

Christian County Erosion Prevention and Sediment Control Guidelines Manual



October 2017

PREFACE

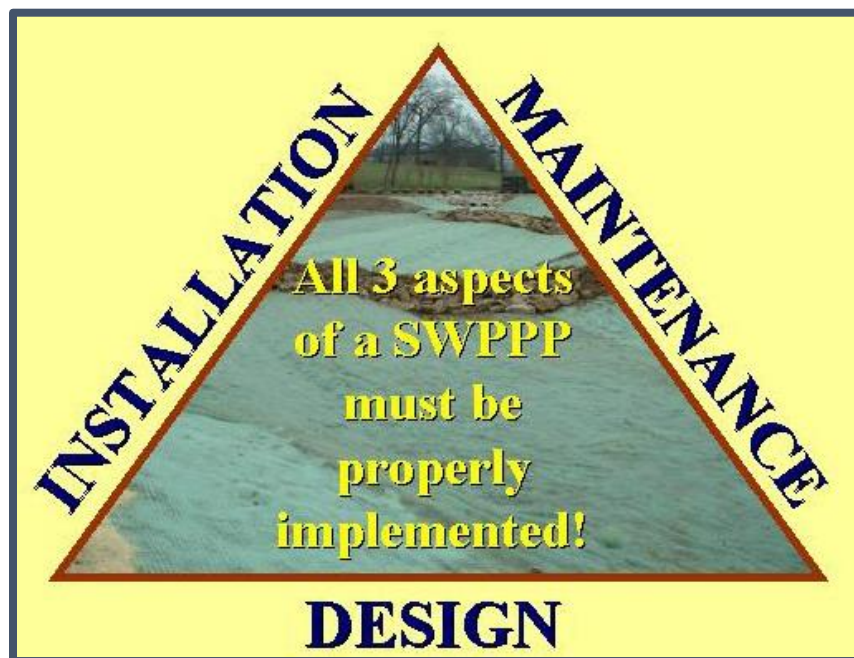
The purpose of the Manual is to provide a comprehensive and detailed approach towards preventing erosion and controlling sediment on construction sites as required within the Christian County Zoning Regulation and the Stormwater & Erosion Control Regulations for Christian County. It has been updated to include the latest information regarding materials and installation practices that have proven effective over the past years. There are numerous other resources available and readers are encouraged to incorporate other industry proven methods which may not be addressed in this guide.

Another unique feature of this manual is its educational value. Under the National Pollution Discharge Elimination System (NPDES) rules, public involvement and educational outreach will be a major part of water quality standards.

DISCLAIMER

The Erosion Prevention and Sediment Control Guidelines Manual was developed for the sole purpose of providing the most updated Erosion Prevention, Run-off Management, Sediment and Tracking Controls, and Pollution Prevention Best Management Practices (BMP's). The contents of this manual should not be interpreted as necessarily representing the policies or recommendations of other referenced agencies or organizations. The mention of trade names, products or companies does not constitute an endorsement.

Periodic updates will be made as materials, practices, and policies change within the industry and are made available.



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INTRODUCTION

OVERVIEW

Best Management Practices (BMPs) are effective, practical, structural or nonstructural methods which prevent, reduce, or control the movement of sediment and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of land disturbing activities. These guidelines and BMPs are intended to provide the designer, contractor and builder with design criteria and minimum standards for the installation of erosion and sediment controls to comply with the Christian County's Stormwater and Erosion Control Regulations. The regulations were enacted to protect the health, safety, and property of the citizens of Christian County and to help protect area water resources from pollution due to erosion and transportation of sediment and other pollutants. The regulations are applicable to all land development and land disturbance activity within the Christian County where the area of disturbance is greater than one acre or near valuable natural resources. The regulations require that no person cause or allow sediment to be deposited in any public street, public land, or on any property not under their control as a result of land disturbance from construction activities.

You can comply with the regulations by meeting the following objectives:

- a. Minimize the area disturbed by construction and development;
- b. Provide for containment of sediment until areas are stabilized;
- c. Stabilize disturbed areas as soon as practical after project completion; and
- d. Provide permanent erosion, drainage, and detention controls.



Multiple BMPs (scheduling, preservation of vegetation, seeding, erosion control blankets, velocity dissipation devices, check dams, soil roughening, and compost filter socks) are being implemented at a project to prevent erosion and contain sediment

GENERAL DESIGN GUIDELINES

Erosion is a natural process where soil and rock are loosened and removed. Natural erosion normally occurs at a very slow pace, but when land is disturbed on a construction site, the erosion rate often increases dramatically. When erosion occurs on a construction site and runoff carries sediment off the site, there is often a negative impact on downstream drainage systems and water quality.

The purposes of erosion and sediment controls are to minimize the amount of erosion that occurs as a result of construction activity and to prevent the sediment that is produced from leaving the property. Effective erosion and sediment control requires that the soil surface be protected from the erosive forces of wind, rain, and runoff and that the eroded soil be captured and retained onsite. The following principles are effective when they are integrated into a system of control practices and management techniques to control erosion and prevent sedimentation offsite.

When designing sediment and erosion controls, it is necessary to determine whether there is sheet flow or concentrated flow of stormwater on the property. Sheet flow occurs on gently sloping land without defined drainage ways. The stormwater tends to disperse evenly across the property, although the drainage may be in one direction due to the overall slope of the property. Concentrated flow occurs on property where there are defined drainage ways that may range from gentle swales to clearly defined waterways. It is possible to have a combination of sheet flow and concentrated flow on the same property.

Erosion Protection

Proper planning will help identify potential erosion problems, particularly highly susceptible areas, such as areas of concentrated flow. Removing the vegetative cover and altering the soil structure by clearing, grading, and compacting the surface increases an area's susceptibility to erosion. Scheduling can be a very effective means of reducing erosion. Schedule construction activities to minimize the exposed area and the duration of exposure. Apply stabilizing measures as soon as possible after the land is disturbed. Plan and implement temporary or permanent vegetation, mulches, or other protective practices to correspond with construction activities. Protect channels from erosion forces by using protective linings and the appropriate channel design. Consider possible future repairs and maintenance of these practices in the design. In scheduling, take into account the season and the weather forecast. Clearing existing vegetation reduces the surface roughness and infiltration rate and increases runoff velocities and volumes. This is particularly a concern in areas of concentrated flow. Use measures that break the slopes to reduce the problems associated with concentrated flow volumes and runoff velocities. Practical ways to reduce velocities include conveying stormwater runoff away from steep slopes to stabilized outlets, preserving natural vegetation where possible, and mulching and vegetating exposed areas immediately after construction.

Sediment Containment

Even with careful planning some erosion is unavoidable, and the resulting sediment must be trapped on the site. In areas where runoff occurs primarily as sheet flow, containment of sediment is relatively simple. In these areas, temporary containment devices may be sufficient. Where concentrations of flow occur, containment of sediment becomes more difficult as the rate and volume of flow increase. In these areas, more extensive or permanent control devices need to be provided. Areas of steep topography and cut or fill slopes need to be given special consideration. Due to the environmental sensitivity of streams, rivers, losing streams, sinkholes, and other karst topographic features, special consideration also needs to be given to these areas. Plan the location where sediment deposition will occur and maintain access for periodic removal of accumulated sediment. Protect low points below disturbed areas by building barriers to reduce sediment loss. Sediment traps and basins should be constructed before other land disturbing activities.

Temporary versus Permanent Controls

Temporary controls, such as silt fences, erosion control blankets, etc., are provided for the purpose of controlling erosion and containing sediment until construction is complete. Temporary controls are not needed after the area is stabilized. Permanent controls consist of riprap, concrete trickle channels, detention basins, etc., which will remain in place through the life of the development. It is possible for the same structure to serve both a temporary and permanent purpose.

Maintenance

Inspection and maintenance are vital to the performance of erosion and sedimentation control measures. If not properly maintained, some practices may cause more damage than they prevent. Always evaluate the consequences of a measure failing when considering which control measure to use, since failure of a practice may be hazardous or damaging to both people and property. For example, a large sediment basin failure can have disastrous results, and low points in dikes can cause major gullies to form on a fill slope. It is essential to inspect all practices to determine that they are working properly and to ensure that problems are corrected as soon as they develop. The consequences of a measure failing when considering which control measure to use, since failure of a practice may be hazardous or damaging to both people and property. For example, a large sediment basin failure can have disastrous results, and low points in dikes can cause major gullies to form on a fill slope. It is essential to inspect all practices to determine that they are working properly and to ensure that problems are corrected as soon as they develop.



Rolled erosion control products (RECPs) are temporary degradable or long-term non-degradable material manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation.

SCHEDULING EC-1

DEFINITION AND PURPOSE:

This BMP involves developing, for every project, a schedule that includes the sequencing of construction activities with the implementation of construction site BMPs, such as temporary soil stabilization (erosion control) and temporary sediment control measures. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

APPROPRIATE APPLICATIONS:

Construction sequencing shall be scheduled to minimize land disturbance for all projects at all times.

CONDITIONS FOR EFFECTIVE USE:

All land disturbing activities.

WHEN BMP IS TO BE INSTALLED:

Scheduling should take place during the planning stages of the project.

STANDARDS AND SPECIFICATIONS:

Developing a schedule and planning the project are the very first steps in an effective storm water program. The construction schedule shall be incorporated into the SWPPP. Develop the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, pouring foundations, installing utilities, etc., to minimize the active construction area during the rainy season. Schedule major grading operations for the non-rainy season when practical. Try to incorporate phasing of the project into the schedule to reduce the amount of land disturbed at any one time. Incorporate staged seeding and re-vegetation of graded slopes as work progresses. Consider scheduling when establishing permanent and temporary vegetation (appropriate planting time for specified vegetation can be found in sections EC-7, EC-8, and EC-9).

OPERATION AND MAINTENANCE PROCEDURES:

Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions. Amend the schedule when changes are warranted. Remember that BMPs need to be installed prior to the start of construction.

SITE CONDITIONS FOR REMOVAL:

Schedule should be followed throughout the life of the project.

TYPICAL DETAILS:

Not Applicable

PRESERVATION OF EXISTING VEGETATION EC-2

DEFINITION AND PURPOSE:

Preservation of existing vegetation and topsoil is the identification and protection of desirable vegetation that provides erosion and sediment control benefits.

APPROPRIATE APPLICATIONS:

Preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date.

CONDITIONS FOR EFFECTIVE USE:

Protection of existing vegetation requires planning, and may limit the area available for construction activities.

WHEN BMP IS TO BE INSTALLED:

Preservation of existing vegetation shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas identified on the plans to be preserved.

STANDARDS AND SPECIFICATIONS:

Minimize the disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling. Mark vegetated/natural resource areas to be preserved with temporary fencing that is at least 1 meter (3.2 ft.) tall. The fence post spacing and depth shall be adequate to completely support the fence in an upright position. Construction materials, equipment storage, and parking areas shall be located where they will not cause root compaction. Keep equipment away from trees to prevent trunk and root damage. Employees and subcontractors shall be instructed to honor protective devices. No heavy equipment, vehicular traffic, or storage piles of any construction materials shall be permitted within the drip line of any tree to be retained. Trenching shall be as far away from tree trunks as possible, usually outside of the tree drip line or canopy. The ends of damaged or cut roots shall be cut off smoothly.

OPERATION AND MAINTENANCE PROCEDURES:

During construction, limits of disturbance shall remain clearly marked at all times. If damage to protected trees occurs, the injured tree shall be attended to by an arborist.

SITE CONDITIONS FOR REMOVAL:

Temporary fencing shall be removed after final stabilization of the site has occurred.

TYPICAL DETAILS:

Not Applicable

DUST (WIND EROSION) CONTROL EC-3

DEFINITION AND PURPOSE:

Wind erosion control consists of applying water and/or other dust palliatives as necessary to prevent or alleviate erosion by the forces of wind. Dust control shall be applied at all sites. Alternatives to applying water or other dust palliatives include vegetative cover, wind barriers, minimization of soil disturbance, spray on adhesives, and chemical treatment.

APPROPRIATE APPLICATIONS:

This practice is implemented on all exposed soils subject to wind erosion.

CONDITIONS FOR EFFECTIVE USE:

Effectiveness depends on soil, temperature, humidity and wind velocity.

WHEN BMP IS TO BE INSTALLED:

Routinely, especially in advance of and during periods of dry weather.

STANDARDS AND SPECIFICATIONS:

Water shall be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution. