Mulches, Blankets and Mats

Description

These practices involve the application of organic materials to form a temporary, protective soil cover. They can be implemented as a pre-made blanket or applied loose as a mulch. Organic mulches, hydraulically applied mulches, erosion control blankets, and turf-reinforcement mats (TRMs) are discussed in the following sections. When selected and applied correctly, they are the most effective, practical means of controlling runoff and erosion on disturbed land prior to vegetation establishment.

Erosion-control blankets and TRMs, are especially useful in critical areas, such as swales, long channels and slopes steeper than 3:1. Various types of netting materials are also available to anchor organic mulches.

Timely establishment of a good stand of vegetation is critical for limiting soil erosion and for the effectiveness of most BMPs. Therefore, at a minimum, all newly seeded areas should be covered with disc-anchored mulch.

Advantages

- Effective for controlling erosion and stabilizing soil during and after land alteration activities.
- Foster the growth of vegetation, reduce evaporation, insulate the soil, and suppress weed growth.
- Protect the soil surface from the forces of raindrop impact and overland flow.

Purpose

Water Quantity	
Flow attenuation	**N/A**
Runoff volume reduction	**N/A**
Water Quality	
Pollution prevention	
Soil erosion	■
Sediment control	■
Nutrient loading	■
Pollutant removal	
Total suspended sediment (TSS)	◧
Total phosphorus (P)	◧
Nitrogen (N)	□
Heavy metals	□
Floatables	□
Oil and grease	□
Other	
Fecal coliform	□
Biochemical oxygen demand (BOD)	□

■ Primary design benefit
◧ Secondary design benefit
□ Little or no design benefit

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- Reduce flow velocities.
- Reduce soil moisture loss.
- Prevent crusting and sealing of the soil surface.
- Moderate soil temperatures.
- Provide a suitable microclimate for seed germination.
- May increase infiltration.

Limitations

- Mulch, erosion control blankets, TRMs must be selected and installed properly to be effective.
- Mulching may not be effective on slopes greater than 3:1.

Requirements

Design

Organic Mulch

Organic mulches, such as straw and wood fiber, have been found to be very effective in preventing soil erosion.

Wood Fiber

Bark chips and shredded bark by products of timber processing often are used as landscape mulches. They may be applied by hand or with a mulch blower. Wood fiber mulch should consist of raw hard or soft timber that has been run through a mechanical chipper, hammermill or tub grinder. The wood should be substantially free of mold, dirt, sawdust and foreign material and not be in an advanced state of decomposition. Mulch should not contain chipped manufactured boards or chemically treated wood, such as waferboard, particleboard and chromated copper arsenate (CCA) or penta-treated wood.

Do not use materials that may contain competing weed and grass seeds. Decomposition of some wood products can tie up significant amounts of soil nitrogen, making it necessary to modify fertilization rates or to add fertilizer with the mulch.

Straw Mulch

The mulch material may be disc-anchored into the soil, hydraulically bonded, or covered with netting and stapled.

The choice of materials and anchoring of mulches should be based on slope steepness and length, soil conditions, season, type of vegetation, and size of the area. A properly applied and stabilized mulch is always beneficial for site stabilization.

Straw is the mulch most commonly used in conjunction with seeding. The straw should generally come from wheat or oats (“small grains”), but other sources may be specified. Mulch may be spread by hand or with a mulch blower. Straw may be lost to wind and must be chemically or mechanically anchored to the soil immediately after it is spread.

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Anchoring Straw Mulch

The following methods of anchoring mulch may be used:

- A mulch-anchoring tool: is a tractor-drawn implement designed to punch mulch into the soil. A mulch-anchoring tool provides maximum erosion control with straw.
- A regular farm disc, weighted and set nearly straight, may be used instead, but it will not do a job comparable to the mulch-anchoring tool.
- The disk should not be sharp enough to cut through the straw. These methods are limited to slopes no steeper than 3:1, where equipment can operate safely.
- Operate machinery on the contour.

