



Details for Erosion and Sediment Control After a Fire Event

The following information and details are intended as a companion for LCRA’s “Soil Erosion Control After a Fire Event” document. This document provides additional information for landowners to assess and control erosion and sedimentation after a fire event.

Hydrophobic Soils: In severe, slow-moving fires, the combustion of vegetative materials creates a gas that penetrates the soil profile. As the soil cools, this gas condenses and forms a waxy coating. This causes the soil to repel water - a phenomena called hydrophobicity. This hydrophobic condition increases the rate of water runoff. Percolation of water into the soil profile is reduced, making it difficult for seeds to germinate and for the roots of surviving plants to obtain moisture.

Hydrophobic soils do not form in every instance. Factors contributing to their formation are: a thick layer of litter before the fire; a severe slow-moving surface and crown fire; and coarse textured soils such as sand or decomposed granite. (Finely textured soils such as clay are less prone to hydrophobicity.)

The hydrophobic layer can vary in thickness. There is a simple test to determine if this water repellant layer is present:

1. Place a drop of water on the exposed soil surface and wait a few moments. If the water beads up and does not penetrate the soil then it’s hydrophobic.
2. Repeat this test several times, but each time remove a one-inch thick layer of the soil profile. Breaking this water repellant layer is essential for successful reestablishment of plants.

In addition, freezing and thawing, and animal activity will help break up the hydrophobic layer.

Erosion Control Techniques: If the site evaluation shows that ground cover is lacking, reseeding grass in the severely burned areas is recommended. Remember many plants can recover after fire depending on the severity of the burn. It is important to leave existing vegetation if the plants do not threaten personal safety or property. Hazardous trees in danger of falling should be identified first.

Seed mix for Central Texas: The use of native seed is highly recommended. Non-native species can alter the ecology of an area and alter the natural succession process. The following seed mix can be used for most areas of Central Texas. It contains fast germinating “nurse grasses” as well as succession and climax grasses designed to replicate natural restoration processes. Landowners are encouraged to contact the Natural Resource Conservation Service,



Agricultural Extension Service or a local seed supplier to obtain input on seed mixes to use for specific soil types and moisture conditions.

Dates	Climate	Species (pounds/acre)	
Year Round	Permanent Cool/Warm Season (Native Species)	Purple three-awn (<i>Aristida purpurea</i>)	1.4
		Sideoats grama (<i>Bouteloua curtipendula</i>)	2.0
		Silver bluestem (<i>Bothriochloa laguroides</i>)	6.0
		Buffalograss (<i>Buchloe dactyloides</i>)	1.4
		Canadian wildrye (<i>Elymus Canadensis</i>)	1.4
		Engelmann's daisy (<i>Engelmannia pinnatifida</i>)	0.6
		Green sprangletop (<i>Leptochloa dubia</i>)	2.6
		Mexican hat (<i>Ratibida columnifera</i>)	1.0
		Little bluestem (<i>Schizachyrium scoparium</i>)	1.8
		Indiangrass (<i>Sorghastrum nutans</i>)	1.8
		<u>Texas Wintergrass (<i>Nassella leucotricha</i>)</u>	<u>15.0</u>
		Total	35.0

When broadcasting seeding, the above application rate should be doubled and the area rolled to ensure a good seed/soil contact.

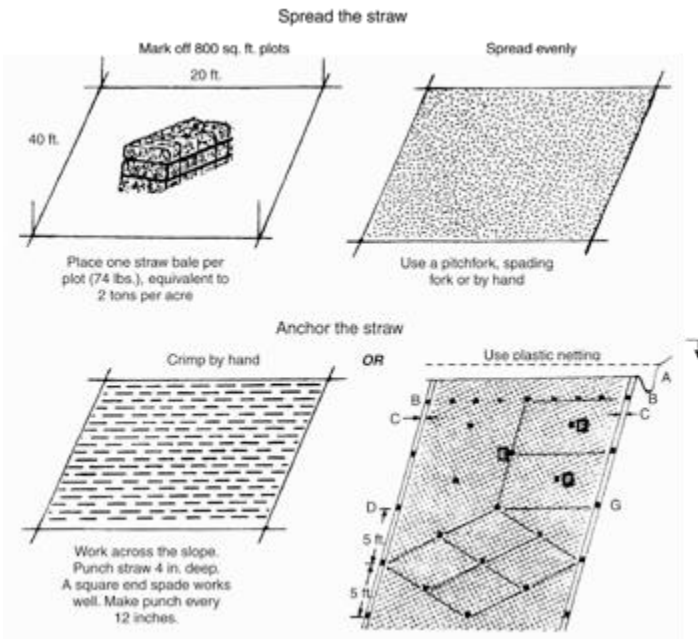
Seeding Tips

1. Roughen the soil surface to provide a better seed bed by breaking through the hydrophobic layer. A steel rake works well for this, or, depending on the slope, a small tractor drawn harrow could be used.
2. Broadcast the seed (a hand cranked seeder works well). Seeding rate depends upon the variety of the seed sown. A good estimate is 10 to 20 pounds per acre of grass seed with another 10 to 15 pounds per acre of the nurse crop. Seed can also be applied with a drill seeder or other mechanized methods. Take care to distribute seed evenly, by sowing fine and large seeds separately or by using a fine seed box when using mechanized seeding.
3. Rake or harrow in 1/4 inch to 3/4 inch deep.
4. If the area is small enough, roll or tamp the seed down to ensure good soil/seed contact.
5. Spread certified, weed-free hay straw. If the area is small, crimp the hay in with a shovel. (This will help keep soil, seed, and mulch in place during wind and rain.)
6. Control weeds as needed by cutting off the flower heads before they can produce seed.
7. Do not use herbicides for broadleaf weed control until after the grass has germinated and developed five leaves.

Weed Control: Weeds are among the first plants to recolonize after a fire. In many instances they are not a problem. However, if the weeds are listed as noxious, they must be controlled. Noxious weeds displace native plants and decrease wildlife habitat, plant productivity and diversity. They can spread downstream or into agricultural areas, resulting in high control costs. Control of noxious weeds is best accomplished through an integrated pest management system that includes chemical, biological, mechanical, and cultural controls.

Mulching: Straw provides a protective cover over seeded areas to reduce erosion and create a suitable environment for revegetation and seed germination. If possible, the straw should be crimped into the soil, covered with plastic netting or sprayed with a tacking agent. If you can only broadcast the straw, do so; it's better to have some coverage than none at all. The straw should cover the entire reseeded section and extend into the undamaged area to prevent wind and water damage. Use only certified weed-free hay straw to avoid spreading noxious weeds.

Straw should be applied to a uniform depth of two to three inches. When applied at the proper density, 20 to 40 percent of the soil surface is visible. One typical square bale will cover about 800 square feet. (Figure 1.)



Spread straw over seeded areas to prevent erosion.

Figure 1. Application of straw to prevent erosion control (graphic courtesy of Natural Resources Conservation Service.)

Hydraulic Mulch

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind. Seed may be added to the mulch for temporary or permanent vegetation. It is not recommended for slopes steeper than 3H:1V or for use in channels unless used in combination with erosion control blankets.

Wood fiber hydraulic mulches are generally short lived and need 24 hours to dry before rainfall occurs to be effective. A second application may be necessary in order to remain effective for an entire rainy season.

This method requires specialized equipment and is usually done by a contractor.

Materials:

- **Hydraulic Mulches:** Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 pounds/acre.
- **Hydraulic Matrices:** Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area: 2,000 to 4,000 pounds/acre wood fiber mulch, and 5 to 10 percent (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)
- **Bonded Fiber Matrix:** Bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 pounds/acre to 4,000 pounds/acre based on the manufacturer's recommendation. A biodegradable BFM is composed of materials that are 100 percent biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Fiber Rolls/Straw Wattles

Fiber Rolls or Straw Wattles consist of straw, coconut fibers, or other similar materials bound into a tight tubular roll. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion. The roll is flexible enough to bend to the contour of the slope. Fiber Rolls must be purchased from an erosion control material supplier.



