VEGETATIVE PRACTICES

Buffer Zone – BF

DEFINITION

A strip of undisturbed, original vegetation, enhanced or restored existing vegetation, or the re-establishment of vegetation surrounding an area of disturbance or bordering streams, ponds, wetlands, or lakes.

PURPOSE

To provide a buffer zone which can filter and infiltrate runoff, reduce storm runoff velocities, protect channel banks from scour and erosion, provide flood protection, cool rivers and streams by creating shade, provide food and cover for wildlife and aquatic organisms, reduce construction noise, and improve aesthetics on the disturbed land. See Figure 1 and Table 1.

CONDITIONS

A natural strip of vegetation should be preserved and, if needed, supplemented to form the buffer zone. There are two types of buffer zones.

General Buffers: A strip of undisturbed, original land adjacent to the disturbed site provides a general buffer. It is useful to filter and infiltrate runoff, and also to reduce construction noise. General buffers may be enhanced to achieve desired goals.

Vegetated Riparian Buffers: Buffers bordering streams are critical due to their protection of streams from sedimentation through filtration and bank stabilization. Riparian buffers are also useful in cooling rivers and providing food and cover for wildlife. In most cases, the buffer zone will be incorporated into the permanent

Riparian Buffer Zone

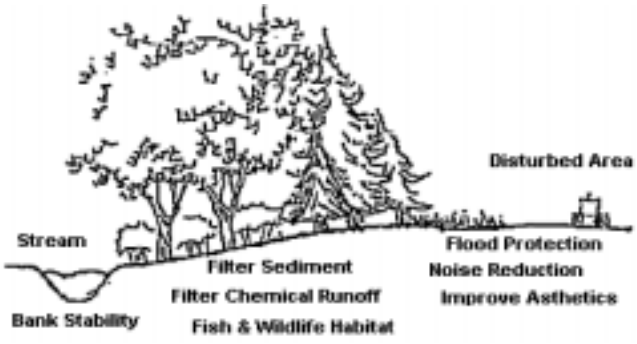


Figure 1

vegetative stabilization. Refer to specification **Disturbed Area Stabilization (With Permanent Vegetation) - PS.**

Effectiveness of Vegetative Buffer Strips

Purpose	Grass	Shrub	Tree
Filter Sediment	High	Low	Low
Filter Chemicals	Medium	Low	Low
Stabilize Stream Banks	Low	High	High
Improve Aesthetics	Medium	Medium	High
Improve Habitat	Medium	Medium	High
Reduce Noise	Low	Medium	High
Intercept Rainfall	High	High	High
Infiltrate Runoff	High	Medium	Medium

Table 1

DESIGN SPECIFICATIONS

Important design factors such as slope, hydrology, width and structure shall be considered.

General Buffers: A width should be selected to permit the zone to serve the purpose(s) stated above. Supplemental plantings may be used to increase the effectiveness of the buffer zone.

Vegetated Riparian Buffers: The structure of vegetated riparian buffers should be considered to determine if the buffer must be enhanced to achieve the necessary goals. The size of the stream as well as the topography of the area must be considered to determine the appropriate width of the vegetated stream buffer. A vegetated stream buffer of 50 feet is suggested for flat lying areas. The buffer should be increased 2 feet in width for every 1% of slope (measured along a line perpendicular to the stream bank).

Unless undisturbed vegetation is left in place and used as the buffer, a constructed, multipurpose riparian buffer should be created consisting of three zones:

- Zone 1 The first 20 feet nearest the stream should consist of trees and shrubs spaced 6-10 feet apart to provide stabilization of the bank deep into the soil.
- Zone 2 The next 10 feet should consist of managed forest for chemical absorption and wildlife habitat.
- Zone 3 The upper 20 feet should be comprised of grasses for sediment and chemical capture.

This general multipurpose design contains trees and shrubs that help to stabilize stream banks and grasses which spread and reduce the flow from adjacent areas as well as increase settling and infiltration. If the ideal vegetated buffer width cannot be achieved; narrower buffers can still be used to obtain the goals of bank stabilization and riparian habitat. If this is the case, several design principals should be considered:

- Sheet flow should be encouraged at the disturbed edge of the vegetated stream buffer.
- The structure of the buffer should consist of understory and canopy species.
- The width should be proportional to the watershed area and slope.
- Native and non-invasive plant species should be used.
- Density must be considered to determine if the existing buffer must be enhanced to achieve the necessary goals. Vegetation must be dense enough to filter sediment and provide detrital nutrients for aquatic organisms.

Stream bank stabilization techniques may be required if steep slopes and/or hydrologic patterns deem it necessary. Refer to specification **Bioengineered Stream Bank Stabilization - SBS.** Vegetated stream buffers on steep slopes may need to be wider to effectively filter overland flow. Corridors subject to intense flooding may require additional stream bank stabilization measures.

PLANTING TECHNIQUES

Plantings for buffer reestablishment and enhancement can consist of bare root seedlings, container grown seedlings, container grown plants, and balled and burlapped plants. Standard permanent erosion control grasses and legumes may be used in denuded areas for quick stabilization. Refer to specification **Disturbed Area Stabilization (With Permanent Vegetation) - PS.**

Soil preparation and maintenance are essential for the establishment of planted vegetation.

MAINTENANCE

Areas closest to the stream should be maintained with minimal impact.

Watering: During periods of drought as well as during the initial year, watering may be necessary in all buffer areas planted or seeded for enhancement.

Replanting: It is imperative that the structure of the vegetated stream buffer be maintained. If the buffer has been planted, it is suggested that the area be monitored to determine if plant material must be replaced. Provisions for the protection of new plantings from destruction or damage from beavers or other damaging pests should be incorporated into the plan.

Disturbed Area Stabilization (With Mulch) – MU

DEFINITION

Applying hay, straw, mulch, plant residues, or other suitable materials, produced on the site if possible, to the soil surface.

PURPOSE

- To reduce runoff and erosion
- To conserve moisture
- To promote germination of seed
- To prevent surface compaction or crusting
- To protect seed from birds
- To modify soil temperature
- To increase biological activity in the soil

CONDITIONS

Mulch may be used to promote vegetation germination and growth during a vegetative stabilization practice, or may be used as a temporary stabilization measure on its own where seed may not germinate due to temporary conditions.

CONSTRUCTION SPECIFICATIONS

Mulching Without Seeding: This standard applies to cleared areas where seed may not have a suitable growing season to produce an erosion-retardant cover, but can be stabilized with a mulch cover. Mulch can be used as an erosion control device for up to six months, but it shall be applied at the appropriate depth (depending on the material used), anchored, and have a continuous 95% cover or greater of the soil surface. Maintenance is required to maintain 95% cover.

Mulching With Seeding: Mulch should be applied when seeding for vegetation stabilization. It significantly assists germination by protecting the seed from birds, by holding moisture at the surface of the soil, and by reducing soil surface temperature. Mulch applied to seeded areas shall achieve 75% soil cover.

Site Preparation: Consider these factors when preparing to use mulch:

1. Grade to enable the use of equipment for applying and anchoring mulch.

2. Install best management practices as required such as diversions, terraces, and/or sediment barriers.

3. Loosen compacted soil to a minimum depth of 4 inches if using mulch while seeding.

Mulching Materials: Select one of the following materials and apply at the rate indicated:

1. Dry straw or hay shall be applied at a rate that provides 95% or greater soil coverage.
2. Wood waste (chips, sawdust or bark) shall be applied at a rate that provides 95% or greater soil coverage. **Organic material from the clearing stage of development should remain on site, be chipped, and applied as mulch.** This method of mulching can greatly reduce erosion control costs. This method should not, however, be used in conjunction with seeding due to soil acidification and nitrogen reduction problems that the decomposition of the "green" material will produce.