Mulch and Tackifiers

A hydro mulch is a processed material that, when mixed with water, can be applied in a continuous stream. Hydraulic mulches vary in type, composition and additives, and range from light- to heavy-duty. They are intended to form a mat-like barrier that controls water- and wind-induced erosion. Although an infinite number of application rates could be used, one or two rates are generally specified. One rate is the blanket equivalent rate required for erosion control, usually between 3,000 and 4,000 pounds per acre, depending on manufacture recommendation for percent slope and length. The other rate, generally half the erosion blanket control rate, is especially useful for enhancing seed germination and soil stabilization on 6:1 or flatter slopes. The ratios of wood fiber and recycled newsprint that make up light-duty hydraulic mulch may vary.

These types of fiber mulch are typically used as hydro-mulch:

- *Bonded Fiber Matrix*. A bonded fiber matrix refers to a continuous layer of elongated wood fiber strands that are held together by a water-resistant bonding agent to form a water-absorbing crust. When properly dried, this acts as an erosion-control blanket. This mulch is applied with a mechanically agitated pumping machine (hydroseeder). Bonded fibers work in a wide range of applications, but are particularly suited for more difficult sites. Properly applied, bonded fiber matrices can provide excellent erosion protection and revegetative support.
- *Wood Fiber Mulch.* When sprayed on the soil, the virgin wood fibers and tackifier that comprise this biodegradable mulch form a blotter-like cover that readily absorbs water and allows infiltration to the underlying soil. Wood fiber mulch should be made entirely from whole wood chips, and not contain recycled materials, such as sawdust or pulverized newspaper, or any substances that inhibit germination or growth. The fibers should be colored with a dye to aid in visual metering when the mulch is applied hydraulically.
- *Blended Mulch.* This mulch consists of specially prepared, biodegradable, shredded paper particles, wood fibers and tackifier. The blend should contain a wetting agent, deforming agent, and nontoxic dyestuff that will impart a bright green or blue color to aid in visual metering during application. Blended mulches are available in several wood-fiber-to-paper ratios; most common is 70:30 or 50:50.

Tackifiers

Tackifiers are necessary to hold fibers together and to keep them from washing or blowing away. Primary tackifier types include:

Design Requirements (continued)

- *Latex Base.* The components for the latex-base adhesive should meet the following requirements. The composition, by weight, of the latex emulsion polymer should be 48 percent styrene, 50 percent butadiene, and 2 percent additive; 42 to 46 percent solids; and a pH, as shipped, of 8.5 to 10.0. The emulsion should not be allowed to freeze or be exposed to sunlight for a prolonged period.
- *Guar Gum*. Guar gum tackifiers should consist of a minimum of 95 percent guar gum by weight; the remainder should consist of dispersing and cross-linking additives.
- *Other Tackifiers.* Other tackifiers include, but are not limited to: water-soluble natural vegetable gums blended with gelling and hardening agents, or a water-soluble blend of hydrophilic polymers, viscosifiers, sticking aids and other gums.

Construction

- Spraying of hydro mulch should not be performed during windy conditions, which would prevent the proper placement. The contractor should protect all traffic, signs, structures and other objects from being marked or disfigured by the mulch/tackifier material. The tackifiers specified should be applied at the manufacturer's recommended rate.
- Wood fiber mulch should be applied with hydraulic spray equipment in a water slurry at a minimum of 2,000 lb per acre for flatter slopes, and up to 3,500 to 4,000 pounds per acre in critical areas where the potential for erosion is high. The tackifier can be premixed by the manufacturer, or can be added in the field. The tackifier should comprise 2 to 5 percent by weight.
- Blended mulches are normally not intended for use on critical areas with high erosion potential. They are an excellent germination medium, and should be considered on flatter slopes and hard-to-reach areas. Tackifier can be premixed by the manufacturer at 2 to 5 percent by weight or can be added in the field.
- The use of wood fiber mulch in combination with straw has been found to be very effective. Typically the straw mulch is blown onto the surface at a rate of 1.5 tons per acre and immediately oversprayed with wood fiber mulch at 500 lb per acre.
- The wood fiber mulch should have tackifier added at 2.5 to 5 percent by weight. Seeding and fertilizing should be done prior to mulching. Disk-anchoring is not required with this practice, which makes this an ideal alternative for hard-to-reach areas where disk-anchoring is not possible.
- A tackifier is a chemical binder that secures mulch to soil. Application of tackifier should be heaviest at the edges of areas and at crests of ridges and banks, to resist wind.
- The tackifier should be applied uniformly to the rest of the area. A tackifier may be applied after the mulch has been spread or it may be sprayed into the mulch as the mulch is being blown onto the soil.

