-hour peak runoff and using a retardance of either B or C, as appropriate. The minimum velocity may be disregarded for waterways with a drainage area of less than 30 acres.

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

Side Slopes. Side slopes should be designed to accommodate the land user's equipment. A side slope of steeper than 6 **:** 1 is difficult to cross.

Depth. The minimum design depth of a waterway shall be 1.0 foot. A waterway that receives water from terraces, diversions, or other tributary channels shall be designed to keep the water surface elevation at, or below, the design water surface elevation in the terrace, diversion, or other tributary channel at their junction when both are flowing at design depth.

Special Treatment Areas. 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.

Areas meeting the following criteria, A through E, may be shaped to a parabolic cross-section with a minimum top width of 20 feet and 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:

A. The drainage area at the outlet is $\leq$ 6 acres.
B. The vegetated area begins within 250 feet of the top of the watershed area and extends for no more than 500 feet downslope.
C. The grade is between 3 percent and 10 percent; however, when the drainage area is $\leq$ 3 acres the grade may exceed 10 percent.

D. The outlet for the area is stable (i.e. a level or gently sloping area, junctions with the flowline of a waterway, or other structural measure, etc.).

E. The area does not serve as an outlet for a diversion or terrace.

Non-Vegetated Channel Or Outlet. Where the minimum velocity for a vegetated channel cannot be obtained, a non-vegetated channel may be used. The maximum permissible velocity for a non-vegetated channel is 1.5 feet per second (fps) for non-cohesive sands and sandy loams, and 2.5 feet per second (fps) for cohesive soils. Non-vegetated channels shall be designed in accordance with Surface Drainage, Field Ditch (607).

Drainage. Subsurface Drains (606), Underground Outlets (620), stone center waterways, or other suitable measures shall be provided for in the design for sites having prolonged flows, a high water table, or seepage problems. Water-tolerant vegetation such as reed canarygrass may be an alternative on some wet sites.

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 earth ditch, a grade stabilization structure, or other suitable outlets.

PLANNING CONSIDERATIONS

Management. Grassed waterways require a high level of management for successful establishment of the vegetation. Regular maintenance during the life of the practice will also be necessary.

Sediment Protection. It is recommended that the drainage area above the grassed waterway be treated with conservation practices. As a general rule, the greater the amount of sediment that is moving from the drainage area into the grassed waterway, the greater will be the problems associated with the grassed waterway. Inadequate land treatment in the drainage area may increase the effort required establishing the grassed waterway and will cause sediment accumulation problems that will increase the maintenance requirements.

Vegetation Establishment. The most critical time in the successful installation of grassed waterways is during the vegetation establishment period. Special protection such as mulch anchoring, straw or hay bale dikes, or other diversion methods is warranted at this critical period. Supplemental irrigation may also be warranted. It is preferable to have vegetation well established before large flows are permitted in the channel. Fabric or rock checks help reduce rill erosion and prevent gullies from developing. Fabric or rock checks should be used when permanent seeding cannot immediately be established and for grassed waterways with high velocities or long duration flow.

When infertile soils will be exposed by construction operations the topsoil should be salvaged for spreading over the exposed infertile areas.

Subsurface drainage and underground outlets may be required to permit establishment and maintenance of the vegetative cover.

On areas where the establishment of vegetation is difficult temporary diversions should be considered for protecting the waterway until vegetation is established. After the diversions are removed any disturbed non-cropped areas need to be seeded to permanent vegetation.

Effects On Water. The quantity of water and rate of runoff are normally unaffected by the installation of a grassed waterway.

Water quality may be improved by a properly designed, installed, and operated grassed waterway. Grassed waterways solve or prevent the erosion problem at the waterway location. A grassed waterway may slow the movement of sediment, pathogens, and soluble and sediment-attached pollutants carried by runoff. Water quality downstream

from a grassed waterway may be improved by the filtering effect of the vegetation.

Degradation of water quality may occur during the construction and establishment period of the grassed waterway.

VEGETATIVE CONSIDERATIONS

Seedbed preparation and the application of fertilizer, seed, sod, and mulch shall be as stated in Critical Area Planting (342). Mulch shall be thoroughly anchored with a notched coulter machine or other method.

Stabilizing crops should be seeded during the summer months and after the late summer seeding period. All crops seeded for stabilizing purposes shall be destroyed at the next seeding period while preparing the seedbed for the permanent grass mixture. Stabilizing crops may include winter rye, oats, sudan, or corn.

Grassed waterways shall be seeded with the permanent grass mixture during the spring period before May 20 or during the late summer period of August 1 to September 10. The spring period may be extended to June 1 in Northeast Iowa and the fall period may be extended to September 20 in plant hardiness Zone 5b (see Section 1, Field Office Technical Guide).

Frost or dormant seedings are not recommended. Oats may be seeded at the rate of one bushel per acre with the permanent seeding but must be mowed before heading.

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.

A maintenance program shall be established to maintain capacity, vegetative cover, and the outlet. Vegetation damaged by farm machinery, herbicides, livestock, or erosion must be replaced or repaired immediately.

It is important to recognize increased and more costly maintenance can be expected for waterways with poor land treatment in the contributing drainage area.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purpose of the practice and its intended life.