

FARM WATER QUALITY PLANNING MANAGEMENT PRACTICE

Grassed Waterway
412

*University of California Cooperative Extension
Natural Resources Conservation Service*



Before



After

Grassed Waterways are natural or constructed channels that are shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of concentrated runoff. The purpose is to convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.

Grassed waterways are wide, shallow, low velocity channels that may replace earthen drainage ditches for the disposal of irrigation runoff water downstream of sumps. Small waterways have a 6-foot bottom width with 4:1 side slopes. Grassed waterways only reduce erosion caused by drainage water flowing through the ditch and do not effect erosion coming off the fields. Grassed waterways are suitable for channels with unstable banks.

See Open Channel #582 and Surface Drainage #607 & #608 for drainage of an area of more than 1 square mile. See Lined Waterway or Outlet #468 or Underground Outlet#620 for erosive soils where grassed waterways are unsuitable.

Advantages

- May filter contaminants
- Reduces ditch erosion
- Protection from overland flow

Disadvantages

- Annual maintenance
- Acreage out of production

Practice Effectiveness for Reducing Water Quality NPS Pollution Potential

Erosion-sheet & rill	Erosion-streambank	Pesticides-leaching	Pesticides-dissolved in runoff	Pesticides-adsorbed to sediment	Nutrients-leaching	Nutrients-surface waters
negligible	slight to moderate		slight	moderate		slight

Empty boxes indicate information not yet collected for this practice

Additional sources of information regarding grassed waterways:

UC Sustainable Agriculture Research and Extension Program <http://www.sarep.ucdavis.edu/>
 UC Weed Research and Information Center <http://wric.ucdavis.edu/>

Some of the information in this management sheet has been taken from the Natural Resource Conservation Service (NRCS) Handbook of Conservation Practices practice #412. Pictures provided by USDA-NRCS. Contact your local NRCS office or visit <http://www.nrcs.usda.gov> for more information.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

412 - GRASSED WATERWAY

I. SCOPE

The work shall consist of grading and shaping a natural or constructed waterway to the lines and grades as shown on the drawings, including furnishing of seed, fertilizer, and mulch required for planting vegetation within the waterway.

II. MATERIALS

Nylon Mat

The mat shall be of 3-dimensional structures of entangled nylon filament mat heat bonded at the intersections. The mat shall be black in color and be resistant to chemical and environmental degradation. The mat shall be at least 9 mm in thickness.

Staples

The staples shall be U,shaped or T,shaped with legs at least 10 inches in length and have a 2-inch crown or top and shall be made of 11 gauge or heavier wire.

Stakes

Stakes shall be cut from new 1-inch wood and be at least 12 inches in length and be wedge shaped with at least a 2-inch top.

Seed

All seed shall be delivered to the site, tagged and labeled in accordance with California Agricultural Code, and shall be acceptable to the County Agricultural Commissioner.

Seed shall be of a quality which has a minimum pure live seed content of 80 percent (percent purity X percent germination) and weed seed shall not exceed 0.5 percent of the aggregate of pure live seed and other material.

Bag tag figures will be evidence of purity and germination. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.

Sprigs

Bermuda Grass sprigs will be stolon or rhizome sprigs, 3- to 12-inches long containing 3 or more nodes. Sprigs shall be taken from healthy, vigorous, strong growing plants and when delivered to the site shall be in a live, moist and healthy condition. They shall not be harvested more than 24 hours prior to delivery, and may be held on site if kept cool and moist for a period not longer than 24 hours.

Plugs

Bermuda grass plugs shall be a minimum surface size of 3 inches X 3 inches and shall be not less than 2-1/2 inches thick. Plugs shall come from healthy, vigorous, established sod that has not been previously harvested for at least nine months. The plugs may be cut on-the-site from sod, or prepared at the place of harvest. They shall not be harvested more than 24 hours prior to delivery.

Plugs shall be kept moist and protected from the sun and drying winds, and aerated as necessary to prevent heating until planted. They may be held on site for a period not longer than 24 hours.

Fertilizer

Unless otherwise specified on the "Practice Requirements" sheet, fertilizer shall be Ammonium Phosphate and contain a minimum of 16 percent nitrogen, 20 percent available phosphoric acid and 0 percent water soluble potash, uniform in composition, dry and free flowing, pelleted, or granular.

All bagged fertilizer shall be delivered in unbroken or unopened containers, labeled in accordance with applicable state regulations and bearing the warranty of the producer for the grade furnished.

Inoculants

The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the plant species and shall not be used later than the date indicated on the container. A mixing medium, as

recommended by the manufacturer, shall be used to bond the inoculant to the seed. For nonpellet inoculated seed, two times the amount of the inoculant recommended by the manufacturer shall be used and seed shall be sown within 24 hours of treatment.