Erosion Control Blankets or Fabrics

Erosion-control blankets are biodegradable, open-weave blankets used for establishing and reinforcing vegetation on slopes, ditch bottoms and shorelines. Several categories (MnDOT Section 3885) are provided with different service application and specific uses as shown in Table 1.

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Category	Service Application	Use	Acceptable Types
1	Very Temporary	Flat areas, shoulder drain outlets, roadway shoulders, lawns, mowed areas.	Straw, wood fiber, rapidly degradable netting on one side
2	One Season	Slopes 1:3 and steeper less than 50 ft long, ditches with gradients 2% or less, flow velocities less than 5.0 fps.	Straw, wood fiber, netting on one side
3	One Season	Slopes 1 vertical:3 horizontal and steeper, more than 50 ft long, ditches with gradients 3% or less, flow velocities less than 6.5 fps.	Straw, wood fiber, netting on two sides
4	Semipermanent	Ditches with gradients 4% or less, flow velocities less than 8.0 fps, flow depth 6 inches or less.	Straw/coconut, wood fiber, netting on two sides
5	Semipermanent	Ditches with gradients 8% or less, flow velocities less than 15.0 fps and flow depth less than 8 inches, watercourse banks within the normal flow elevation.	Coconut fiber, netting on two sides

Table 1 Fabric Categories
Source: MPCA 2000.

- Category 1 is a temporary fabric used on flat areas, and around drain outlets and consists of straw and/or wood fiber with rapidly degradable netting on one side.
- Category 2 is suitable for one season use on slopes of 1:3 and steeper that are less than 50 feet long. Category 2 typically consists of straw and/or wood fiber with netting on one side.
- Category 3 is suitable for one season use on slopes of 1:3 and steeper and more than 50 feet. Category 3 typically consists of straw and/or wood fiber with netting on two sides.
- Category 4 is used for semipermanent applications on ditches with gradients 4% or less and flow velocities less than 15 fps. Category 4 typically consists of straw/coconut and wood fiber with netting on two sides.
- Category 5 is used for semipermanent applications on ditches with gradients 8% or less and flow velocities less than 15 fps. Category 5 typically consists of coconut fiber with netting on two sides.

Fiber Material. Erosion-control blankets should consist of a uniform web of interlocking fibers with net backing. The blanket should be of uniform thickness, with the material fibers being evenly distributed over the area of the blanket. The blankets should be porous enough to promote plant growth yet shield the underlying soil surface from erosion. All material should have been properly cured to achieve curled and barbed fibers. All blankets should be smolder resistant.