Fiber Rolls/Straw wattles are used in a similar fashion to log terraces.

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- As check dams in unlined ditches
- Down-slope of exposed soil areas

Limitations:

- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 inch diameter or installations achieving the same protection (i.e. stacked smaller diameter fiber rolls, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Material:

- Core material: Core material should be biodegradable or recyclable. Material may be compost, mulch, aspen wood fibers, chipped site vegetation, agricultural rice or wheat straw, coconut fiber, 100 percent recyclable fibers, or similar materials.
- Containment Mesh: Containment mesh should be 100 percent biodegradable, photodegradable or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or similar material.

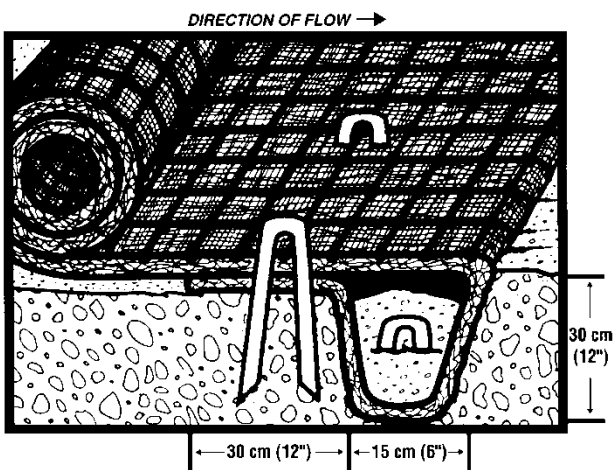
Soil Protection Blankets and Matting

Soil protection blankets and matting material are used as an aid to control erosion in critical areas such as slopes and channels and to assist in the establishment of protective vegetation. Material selection is based on site conditions (slope or channel condition and soil type). See the LCRA Water Quality Management Technical Manual or contact the supplier for assistance in selecting materials.

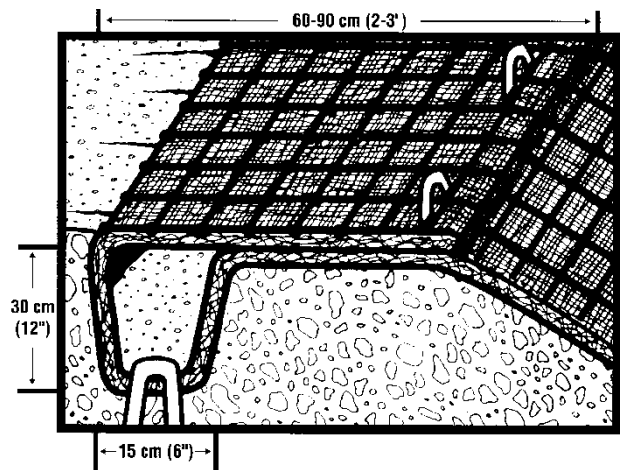
Install blankets per the manufacturer's recommendations. Proper installation of blankets and matting is necessary for these materials to function as intended. Proper anchoring of the material and preparation of the soil are two of the most important aspects of installation.

Notes:

1. Remove clods and rocks more than 1.5 inches in diameter and any foreign material that will prevent contact of the protective mat with the soil surface.
2. Fertilize and seed in accordance with seeding or other type of planting plan.
3. Dig anchor trenches 6 inches wide and 12 inches in depth.
4. Use enough mat to allow a minimum of 2 inch turnover at bottom of trench for stapling, while maintaining the top edge flush with the soil surface.
5. Make sure matting is uniformly in contact with the soil.
6. Secure lap joints and staple (flush with the ground).
7. Inspect blankets and matting weekly and after each rain event (of 0.5 inch or more) to locate and repair any damage. Apply new material if necessary to restore function.
8. Temporary irrigation should be provided. Significant rainfall (on-site rainfall of 0.5 inch or greater per week) may allow watering to be postponed until the next scheduled irrigation.