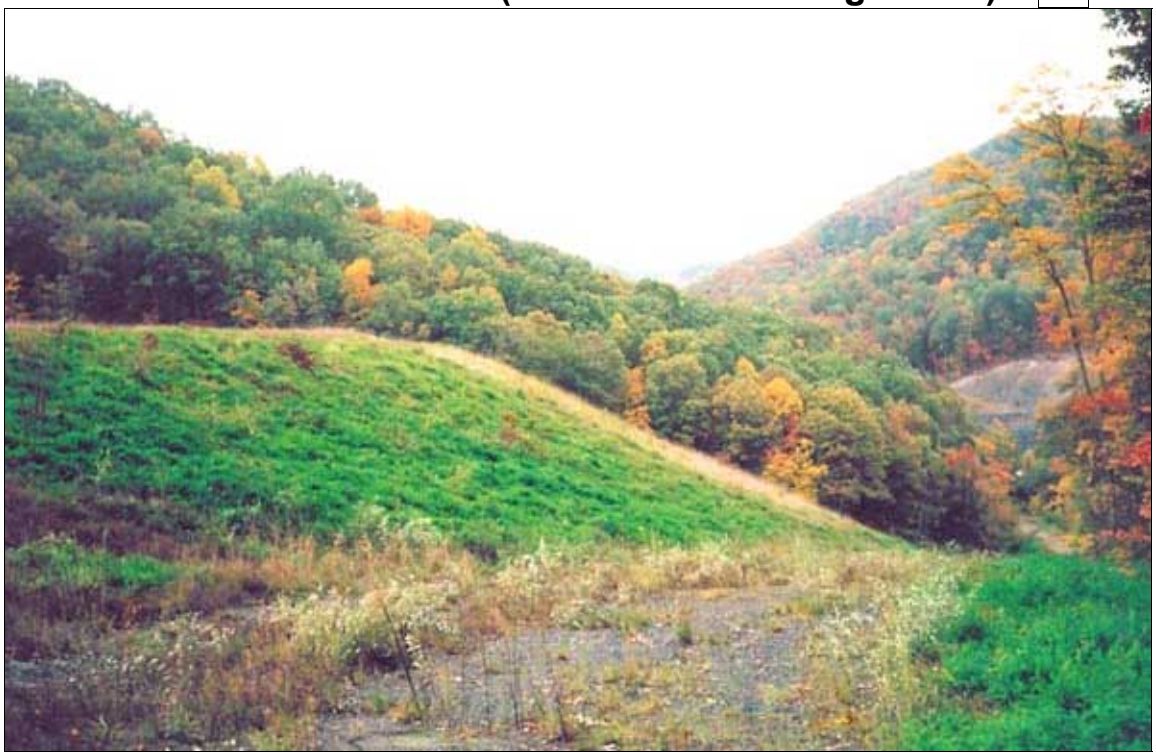
Anchoring Mulch: Anchor straw or hay mulch immediately after application by one of the following methods:

1. Emulsified asphalt can be (a) sprayed uniformly onto the mulch as it is ejected from the blower machine or (b) sprayed on the mulch immediately following mulch application when straw or hay is spread by methods other than special blower equipment. The combination of asphalt emulsion and water shall consist of a homogeneous mixture satisfactory for spraying. The mixture shall consist of 100 gallons of emulsified asphalt and 100 gallons of water per ton of mulch. Care shall be taken at all times to protect state waters, the public, adjacent property, pavements, curbs, sidewalks, and all other structures from asphalt discoloration.
2. Hay and straw mulch may be pressed into the soil immediately after the mulch is spread. A special "crimper" or disk harrow with the disks set straight may be used. Serrated discs are preferred and should be 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disks shall be dull enough to press the mulch into the ground without cutting it, leaving much of it in an erect position. Mulch should not be plowed into the soil.
3. Synthetic tackifiers or binders may be applied in conjunction with or immediately after the mulch is spread. Synthetic tackifiers should be mixed and applied according to manufacturer's specifications. Refer to specification **Tackifiers and Binders - TB**.

MAINTENANCE

Inspection of the application should be performed along with other regularly scheduled erosion and sediment control inspections. Any areas that have washed out due to high storm water flows should be reconsidered for different BMP use, or at least retreated. Areas that have been disturbed by blowing wind should be retreated. Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified.

Disturbed Area Stabilization (With Permanent Vegetation) – PS



DEFINITION

The planting of perennial vegetation such as trees, shrubs, vines, grasses, or legumes on exposed areas for final permanent stabilization. Permanent perennial vegetation shall be used to achieve final stabilization.

PURPOSE

- To reduce storm water runoff velocity
- To maintain sheet flow
- To protect the soil surface from erosion
- To promote infiltration of runoff into the soil
- To improve wildlife habitat
- To improve aesthetics

CONDITIONS

Permanent perennial vegetation is used to provide a protective cover for exposed areas including cuts, fills, and other denuded areas that will not be regraded. Permanent stabilization should be applied where topsoil was never stripped, or has been returned and incorporated into the soil surface.

PLANNING CONSIDERATIONS

1. When stripping a site, topsoil should be stockpiled for later use.
2. Stockpiled topsoil should be stabilized using temporary vegetation. Refer to specification **Disturbed Area Stabilization (With Temporary Vegetation) - TS.**
3. Where a suitable planting medium is not present, topsoil shall be imported and incorporated into the site.
4. Block sod provides immediate cover. It is especially effective in controlling erosion adjacent to concrete flumes and other structures. Refer to specification **Disturbed Area Stabilization (With Sod) - SO.**
5. When mixed plantings are done during marginal planting periods, companion crops shall be used.
6. No-till planting can be effective when planting is done following a summer or winter annual cover crop.
7. Irrigation should be used when the soil is dry or when summer plantings are done.

8. Low maintenance plants, as well as native species, should be used to ensure long-lasting erosion control.
9. Wildlife plantings should be included when applicable.

Wildlife Plantings: Commercially available plants beneficial to wildlife species include the following:

Mast Bearing Trees: Beech, Black Cherry, Blackgum, Chestnut, Oak, Hackberry, Hickory, Locust, and Persimmon.

Trees that produce nuts or fruits are favored by many game species.

Shrubs and Small Trees: Bayberry, Bicolor Lespedeza, Crabapple, Dogwood, Huckleberry or Native Blueberry, Mountain Laurel, Rhododendron, Native Holly, Red Cedar, Red Mulberry, Sumac, Wax Myrtle, Wild Plum and Blackberry. Plant shrubs in patches without tall trees to develop stable shrub communities. All produce fruits used by many kinds of wildlife, except for lespedeza, which produces seeds used by quail and songbirds.

CONSTRUCTION SPECIFICATIONS

Grading and Shaping: Grading and shaping may not be required where hydraulic seeding and fertilizing equipment is to be used. Vertical banks shall be sloped to enable plant establishment.

When conventional seeding and fertilizing are to be done, grade and shape the slope, where feasible and practical, so that equipment can be used safely and efficiently during seedbed preparation, seeding, mulching and maintenance of the vegetation.

Concentrations of water that could cause excessive soil erosion should be diverted to a safe outlet. Diversions and other treatment practices must conform to the appropriate standards and specifications set out in this handbook.