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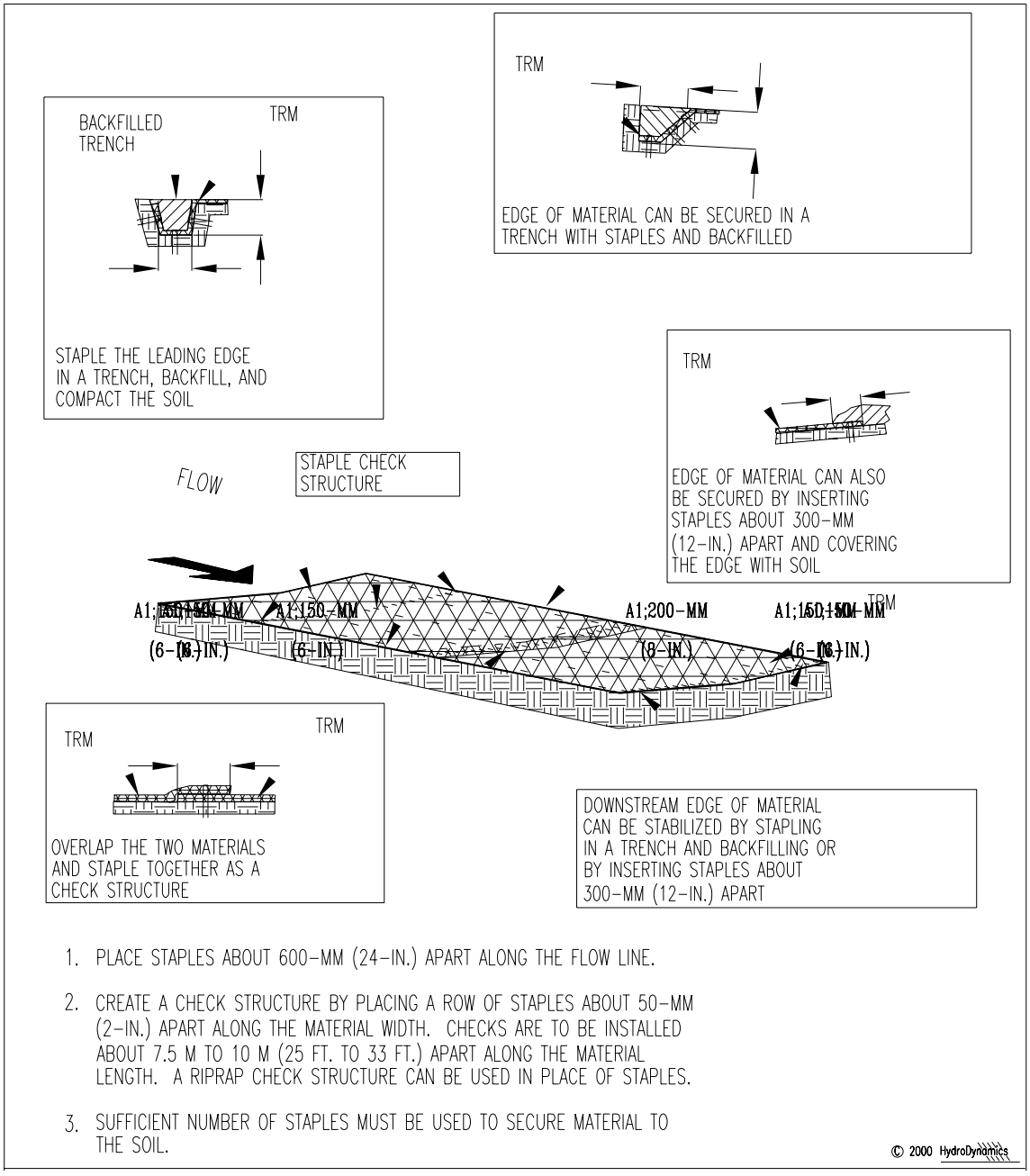

Figure 1: Installing an Erosion Control Blanket in a Drainage Channel
Source: Hydrodynamics, Inc. in Fifield, 1999

Mulches, Blankets and Mats

Requirements

Design (continued)

Net Backing. The net backing on each blanket should consist of polypropylene mesh. For Category 1 blankets, the net backing should start to decompose after one month with 80% breakdown occurring within three months. For Category 2 and 3 blankets, the netting should contain sufficient UV stabilization for breakdown to occur within a normal growing season. For Category 4 and 5 blankets, the netting should be UV stabilized to provide a service life of two to three years.

- A netting is often used to keep straw mulch in place until vegetation becomes established. Synthetic net is most used, but jute nets are useful in channel and critical-area stabilization. Nets should be biodegradable, and degrade within six months.
- Nets are not designed to provide moisture-conservation benefits or erosion protection. Therefore, they are used in conjunction with organic mulches, such as straw. In critical areas, netting should always be installed over the mulch. Hydraulic mulches, such as wood fiber, may be sprayed on top of an installed net. Install netting and matting in accordance with the manufacturer's instructions.

Construction

In areas with concentrated flow, mulch materials should be applied as follows:

- Lay mat parallel to the direction of water flow with netting on top. Spread blankets evenly without stretching so fibers are in direct contact with the soil. Adjacent strip edge shall be overlapped 2-4 inches. Strip ends should overlap a minimum of 10 inches with the upgrade strip on top.
- The upslope end of each blanket should be buried at least 6 inches in a vertical trench with the soil pressed firmly against the embedded mat. Additional check trenches at 50 feet or less intervals may be desirable on steep grades or long flow areas.
- Strip ends and end overlaps should be stapled with not more that 12 inches between staples. All other joints and edges should be stapled at 4-foot intervals. Additional staples should be placed down the center of each blanket in a diamond pattern at a maximum of 4-foot intervals.
- Where velocities exceed 5 cfs place edge and center staples at 2-foot intervals. All staples should be inserted flush with the ground surface. Staples should be 11 gauge or heavier with a 1-2 inch crown. Staple length should be determined by soil condition as follows: Highly compacted soils - 6 inches; friable soils - 8 inches; loose and sandy soils - 10 inches.

In areas with broad sheet flow, mulch materials should be applied as follows:

- Mats may be placed either parallel or perpendicular to slope direction. Spread blankets evenly without stretching so fibers are in direct contact with the soil. Adjacent strip edges shall be overlapped 2-4 inches with upgrade strip on top.
- Ends of each mat should be stapled with not more than 12 inches between staples. All other edges and mat centers should be stapled to hold the mat in place with not more that 4-6 feet between staples. All staples should be inserted flush with the ground surface. Staples should be 11 gauge or heavier, U-shaped with 1-2 inch crown. Staple length should be determined by soil conditions discussed above.

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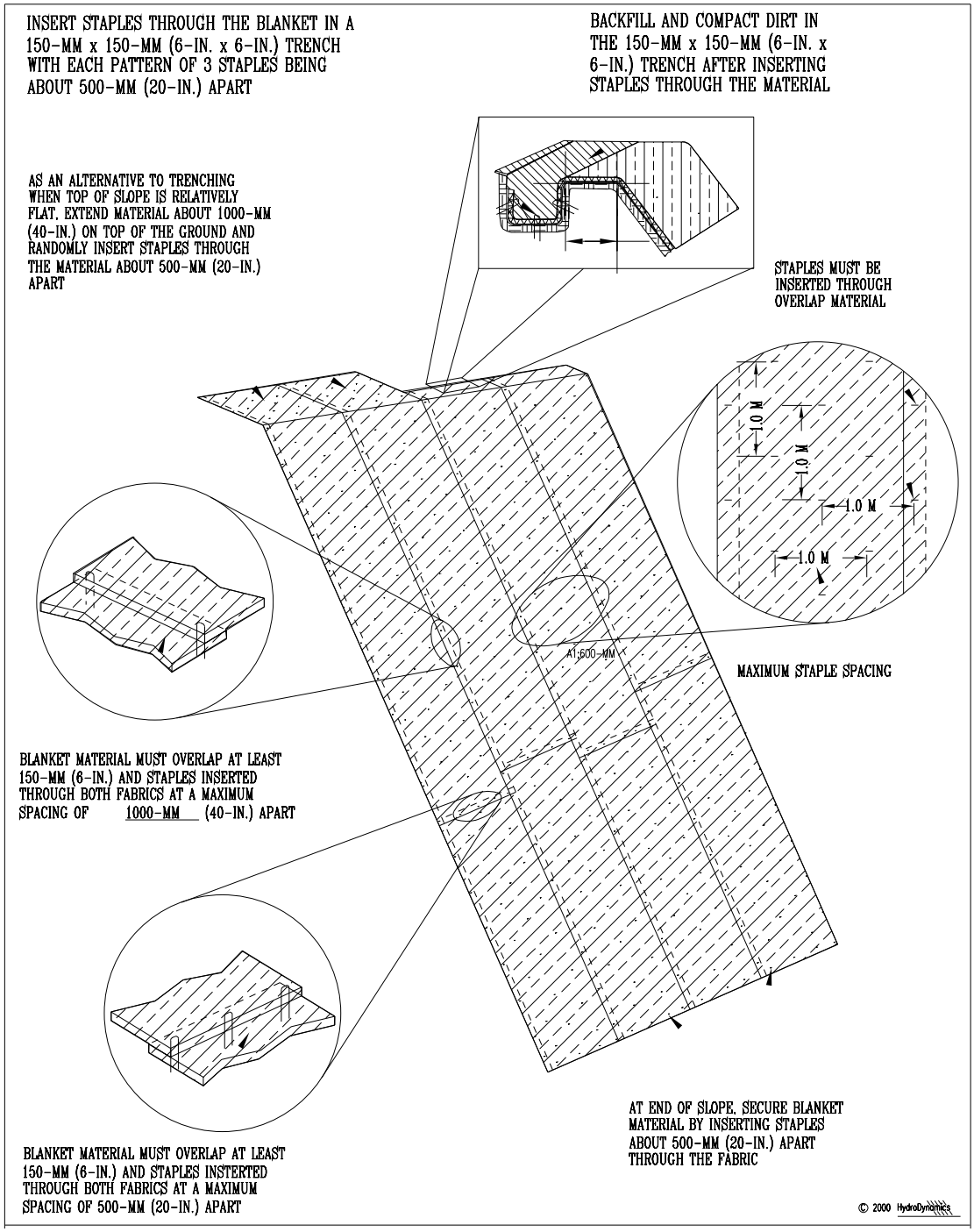

Figure 2: Installing an Erosion Control Blanket on a Hillside
Source: Hydrodynamics, Inc. 1999

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Requirements Construction (continued)

- Staples used to anchor Category 1 and 2 blankets should be U shaped, 11 gauge or heavier steel wire having a span width of 1 inch and a length of 6 inches or more from top to bottom after bending. Staples used to anchor Category 3 and 4 and 5 blankets should have a minimum length of 8 inches.

Turf-Reinforcement Mats (TRMs)

Turf-reinforcement mats (TRMs) are synthetic, nondegradable mats that are usually buried to add stability to soils. They come in a wide range of designs and have been proven to be valuable on slopes and in channel-lining applications.

- TRMs are designed to be permanent and often are filled with soil and vegetated when installed.
- Turf-reinforcement matting consisting of nondegradable, three-dimensional matrix materials should be used with expected velocities of 15 fps and shear stress of 8 lb/ft 2 . Beyond these velocities and shears, vegetated structures such as articulated block, cable concrete and cribwalls, should be considered.
- A TRM may have a biodegradable component intermixed with the synthetic portion to aid plant establishment.

Construction

- Once finish grade is established, the area should be seeded, the TRM installed and, if appropriate, immediately filled with topsoil, and then seeded.
- The finish surface is normally seeded and covered with an erosion-control blanket or hydraulically applied mulch to keep the soil from eroding and aid in germination of a permanent stand of vegetation.
- TRMs are installed in a variety of ways. Follow the manufacturer's recommendations for specific applications.

Maintenance

- Inspect all mulches and erosion control fabrics periodically, and after rainstorms to check for rill erosion, dislocation or failure. Where erosion is observed, apply additional mulch or repair fabric.
- Continue inspections until vegetation is established.
- If washout occurs, repair the slope grade, reseed and reinstall mulch. Continue inspections until vegetation is firmly established.

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Sources

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