Initial Anchor Trench for Blankets and Mats



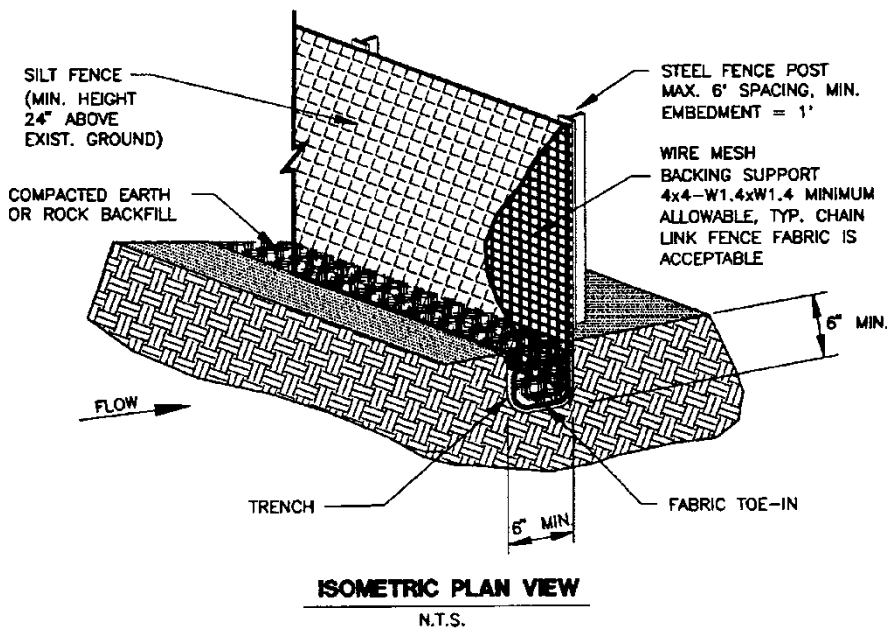
Terminal Anchor Trench for Blankets and Mats

Silt Fence

The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas of a limited extent (maximum contributing drainage area of 2 acres). Silt fence can be purchased at building supply stores or erosion control suppliers.

Notes:

1. Use polypropylene, polyethylene or polyamide woven or nonwoven fabric (36 inches wide, weighing 4 oz/yd) and 2" x 4", 12 gauge minimum woven wire backing.
2. Use steel fence posts, at least 4 feet long, embedded 1-foot deep and spaced not more than 8 feet on center.
3. Toe in the silt fence so that the down-slope face of the trench is flat and perpendicular to the line of flow (6" x 6" trench). Where fence cannot be trenched in (e.g., pavement or rock outcrop), weight fabric flap with 3 inches of pea gravel on uphill side to prevent flow from seeping under fence.
4. Use J-hooks as needed when silt fences cross contour lines to create catchment areas and slow flow velocity. Use J-hooks at downhill fence ends to prevent runoff from escaping around sides. Refer to the J-hook placement detail found below.
5. Inspect silt fences weekly and after each rain event (of 0.5 inch or more) to locate and repair any damage.
6. Remove sediment when buildup reaches 6 inches. Dispose of sediment in a manner that will not cause additional siltation.
7. When revegetation is complete, properly dispose of any sediment buildup and restore the prior location of the silt fence. The fence materials should be disposed of in an approved landfill or reused if in serviceable condition.