For pellet inoculated seed, the inoculation rate shall be at least 30 pounds per 1,000 pounds of raw seed and the seed shall be labeled to show the Lot Number, Expiration Date of the Rhizobia, and Percent Coat of the finished product.

Pellet inoculated seed shall be sown within 30 days of inoculation, shall be kept cool until sown, and shall achieve at least 80 percent nodulation.

Mulch

Straw mulch shall be new straw derived from rice, wheat, oats, or barley. The contractor, owner, or their representative shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before sprigs, plugs, and straw obtained from outside the county in which it is to be used is delivered to the site of the work.

III. SITE PREPARATION AND CHANNEL CONSTRUCTION

The foundation area shall be cleared by removing obstructions, trees (if necessary), stumps, roots, brush, boulders, debris, and other objectionable material. Removal shall be done in such manner as to avoid damage to other trees and property.

Any topsoil excavated to shape the channel shall be stockpiled until needed for spreading over areas that will be vegetated.

The channel shall be constructed to the cross-section, lines and grades as shown on the construction drawings. All spoil material shall be placed in areas as staked in the field and shaped to accommodate the vegetation operation. All fill areas within the cross-section of the waterway shall be compacted by a minimum of one passage of the equipment over the entire fill surface area of each lift. The final grading operation shall be made to accommodate seedbed preparation.

IV. SEEDING MIXTURE

The seed(s), sprigs, plugs, and rate(s) specified on the Practice Requirements sheet shall be used.

The seeding rate(s) shall be the weight exclusive of any coating material. Any legume seed used shall be inoculated.

Planting shall be performed after final grading is completed and any protective armor work has been finished unless otherwise specified on the Practice Requirements sheet.

V. SEEDBED PREPARATION

The area to be planted shall be weed free and have a firm seedbed which has previously been roughened by scarifying, disking, harrowing, chiseling, or otherwise worked to a depth of 2 to 4 inches. No implement shall be used that will create an excessive amount of downward movement of clods on sloping areas. Seedbed may be prepared at time of completion of earthmoving work.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance shall be removed. Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed.

VI. SEEDING, SPRIGGING OR PLUGGING, FERTILIZING, MULCHING AND ANCHORING THE MULCH

Seeding

Seed shall be drilled or broadcast by hand, mechanical hand seeder, or power operated seeder. Seed shall be incorporated into the soil, but not more than 1 inch deep.

Fertilizing

Fertilizer shall be distributed uniformly over the seedbed at the rate of 500 pounds per acre unless a different amount is specified on the Practice Requirements sheet. Fertilizer shall be applied in any way that will result in uniform distribution. The fertilizer shall be incorporated into the soil. Fertilizing it shall not be accomplished more than 15 days prior to seeding.

Mulching

A mulch covering shall be distributed uniformly over the seeded area within 48 hours following seeding. Straw mulch shall be applied at a rate of 2 tons per acre unless a different amount is specified on the Practice

Requirements sheet. The mulch shall be applied by hand, blower, or other suitable equipment. If straw is applied by blower, it shall not be chopped in lengths less than 6 inches.

Anchoring the Mulch

The mulch shall be anchored in place. Anchoring process may include using hand tools, mulching rollers, disks, or similar types of suitable equipment and shall be performed in a satisfactory manner.

Sprigging or Plugging

Bermuda grass sprigs or plugs shall be planted in areas having adequate moisture throughout the summer. The sprigs or plugs shall be planted into moist soil beginning at the waterline and shall be planted in one or more rows as shown on the attached drawing with plants every 12 to 15 inches apart in a row. The adjacent row will be 12 to 15 inches apart and staggered with respect to the bottom row.

Sprigs will be planted in such a manner so that at least two or more nodes of the plant will be buried in the ground.

A planting hole for each plug shall be prepared with an appropriate hand tool. Planting techniques will be such that the soil is adequately firmed around each plug.

VII. IRRIGATION

When specified, irrigation water shall be applied at the times and rates as listed on the Practice Requirements sheet.

VIII. OTHER REQUIREMENTS

Other details for the establishment and maintenance of the plants including, but not limited to, the need for livestock and traffic control shall be applied as listed on the Practice Requirements sheet.

IX. SPECIAL MEASURES

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

X. CONSTRUCTION OPERATIONS

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits.

The owner, operator, contractor, and other persons shall conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

XI. OPERATION AND MAINTENANCE

The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height.

Remove all foreign debris that hinders system operation.

Limit the traffic and do not use as a roadway.

Limit livestock usage to vegetative growth periods when they will not damage vegetative root system or compact the soil.

Immediately repair any vandalism, vehicular, or livestock damage.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Check all rock riprap sections for accelerated weathering and displacement. Replace to original grades if necessary.

Other items specific to this project are listed on the "Practice Requirement" sheet.

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

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 waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. The minimum 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, "n" values, and recommendations in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-lined Open Channels.

The permissible velocity for waterways lined with vegetation of good cover and with proper maintenance shall not exceed 5 ft./sec. For channels with poor cover and little maintenance, the velocity shall not exceed 3 ft./sec.

Width - 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 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 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.

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.

Protective Armor - When the grade of the waterway for any reach is sufficiently steep to create velocities greater than 5 ft. per sec., a protective armor of a 3-dimensional nylon filament

mat may be used. In these cases the maximum velocities shall not exceed 10 ft./sec. When velocities exceed 10 ft./sec. for any reach, the waterway for that reach shall be designed in accordance with Practice Standard (468) Lined Waterway or Outlet.

Drainage - Designs for sites having prolonged flows, a high water table, or seepage problems shall include NRCS Practice Standard (606) Subsurface Drains, (620) Underground Outlet, stone center drain 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 NRCS Conservation Practice Standard (342) Critical Area Planting.

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

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.

CONSIDERATIONS

The most critical time in successfully installing grassed waterways is when vegetation is being established. Special protection such as mulch anchoring, straw or hay bale dikes, or other diversion methods are warranted at this critical period. Supplemental irrigation may also be warranted. The vegetation should be well established before large flows are permitted in the channel.

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 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.

Water-tolerant vegetation may be an alternative 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.

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

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

Planning

1. The drainage area must be treated adequately against sheet and rill erosion before a grassed waterway is installed to keep sediment from damaging the vegetation and reducing capacity of the grassed waterway.
2. Vegetated waterways perform most dependably in areas where dense stands of sod forming perennial grass can be used that will permit increasing water velocities several feet per second as compared to the bare earth channel. When only shallow rooted annual species can be maintained, safe velocities cannot appreciably exceed those for bare earth. When annual species are the only choice for waterway cover, supporting grade control structures will usually be needed for gully control.
3. Planting should be timed so plants will be established prior to expected runoff. Grassed outlets are easily damaged by continuous flows over long periods. Waterways receiving irrigation tailwater or prolonged trickle flows from snow melt will often require mechanical conveyances of sufficient capacity to contain the low-volume sustained flows.
4. Where irrigation water is available for establishment and maintenance, properly vegetated waterways can often provide esthetically pleasing solutions to erosion control problems for parks, golf courses and other green-belt areas. In such settings the waterways will require protection from

excessive traffic. Turf grasses that will withstand close frequent mowing should ordinarily be used for waterways on non-agricultural land.

5. Waterways require protection from channel flows until the vegetation is fully established and must have continuous protection from damage by vehicular traffic and grazing. Herbicides that would damage the cover must not be used. When temporary berms or dikes are used to keep runoff from entering the waterway during establishment, allow sufficient distance from the waterway edge to accommodate removal without damaging the waterway.
6. Invading pocket gophers can cause excessive damage to waterways if not controlled. Maintenance plans should make provisions for prompt eradication.
7. Waterway shaping must be completed and associated mechanical structures (drops, pipes, permanent sprinkler systems, etc.) installed and inspected for conformance to design before starting vegetative measures.
8. The vegetative species chosen must be compatible with the overall crop management system. This is of special importance when selecting perennial or reseeding type annual species.
9. Annual species used for erosion control should be capable of rapid vigorous establishment and growth. Species should be selected for machine operations minimal and avoid use of equipment when soils are wet.
10. The planting mixture will be in conformance with the Vegetative Guide in Section II-D of the Field Office Technical Guide.
11. When used as a stable outlet for another practice, waterways may increase the likelihood of dissolved and suspended pollutants being transported to surface waters when these pollutants are delivered to the waterway.

Cultural Resources Considerations

NRCS' objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS' objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Water Quantity

This practice is used either to stabilize an active gully or serves as a stable outlet channel for contouring, contour stripcropping, diversions, terraces, rock barriers, water control structures,

hillside ditches, and underground outlets. Since they are usually installed in areas of concentrated flow, their effect on the quantity of ground and surface water is minor. There may be a slight reduction in the peak discharge from the drainage area.

1. Effects on the components of the water budget, especially on volumes and rates of runoff.

Water Quality

This practice may reduce the erosion in a concentrated flow area, such as in a gully or in ephemeral gullies. This may result in the reduction of sediment and substances delivered to the receiving waters. Vegetation may act as a filter in removing some of the sediment delivered to the waterway, although this is not the primary function of a grassed waterway.

Any chemicals applied to the waterway in the course of treatment of the adjacent cropland may wash directly into the surface waters in the case where there is a runoff event shortly after spraying.

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substance carried by runoff.
2. Filtering effects of vegetation on movement of sediment and dissolved and sediment-attached substances.
3. Short-term and construction-related effects on downstream water resources.

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.

Seeding 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 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.

Control noxious weeds.

Do not use as a field road. Avoid crossing with heavy equipment when wet.