Plant Selection: Refer to Table 1 for suggested species. Plants should be selected on the basis of species characteristics, site and soil conditions, planned use and maintenance of the area; time of year of planting, method of planting; and the needs and desires of the land user.

Plant selection may also include annual companion crops. Annual companion crops should be used only when the perennial species are not planted during their optimum planting period. Care should be taken in selecting companion crop species and seeding rates because annual crops will compete with perennial species for water, nutrients, and growing space. A high seeding rate of the companion crop may prevent the establishment of perennial species.

Ryegrass shall not be used in any seeding mixtures containing permanent, perennial species due to its ability to out-compete desired species chosen for permanent perennial cover.

Seed Quality: The term “pure live seed” is used to express the quality of seed and is not shown on the label. Pure live seed (PLS) is expressed as a percentage of the seeds that are pure and will germinate. Information on percent germination and purity can be found on seed tags. PLS is determined by multiplying the percent of pure seed with the percent of germination; i.e.,

(PLS = % germination x % purity)

EXAMPLE: Common bermuda seed

70% germination, *80%* purity
PLS = *70%* germination x 80% purity
PLS = 56%

The percent of PLS determines the amount of seed needed. If the seeding rate is 10 pounds PLS and the bulk seed is 56 % PLS, the bulk seeding rate is:

$$\frac{\text{10 lbs PLS/acre}}{\text{56\% PLS}} = 17.9 \text{ lbs/acre}$$

An application of 17.9 lbs/acre will provide 10 lbs/acre of pure live seed.

Permanent Cover Seeding Mixtures

Seeding Dates	Grass Seed	Percentages
February 1 to July 1	Kentucky 31 Fescue	80%
	Korean Lespedeza	15%
	English Rye	5%
June 1 to August 15	Kentucky 31 Fescue	55%
	English Rye	20%
	Korean Lespedeza	15%
	German Millet	10%
April 15 to August 15	Bermudagrass (hulled)	70%
	Annual Lespedeza	30%
August 1 to December 1	Kentucky 31 Fescue	70%
	English Rye	20%
	White Clover	10%
February 1 to December 1	Kentucky 31 Fescue	70%
	Crown Vetch	25%
	English Rye	5%

Source: TDOT Standard Specifications

Table 1

Topsoil: Topsoil should be friable and loamy, free of debris, objectionable weeds and stones, and contain no toxic substances that may be harmful to plant growth. When replacing topsoil on disturbed areas, maintain needed erosion and sediment control practices such as diversions, berms, sediment basins, etc. Grades containing these structures should be maintained after the topsoil is applied.

Topsoil should be handled only when it is dry enough to work without damaging soil structure. A uniform application of 5 inches (unsettled) is recommended, but may be adjusted at the discretion of the engineer or landscape architect. See Table 2 for additional information about the volume of topsoil to achieve various depths.

Seedbed Preparation: When conventional seeding is to be used, topsoil should be applied to any area where the disturbance results in subsoil being the final grade surface.

Broadcast plantings

1. Seedbed preparation may not be required where hydraulic seeding equipment is to be used.
2. Tillage, at a minimum, shall adequately loosen the soil to a depth of 4 to 6 inches; alleviate compaction; incorporate topsoil, lime, and fertilizer; smooth and firm the soil; allow for the proper placement of seed, sprigs, or plants; and allow for the anchoring of straw or hay mulch if a crimper is to be used.
3. Tillage may be done with any suitable equipment.
4. Tillage should be done parallel to the contour where feasible.
5. On slopes too steep for the safe operation of tillage equipment, the soil surface shall be pitted or trenched across the slope with appropriate hand tools to provide consecutive beds, 6 to 8 inches apart, in which seed may

lodge and germinate. Hydraulic seeding may also be used.

Individual Plants

1. Where individual plants are to be set, the soil shall be prepared by excavating holes, opening furrows, or dibble planting.
2. For nursery stock plants, holes shall be large enough to accommodate roots without crowding.
3. Where pine seedlings are to be planted, use a subsoiler under the row to a depth of 36 inches on the contour four to six months prior to planting. Subsoiling should be done when the soil is dry, preferably in August or September.
4. Trees should not be planted in power line right-of-ways or under power lines.

Inoculants: All legume seed shall be inoculated with appropriate nitrogen fixing bacteria. The inoculants shall be pure culture prepared specifically for the seed species and used within the dates on the container.

A mixing medium recommended by the manufacturer shall be used to bond the inoculants to the seed. For conventional seeding, use twice the amount of inoculants recommended by the manufacturer. For hydraulic seeding, four times the amount of innoculant recommended by the manufacturer shall be used.

All inoculated seed shall be protected from the sun and high temperatures and shall be planted the same day inoculated. No inoculated seed shall remain in the hydroseeder longer than one hour.

Cubic Yards of Topsoil Required to Attain Various Soil Depths

Depth (Inches)	Per 1,000 Square Feet	Per Acre
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

Table 2

PLANTING

Hydraulic Seeding: Mix the seed (innoculated if needed), fertilizer, and wood cellulose or wood pulp fiber mulch with water and apply in a slurry uniformly over the area to be treated. Apply within one hour after the mixture is made.

Conventional Seeding: Seeding will be done on a freshly prepared seedbed. For broadcast planting, use a cultipacker seeder, drill, rotary seeder, other mechanical seeder, or hand seeding to distribute the seed uniformly over the area to be treated. Cover the seed lightly with l/8 to l/4 inch of soil for small seed and l/2 to 1 inch for large seed when using a cultipacker or other suitable equipment.

No-Till Seeding: No-till seeding is permissible into annual cover crops when planting is done following maturity of the cover crop or if the temporary cover stand is sparse enough to allow adequate growth of the permanent (perennial) species. No-till seeding shall be done with appropriate no-till seeding equipment. The seed must be uniformly distributed and planted at the proper depth.

Individual Plants: Shrubs, vines and sprigs may be planted with appropriate planters or hand tools. Pine trees shall be planted manually in the subsoil furrow. Each plant shall be set in a manner that will avoid crowding the roots.

Nursery stock plants shall be planted at the same depth or slightly deeper than they grew at

the nursery. The tips of vines and sprigs must be at or slightly above the ground surface.

Where individual holes are dug, an appropriate amount of fertilizer shall be placed in the bottom of the hole, two inches of soil shall be added, and the plant shall be set in the hole and the hole filled in.

APPLYING MULCH

Mulch is required for all permanent vegetation applications. Mulch applied to seeded areas shall achieve 75% soil cover. Select the mulching material from the following and apply as indicated:

1. When using temporary erosion control blankets or block sod, mulch is not required.
2. Dry straw or dry hay of good quality and free of weed seeds can be used. Dry straw shall be applied at the rate of 2 tons per acre. Dry hay shall be applied at a rate of 2 l/2 tons per acre. *Sericea lespedeza* hay containing mature seed shall be applied at a rate of three tons per acre.
3. Straw or hay mulch will be spread uniformly within 24 hours after seeding and/or planting. The mulch may be spread by blower type spreading equipment, other spreading equipment or by hand.
4. Wood cellulose mulch or wood pulp fiber shall be used with hydraulic seeding. It shall be applied at the rate of 500 pounds per acre. Dry straw or dry hay shall be applied (at the rate indicated above) after hydraulic seeding.
5. One thousand pounds per acre of wood cellulose or wood pulp fiber, which includes a tackifier, shall be used with hydraulic seeding on slopes ¾:1 or steeper.
6. Wood cellulose and wood pulp fibers shall not contain germination or growth inhibiting factors. They shall be evenly dispersed when agitated in water. The fibers shall contain a dye to aid in uniform application during seeding.

ANCHORING MULCH

Anchor straw or hay mulch immediately after application by one of the following methods:

1. Emulsified asphalt can be (a) sprayed uniformly onto the mulch as it is ejected from the blower machine or (b) sprayed on the mulch immediately following mulch application when straw or hay is spread by methods other than special blower equipment. The combination of asphalt emulsion and water shall consist of a homogeneous mixture satisfactory for spraying. The mixture shall consist of 100 gallons of emulsified asphalt and 100 gallons of water per ton of mulch. Care shall be taken at all times to protect state waters, the public, adjacent property, pavements, curbs, sidewalks, and all other structures from asphalt discoloration.
2. Hay and straw mulch may be pressed into the soil immediately after the mulch is spread. A special “crimper” or disk harrow with the disks set straight may be used. Serrated disks are preferred, and should be 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disks shall be dull enough to press the mulch into the ground without cutting it, leaving much of it in an erect position. Mulch shall not be plowed into the soil.
3. Synthetic tackifiers or binders may be applied in conjunction with or immediately after the mulch is spread. Synthetic tackifiers should be mixed and applied according to manufacturer’s specifications. Refer to specification **Tackifiers and Binders - TB.**

BEDDING MATERIAL

Mulch is used as a bedding material to conserve moisture and control weeds in nurseries, ornamental beds, around shrubs, and on bare areas.

Material	Depth
Grain straw	4” to 6”
Grass Hay	4” to 6”

Pine needles	3” to 5”
Wood waste	4” to 6”

IRRIGATION

Irrigation will be applied at a rate that will not cause runoff.

MAINTENANCE

Inspection of the seeding and mulch application should be performed along with other regularly scheduled erosion and sediment control inspections. Any areas that have washed out due to high storm water flows, areas that have been disturbed by blowing wind, and areas that do not show good germination should be retreated. Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified.

Disturbed Area Stabilization (With Sod) – SO

DEFINITION

A permanent vegetative cover using sod brought from locations off site.

PURPOSE

- To establish immediate ground cover
- To reduce storm water runoff
- To protect the soil surface from erosion
- To reduce damage from sediment and runoff to downstream areas
- To improve aesthetics

CONDITIONS

This application is appropriate for areas that require immediate vegetative covers, such as drop inlets, grass swales, and waterways with intermittent flow.

PLANNING CONSIDERATIONS

Sod can initially be more costly than seeding, but the advantages often justify the increased initial costs.

- Immediate erosion control and green surface
- Reduced failure as compared to seed as well as the lack of weeds
- Can be established nearly year-round

Sod is preferable to seed in waterways and swales because of the immediate protection of the channel after application. Sod must be staked in concentrated flow areas (See Figure 1).

CONSTRUCTION SPECIFICATIONS

Soil Preparation: Bring soil surface to final grade. Clear surface of trash, woody debris, stones and clods larger than 1". Apply sod to soil surfaces only and not frozen surfaces, or gravel type soils.

Properly applied topsoil will help guarantee a stand of grass. Don't use topsoil recently treated with herbicides.

Mix fertilizer and/or lime into soil surface. Fertilize and/or lime based on soil tests and/or contact with NRCS.

Installation: Lay sod with tight joints and in straight lines. Don't overlap joints. Stagger joints and do not stretch sod (See Figure 2).

On slopes steeper than 3:1, sod should be anchored with pins or other approved methods. Installed sod should be rolled or tamped to provide good contact between sod and soil.

Irrigate sod and the top 4" of soil immediately after installation.

Sod should not be cut or spread in extremely wet or dry weather. Irrigation should be used to supplement rainfall for a minimum of 2 - 3 weeks.

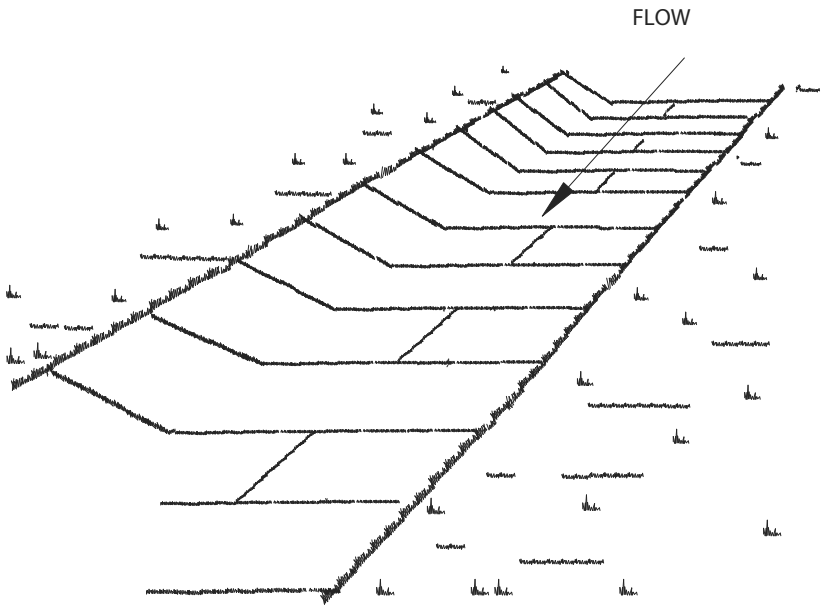
Materials: Sod selected should be certified. Sod grown in the general area of the project is desirable.

1. Sod should be machine cut and contain ¾" (+ or – ¼") of soil, not including shoots or thatch.
2. Sod should be cut to the desired size. Torn or uneven pads should be rejected.
3. Sod should be cut and installed within 36 hours of digging.
4. Avoid planting when subject to frost heave or hot weather if irrigation is not available.

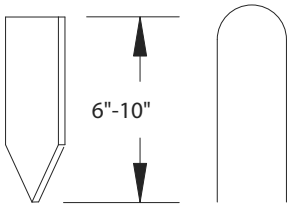
MAINTENANCE

Re-sod areas where an adequate stand of sod is not obtained. New sod should be mowed sparingly. Grass height should not be cut to less than 2"-3".

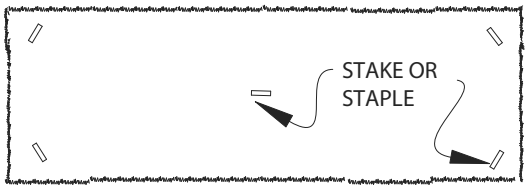
SODDED WATERWAYS

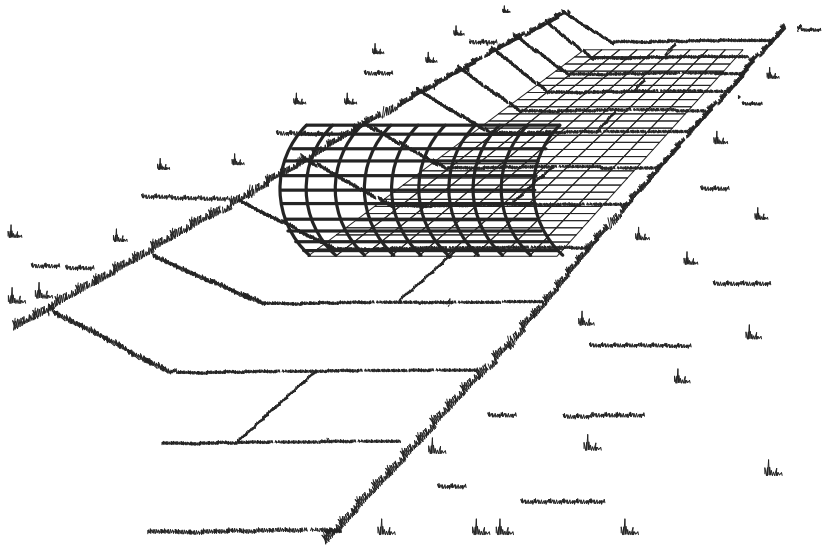


LAY SOD ACROSS THE DIRECTION OF FLOW.



USE STAKES OR STAPLES TO FASTEN SOD FIRMLY AT THE ENDS OF STRIPS AND IN THE CENTER, OR EVERY 3-4 FEET IF THE STRIPS ARE LONG. WHEN READY TO MOW, DRIVE STAKES OR STAPLES FLUSH WITH THE GROUND.



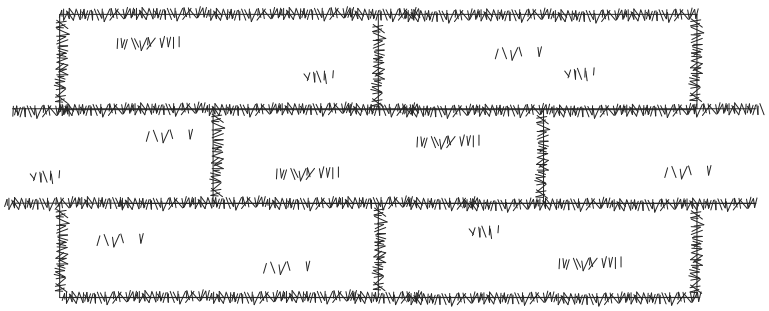


IN CRITICAL AREAS, SECURE SOD WITH NETTING. USE STAPLES.

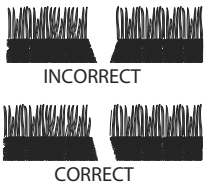
Source: VA DSWC

Figure 1

SODDING



LAY SOD IN A STAGGERED PATTERN. BUTT THE STRIPS TIGHTLY AGAINST EACH OTHER. DO NOT LEAVE SPACES AND DO NOT OVERLAP. A SHARPENED MASON'S TROWEL IS A HANDY TOOL FOR TUCKING DOWN THE ENDS AND TRIMMING PIECES.

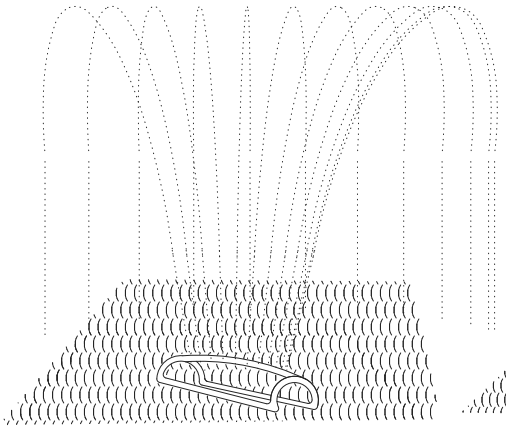


INCORRECT

CORRECT

BUTTING - ANGLED ENDS CAUSED BY THE AUTO-MATIC SOD CUTTER MUST BE MATCHED CORRECTLY.

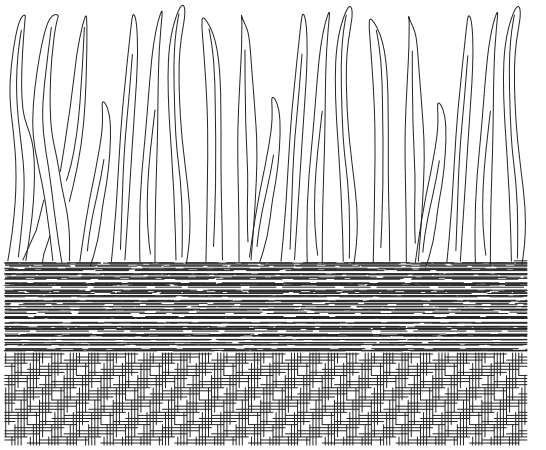
ROLL SOD IMMEDIATELY TO ACHIEVE FIRM CONTACT WITH THE SOIL.



WATER TO A DEPTH OF 4" AS NEEDED. WATER WELL AS SOON AS THE SOD IS LAID.

MOW WHEN THE SOD IS ESTABLISHED - IN 2-3 WEEKS. SET THE MOWER HIGH (2"-3").

APPEARANCE OF GOOD SOD



SHOOTS OR GRASS BLADES. GRASS SHOULD BE GREEN AND HEALTHY, MOWED AT A 2"-3" CUTTING HEIGHT.

THATCH - GRASS CLIPPINGS AND DEAD LEAVES, UP TO 1/2" THICK.

ROOT ZONE - SOIL AND ROOTS. SHOULD BE 1/2"-3/4" THICK, WITH DENSE ROOT MAT FOR STRENGTH.

Source: VA DSWC

Figure 2

Disturbed Area Stabilization (With Temporary Vegetation) – TS

DEFINITION

The establishment of temporary vegetative cover with fast growing species for seasonal protection on disturbed or denuded areas.

PURPOSE

- To reduce storm water runoff velocity
- To maintain sheet flow
- To protect the soil surface from erosion
- To promote infiltration of runoff into the soil
- To improve wildlife habitat
- To improve aesthetics
- To improve the soil condition for permanent plantings

CONDITIONS

Temporary vegetative measures should be coordinated with permanent measures to assure economical and effective stabilization. Most types of temporary vegetation are ideal to use as companion crops until the permanent vegetation is established. Note: *Some species of temporary vegetation are not appropriate for companion crop plantings because of their potential to out compete the desired species (e.g. annual ryegrass).*

CONSTRUCTION SPECIFICATIONS

Grading and Shaping: Excessive water runoff shall be reduced by properly designed and installed erosion control practices such as ditches, dikes, diversions, sediment barriers, etc.

No shaping or grading is required if slopes can be stabilized by hand-seeded vegetation or if hydraulic seeding equipment is to be used.

Seedbed Preparation: When a hydraulic seeder is used, seedbed preparation may not be required. When using conventional or hand-seeding, seedbed preparation may not be required when the soil material is loose and not compacted by equipment or rainfall.

When soil has been compacted by equipment or rainfall, or consists of smooth cut slopes, the soil shall be disked, plowed, tilled, or otherwise scarified to provide a place for seed to lodge and germinate.

Seeding: Select a grass or grass-legume mixture suitable to the area and season of the year. See Table 1 for suggestions of temporary seeding species. Seed shall be applied uniformly by hand, cyclone seeder, drill, cultipacker seeder, or hydraulic seeder (slurry including seed and mulch). Drill or cultipacker seeders should normally place seed one quarter to one half inch deep. Appropriate depth of planting is ten times the seed diameter. Soil should be "raked" lightly to cover seed with soil if seeded by hand.

Mulching: Temporary vegetation may be established without the use of mulch. Mulch without seeding may be considered for short-term protection. Refer to **Disturbed Area Stabilization (With Mulch) - MU.**

Irrigation: During times of drought, water shall be applied at a rate not causing runoff and erosion. The soil shall be thoroughly wetted to a depth that will insure germination of the seed. Subsequent applications should be made as needed. Newly seeded areas require more water than more mature plants.

MAINTENANCE

Inspections of temporarily seeded areas should be made before anticipated storm events (or series of storm events such as intermittent showers over one or more days) and within 24 hours after the end of a storm event of 0.5 inches or greater, and at least once every fourteen calendar days. Inspections should identify any areas that need reseeding or need additional BMP's. Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified.

Temporary Cover Seeding Mixtures

Seeding Dates	Grass Seed	Percentages
January 1 to May 1	Italian Rye	33%
	Korean Lespedeza	33%
	Summer Oats	34%
May 1 to July 15	Sudan - Sorghum	100%
May 1 to July 15	Starr Millet	100%
July 15 to January 1	Balboa Rye	67%
	Italian Rye	33%

Table 1

Source: TDOT Standard Specifications

Erosion Control Blanket/Matting – MA

DEFINITION

A protective blanket or soil stabilization mat used to assist in establishment of temporary or permanent vegetation on steep slopes, channels, or stream banks.

PURPOSE

- To prevent erosion of the soil surface
- To promote seed germination
- To protect young vegetation
- To prevent erosion of seed
- To prevent wind dispersal of seed or mulch
- To allow for easy installation of seed and/or mulch

CONDITIONS

Matting and blankets can be applied to steep slopes where erosion hazards are high and conventional seeding is likely to be too slow in providing adequate protective cover. **Concentrated flow areas, all slopes steeper than 2.5:1, with a height of ten feet or greater, and cuts and fills within stream buffers, should be stabilized with the appropriate erosion control matting or blanket.** Maintenance of the final vegetative cover must be considered when choosing blankets versus matting.

PLANNING CONSIDERATIONS

Care must be taken to choose the type of blanket or matting which is most appropriate for the specific needs of a project. Manufacturer's recommendations should be followed when choosing products.

Temporary Erosion Control Blankets

This includes rolled erosion control blankets consisting of a plastic netting which covers and is intertwined with a natural organic or manmade mulch; or, a jute mesh which is typically homogenous in design and can act alone as a soil stabilization blanket. Temporary blankets as a minimum should be used to stabilize concentrated flow areas with a velocity less than 5 ft/sec and slopes 2.5:1 or steeper with a height of 10 feet or greater. Because temporary blankets will deteriorate in a short

period of time, they provide no long-term erosion prevention protection when used alone.

Benefits of using temporary erosion control blankets include the following:

- Protection of the seed and soil from raindrop impact and subsequent displacement
- Thermal consistency and moisture retention for seedbed area
- More complete and faster germination of grasses and legumes

Permanent Erosion Control Matting

Consists of a permanent, non-degradable, three-dimensional plastic structure that is filled with soil prior to planting. These mats are also known as turf reinforcing mats. Roots penetrate the matrix, forming a continuous anchorage for vegetation. Matting should be used when a vegetative lining is desired in storm water conveyance channels where the projected or designed velocity is between about five and ten feet per second. These velocities are suggestions only. Concentrated flow channel linings should be designed by a professional experienced in the use of these materials, and according to the manufacturer's recommendations.

Benefits of using erosion control matting include the following:

- All of the benefits gained from using erosion control blankets
- Provides erosion protection from flows of high capacity storm water conveyance channels
- Acts as a filter for fine sediment during lower flow storm water events

CONSTRUCTION SPECIFICATIONS

All blanket and matting materials should be nontoxic to vegetation and to the germination of seed. Netting should be intertwined with the mulching material/fiber to maximize strength and provide for ease of handling.

Temporary Blankets

Machine produced temporary blankets should have a consistent thickness with the organic material evenly distributed over the entire blanket area. All blankets should have a minimum width of 48 inches. Machine produced temporary blankets include the following:

1. Straw blankets are temporary blankets that consist of weed-free straw from agricultural crops formed into a blanket. Blankets with a top side of photodegradable plastic mesh size of 5/16 x 5/16 inch and sewn to the straw with biodegradable thread are appropriate for slopes. The blanket should have a minimum thickness of 3/8 inch and minimum dry weight of 0.5 pounds per square yard.
2. Excelsior blankets are temporary blankets that consist of curled wood excelsior (80% of fibers are six inches or longer) formed into a blanket. The blanket should have clear markings indicating the top side of the blanket and be smolder resistant. Blankets should have photodegradable plastic mesh having a maximum mesh size of 1 ½ x 3 inches. The blanket should have a minimum thickness of ¼ of an inch and a minimum dry weight of 0.8 pounds per square yard. Slopes require excelsior matting with the top side of the blanket covered in the plastic mesh, and for waterways, both sides of the blanket require plastic mesh.
3. Coconut fiber blankets are temporary blankets that consist of 100% coconut fiber formed into a blanket. The minimum thickness of the blanket should be ¼ of an inch with a minimum dry weight of 0.5 pounds per square yard. Blankets should have photodegradable plastic mesh, with a maximum mesh size of 5/8 x 5/8 inch and be sewn to the fiber with a breakdown resistant synthetic yarn. Plastic mesh is required on both sides of the blanket if used in waterways. A maximum of two inches is allowable for the stitch pattern and row spacing.
4. Wood fiber blankets are temporary blankets that consist of reprocessed wood fibers that do not possess or contain any growth or germination inhibiting factors. The blanket should have a photodegradable plastic mesh; with a maximum mesh size of 5/8 x ¾ inch, securely bonded to the top of the

mat. The blanket should have a minimum dry weight of 0.35 pounds per square yard. A maximum of two inches is allowable for the stitch pattern and row spacing. This practice should be applied only to slopes.

5. Jute mesh consists of woven root fiber or yarn, with regularly spaced openings between strands. A typical jute mesh will weigh approximately 1.0 pounds per square yard for basic slope applications.

Permanent Matting

Permanent matting consists of a web of nettings, monofilaments or fibers that are entangled to form a strong and dimensionally stable matrix. Mats should maintain their shape before, during, and after installation, under dry or water saturated conditions. Mats must be stabilized against ultraviolet degradation and shall be inert to chemicals normally encountered in a natural soil environment.

INSTALLATION

Always follow the manufacturer's recommendations for orienting, overlapping, entrenching, and securing blankets or mats. The following are basic guidelines that may vary by manufacturer or application.

Site Preparation: After the site has been shaped and graded to the approved design, prepare a friable seedbed relatively free from clods and rocks more than one inch in diameter, and any foreign material that will prevent contact of the blanket or mat with the soil surface.

Temporary Blankets: Erosion control blankets should generally be installed vertically from the top of the slope to the bottom (See Figure 1). Trim blankets as necessary to fit the area to be covered. For slopes shallower than 2:1, and with a height of twice the width of the blanket roll or less, up to a maximum height of 16 feet, the blanket may be applied horizontally across the slope. For use in concentrated flow areas, place the blanket in the direction of the water flow.

Always entrench the blanket beyond the top and bottom of the slope and at any horizontal joint a minimum of 6 inches, or per manufacturer's recommendation. Overlap vertical joints at least 3 inches, or per manufacturer's recommendation (See Figure 2).

Permanent Matting: When installing permanent matting in a storm water conveyance channel, begin at the bottom of the slope and progress upstream, centering the mat in the middle of the channel. Shingle upstream layer over downstream layer, overlapping 3 feet. Overlap 3 inches minimum along longitudinal seams. Entrench the upper and lower edges beyond the slope (See Figure 3).

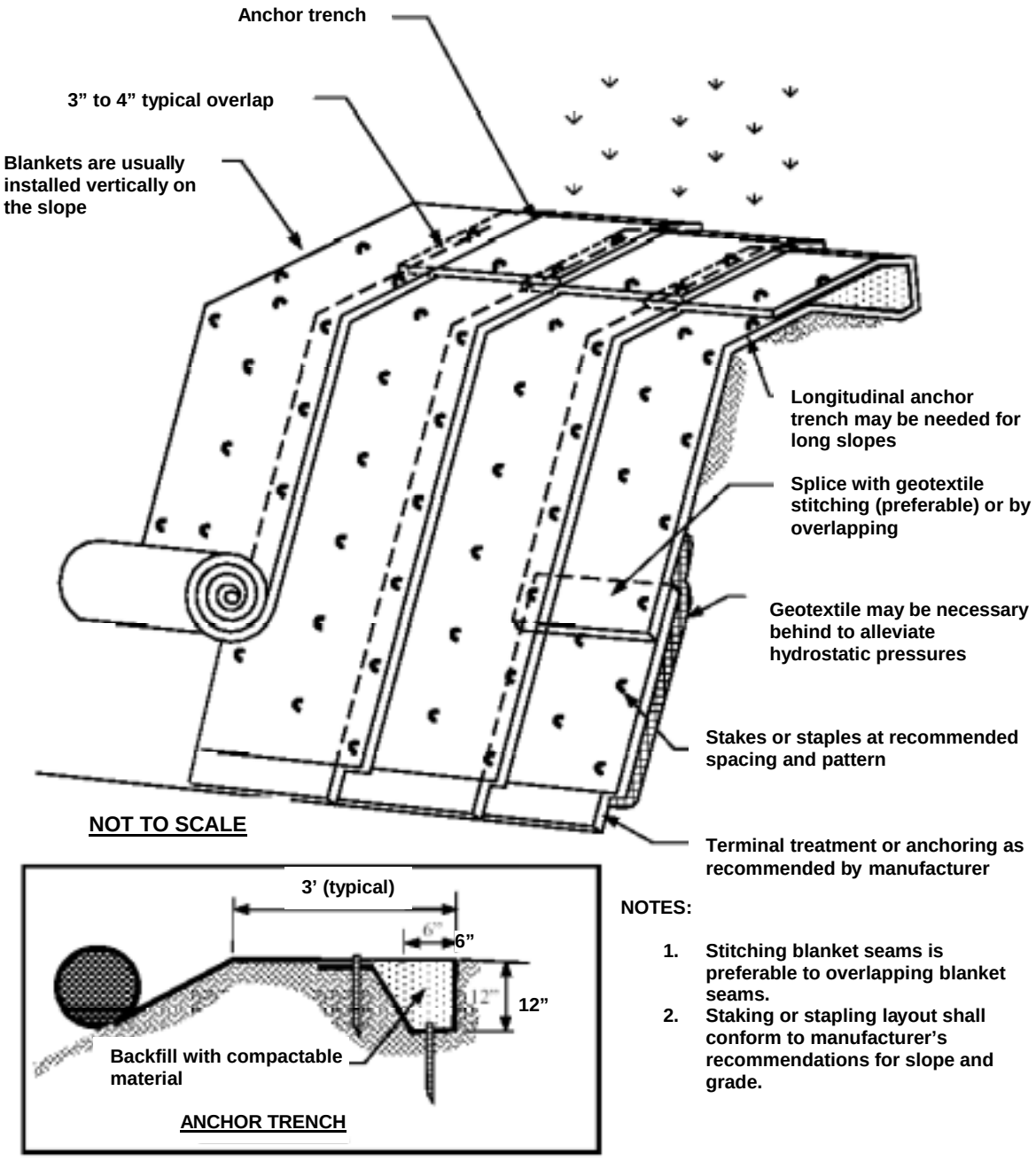
Staples: Staples should be used to anchor temporary blankets, and either staples or stakes should be used to anchor permanent matting. Follow manufacturer's recommendations for stapling or staking pattern and frequency.

Planting: Seed and any necessary soil amendments should be applied prior to installation of temporary blankets. For permanent mats, the area should be brought to final grade, and any soil amendments tilled or plowed into the soil surface. After the permanent mat has been installed and backfilled with topsoil, the area should be seeded and mulched. Refer to specifications **Disturbed Area Stabilization (With Permanent Vegetation) – PS** and **Disturbed Area Stabilization (With Mulch) – MU**.

MAINTENANCE

Inspections of blankets and matting should be made before anticipated storm events (or series of storm events such as intermittent showers over one or more days) and within 24 hours after the end of a storm event of 0.5 inches or greater, and at least once every fourteen calendar days. Blanket and matting inspections should identify washed out areas, areas needing additional staples, and/or additional areas needing blankets or matting. Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified.

Erosion Control Blanket - Slope Installation



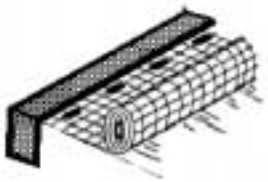
NOTES:

1. Stitching blanket seams is preferable to overlapping blanket seams.
2. Staking or stapling layout shall conform to manufacturer's recommendations for slope and grade.

Figure 1

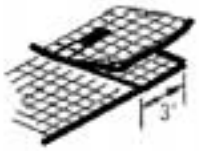
Source: Knoxville Engineering Department

Anchoring Details For Erosion Control Blanket



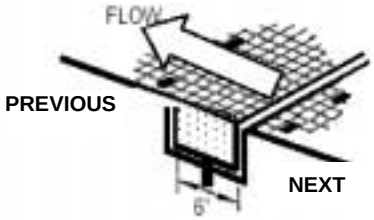
UPHILL ANCHOR SLOT:

Bury the uphill end of the mat within a trench at least 6" deep (12" deep for longer slopes). Tamp the soil firmly. Staple or stake at 12" intervals across the mat.



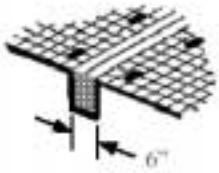
OVERLAP:

Overlap edges of the strips at least 3" (and preferably more for channels). Stake or staple every 12" down the center of the overlap.



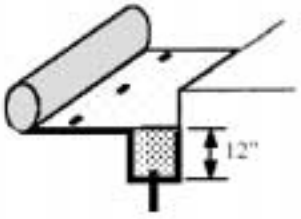
ANCHOR SLOT (WITHIN A CHANNEL):

Dig a slot 6" deep and 6" wide at end of the PREVIOUS roll, and insert NEXT roll on bottom and sides of anchor slot. Insert the PREVIOUS roll on bottom and sides of anchor slot, and then install stakes or staples through both rolls at the bottom of the anchor slot. Fill anchor slot with soil, tamp firmly, and then install NEXT roll in the upstream direction.



CHECK SLOTS:

Check slots should be made every 50 feet on slopes and intermittent drainage channels. Insert a fold of the mat into a 6" deep trench and tamp firmly. Staple or stake at 12" intervals across the mat. Lay mat smoothly on the surface of the soil. Do not stretch the mat and do not allow wrinkles.



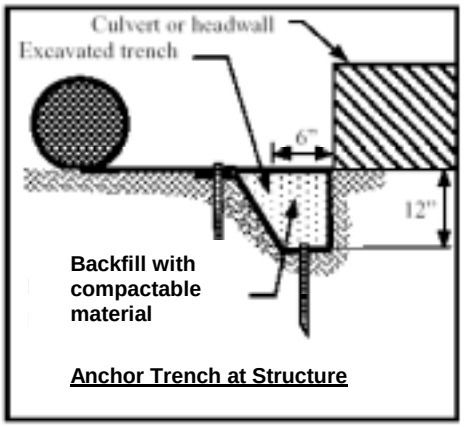
ANCHORING ENDS AT STRUCTURES:

Place end of mat in a 12" deep slot at the side of structure. Place stakes or staples at 12" intervals within slot. Fill trench and tamp firmly. Roll mat up the channel or downhill as necessary.

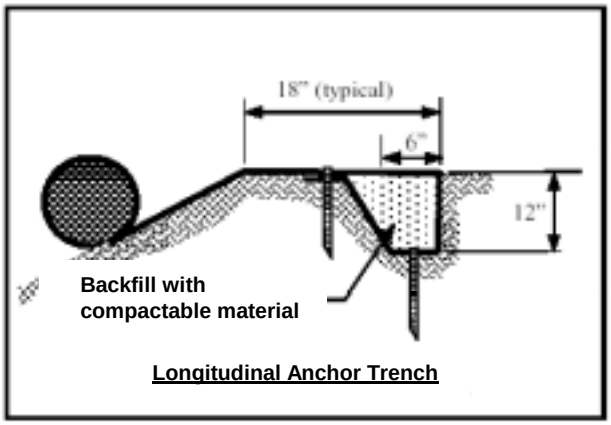
Figure 2

Source: Knoxville Engineering Department

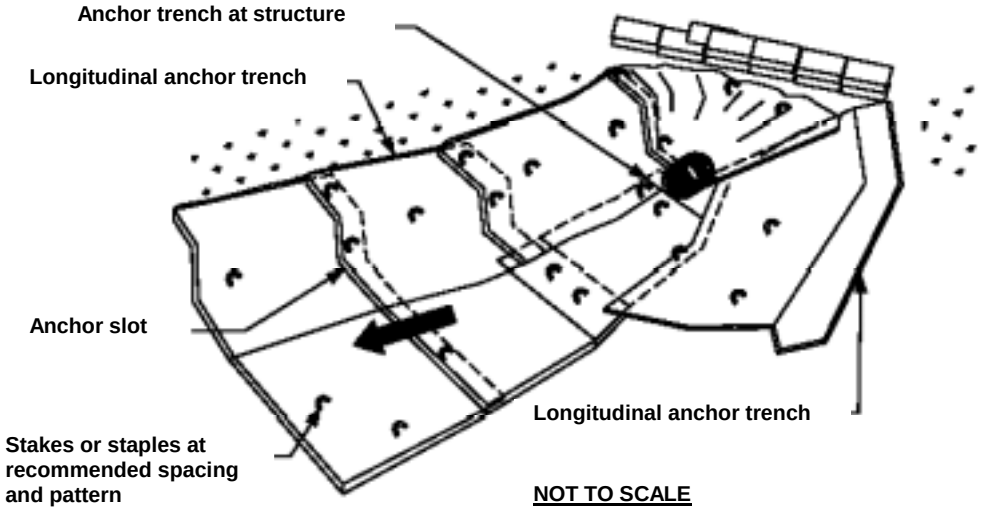
Erosion Control Matting - Channel Installation



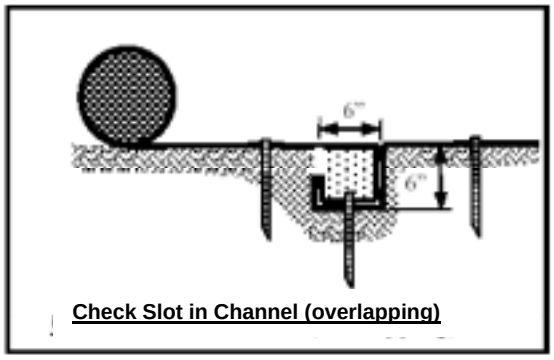
Anchor Trench at Structure



Longitudinal Anchor Trench



NOT TO SCALE



Check Slot in Channel (overlapping)

NOTES:

1. **Stitching blanket seams is preferable to overlapping blanket seams.**
2. **Staking or stapling layout shall conform to manufacturer's recommendations for slope and grade.**

Figure 3

Source: Knoxville Engineering Department

Polyacrylamide – PAM

DEFINITION

The land application or storm water application of product containing anionic polyacrylamide (PAM).

PURPOSE

Land application of PAM is performed to reduce soil surface erosion due to wind and/or water forces. Storm water applications of PAM promote settling of fine soil particles in sediment basins.

CONDITIONS

Polyacrylamides have two general erosion and sediment control applications. One temporary practice is direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. Such areas may include construction sites where land-disturbing activities prevent the establishment or maintenance of a vegetative cover. The product may also be applied to storm water as it enters sediment basins. This will cause soil particles to bind together and settle within the pond.

This temporary practice is not intended for application to surface waters of the state. It is intended for application within construction storm water drainages that feed into pre-constructed sediment ponds or basins.

PLANNING CONSIDERATIONS

Anionic PAM is available in emulsions, powders, and gel bars or logs. It is required that other Best Management Practices be used in combination with anionic PAM. The use of seed and mulch for additional erosion protection beyond the life of the anionic PAM is recommended. Repeat application if disturbance occurs to target area.

The following recommendations relating to design may enhance the use of, or avoid problems with the practice:

1. **Use 25-foot setbacks when applying anionic PAM near natural water bodies.**

2. Consider that performance of PAM decreases with time and exposure to ultraviolet light.
3. In concentrated flow channels, the effectiveness of PAM decreases.
4. Mulch to protect seed, if seed is applied with anionic PAM.
5. Never add water to PAM, add PAM slowly to water. If water is added to PAM, clumping can form which can clog dispensers. This signifies incomplete dissolving of the PAM and therefore increases the risk of under-application.
6. NOT ALL POLYMERS ARE PAM.

DESIGN CRITERIA

Application rates should conform to manufacturer's guidelines for application. **Only the anionic form of PAM should be used. Cationic PAM is toxic and should NOT be used.** PAM and PAM mixtures should be environmentally benign, harmless to fish, wildlife, and plants. PAM and PAM mixtures should be noncombustible.

Anionic PAM, in pure form, should have less than or equal to 0.05% acrylamide monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency. To maintain less than or equal to 0.05% of acrylamide monomer, the maximum application rate of PAM, in pure form, should not exceed 200 pounds/acre/year. Do not over apply PAM. Excessive application of PAM can lower infiltration rate or suspend solids in water, rather than promoting settling.

Users of anionic PAM should obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations. Additives to PAM such as fertilizers, solubility promoters or inhibitors, should be nontoxic. The manufacturer or supplier should provide written application methods for PAM and PAM mixtures. The application method should ensure uniform coverage to the target and avoid drift to non-target areas including waters of the state. The manufacturer or supplier should also provide written instructions to ensure proper safety, storage, and mixing of the product.

Gel bars or logs of anionic PAM mixtures may be used in ditch systems. This application should meet the same testing requirement as anionic PAM emulsions and powders.

To prevent exceeding the acrylamide monomer limit in the event of a spill, the anionic PAM in pure form should not exceed 200 pounds/batch at 0.05% acrylamide monomer (AMD) or 400 pounds/batch at 0.025% AMD.

MAINTENANCE

Inspections should be made before anticipated storm events (or series of storm events such as intermittent showers over one or more days) and within 24 hours after the end of a storm event of 0.5 inches or greater, and at least once every fourteen calendar days. Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified. Maintenance will consist of reapplying anionic PAM to disturbed areas including high use traffic areas that interfere in the performance of this practice.