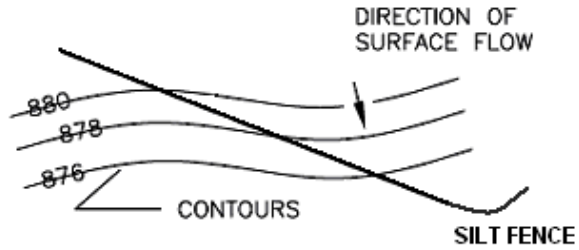
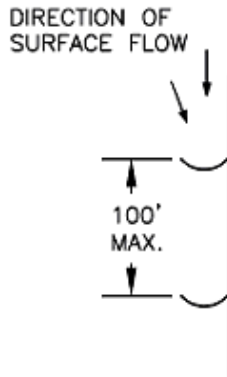


Slope angle	Soil Type		
	Silty	Clays	Sandy
Very steep (1:1)	50 ft.	75 ft.	100 ft.
Steep (2:1)	75 ft.	100 ft.	125 ft.
Moderate (4:1)	100 ft.	125 ft.	150 ft.
Slight (10:1)	125 ft.	150 ft.	200 ft.
Recommended Spacing on Sloping Sites			

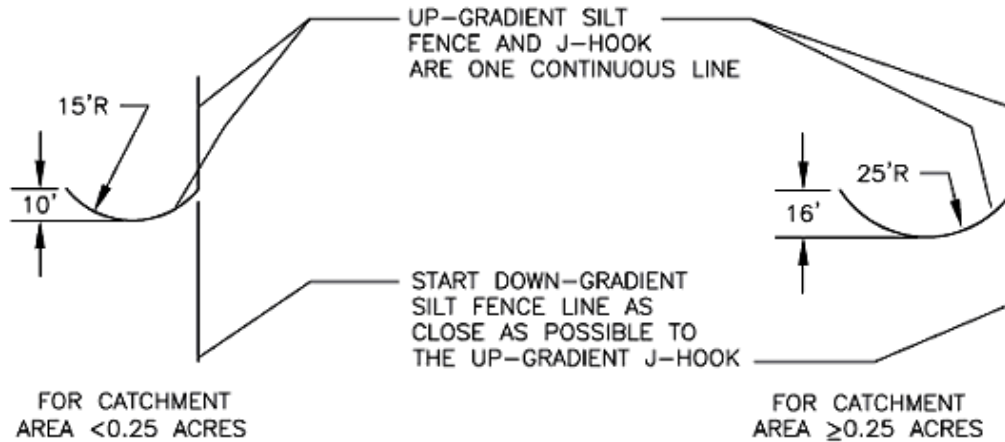
Schematic of a Silt Fence Installation

PLAN VIEW

I. SPACING REQUIREMENTS



II. SIZING REQUIREMENTS:



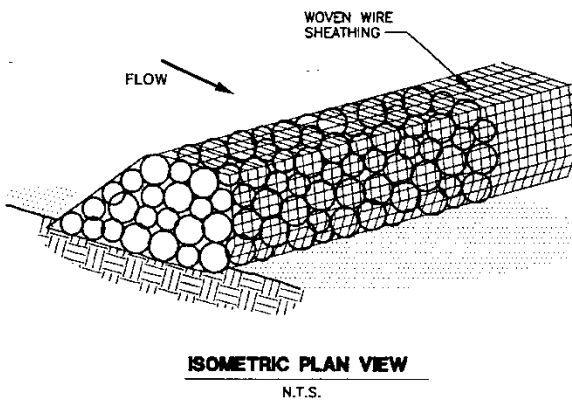
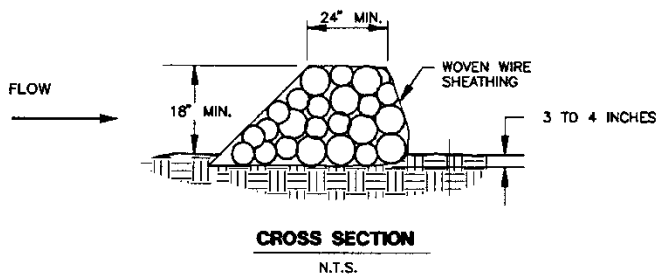
J-hook Placement Details

Rock Berms

The purpose of a rock berm is to serve as a check dam in areas of concentrated flow, or to intercept sediment-laden runoff, detain the sediment and release the water in sheet flow.

Notes:

1. Use clean, open graded 3- to 5-inch diameter rock.
2. Use a woven wire sheathing (maximum opening of 1 inch and a minimum wire diameter of 20 gauge galvanized), and secure with shoat rings.
3. The height should be at least 18" and the top width of at least 2 feet.
4. Install berm along a constant contour and perpendicular to the flow path to prevent runoff from escaping around the sides.
5. Inspect weekly and after each rain event (of 0.5 inch or more) to locate and repair any damage.
6. Remove sediment when buildup reaches 6 inches. Dispose of sediment in a manner that will not cause additional siltation.
7. When revegetation is complete, properly dispose of any sediment buildup. The rock berm should be removed when the site has been revegetated.



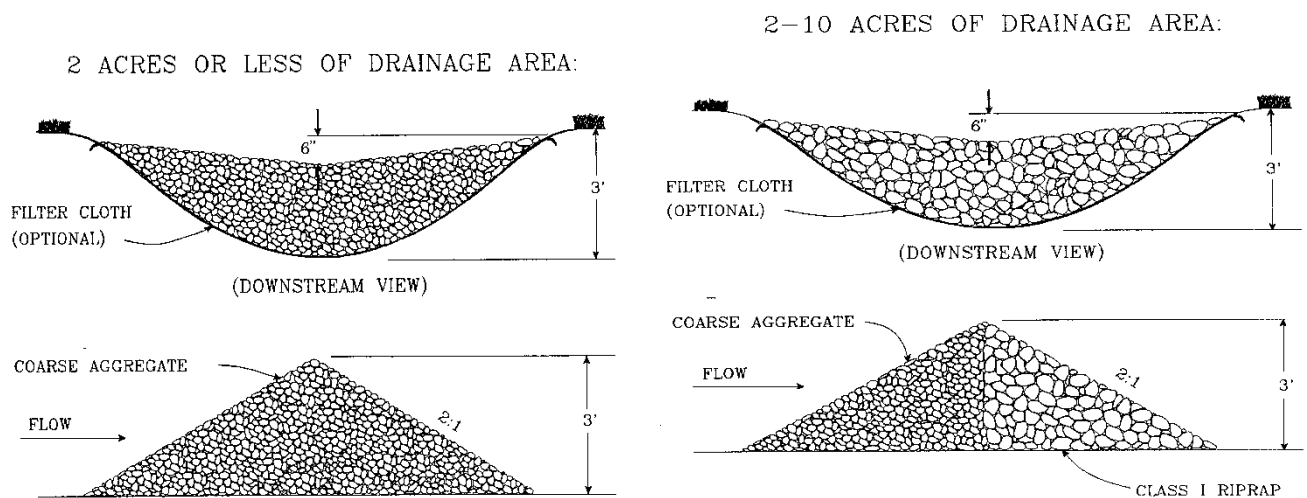
Ditch slope	Spacing
30%	10 ft.
20%	15 ft.
15%	20 ft.
10%	35 ft.
5%	55 ft.
3%	100 ft.
2%	150 ft.
1%	300 ft.
0.50%	600 ft.
Spacing on Channels (rock berm, check dams, Fiber rolls)	

Schematic Diagram of a Rock Berm

Check dams are small barriers consisting of rock or earthen berms placed across a drainage swale or ditch. They reduce the velocity of small concentrated flows, provide a limited barrier for sediment and help disperse concentrated flows, reducing potential erosion.

Notes:

1. Use clean, coarse aggregate for smaller drainage areas; add open graded 3- to 5-inch diameter rock riprap for a more stable structure for larger drainage areas or steeper channels.
2. The dam height should be between 18 and 36 inches and should be keyed into the soil 6 inches.
3. The center of the check dam should be at least 6 inches lower than the outer edges to prevent scour at the ends of the dam.
4. The maximum spacing between the dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
5. Inspect weekly and after each rain event (of 0.5 inch or more) to locate and repair any damage.
6. Remove the sediment when it reaches one half of the original height of the check dam. Dispose of sediment in a manner that will not cause additional siltation.
7. When revegetation is complete, properly dispose of any sediment buildup and restore the prior location of the check dam.
8. Check dams should be removed when the site has been revegetated.



Schematic Diagrams of Rock Check Dams

Contour Log Terraces

Log terraces provide a barrier to runoff from heavy rainstorms. Dead trees are felled, limbed, and placed on the contour perpendicular to the direction of the slope. Logs are placed in an alternating fashion (Figure 2.) so the runoff no longer has a straight downslope path to follow. The water is forced to meander back and forth between logs, reducing the velocity of the runoff, and giving water time to percolate into the soil.

Logs should be 6 to 8 inches in diameter (smaller logs can be used) and 10 to 30 feet long. The logs should be bedded into the soil for the entire log length and backfilled with soil so water cannot run underneath; backfill should be tamped down. Secure the logs from rolling by driving stakes on the downhill side. It is best to begin work at the top of the slope and work down. (It is easier to see how the water might flow by looking down on an area to better visualize the alternating spacing of the logs).



Figure 2. Contour Log Terrace. These barriers are an effective, first-year treatment for hydrophobic soils, low ground cover density, and severely burned areas (graphic courtesy of Natural Resources Conservation Service.)

Fire Break and Fire Lane Erosion Control

When constructing a fire break to contain an approaching wildfire, there is often little time to worry about erosion control. However, it is important to implement erosion control measures after the fire threat has passed.

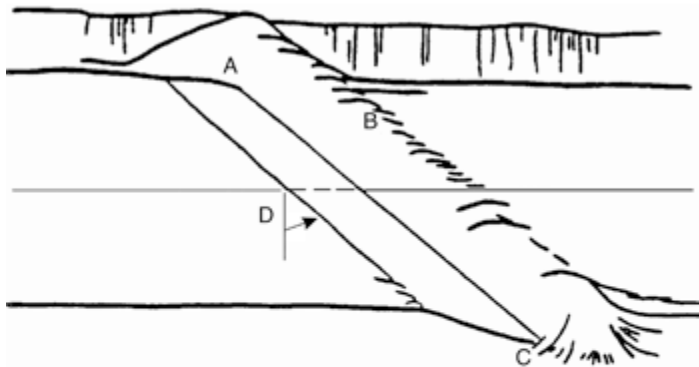
Assess drainage patterns around fire breaks and fire lanes. Windrows that are left after grading fire breaks and fire lanes can redirect runoff and cause increased erosion. Any windrows that redirect or concentrate water should be removed to allow sheet flow to pass over the fire break or lane. If the fire break or lane runs up and down a slope or at an angle to a slope, install water bars at regular intervals.



Water Bars

Water bars are berms of soil or bedded logs that channel water off roads and trails to avoid the creation of gullies. Water bars are angled downslope to the outlet side. These bars can divert water to a vegetated slope below or redirect it to a channel that will take it to a culvert. A rock berm, check dam, or fiber roll can be used to spread flow if no vegetation is present. On-site soils and the road grade will dictate spacing.

Waterbar –
Top view



- A. Bank tie-in point; cut 6 inches to 1 foot into the roadbed.
- B. Cross drain berm height 1 to 2 feet above the roadbed.
- C. Drain outlet cut 8 inches to 16 inches into the roadbed.
- D. Angle drain 30 to 45 degrees downgrade with road centerline.
- E. Up to 2 feet in height.
- F. Depth to 18 inches.
- G. 3 to 4 feet.

Waterbar –
Cross-section

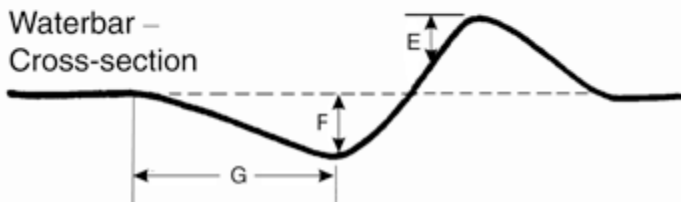


Figure 3. Water bar construction for forest or ranch roads with little or no traffic. Specifications are average and may be adjusted to site conditions.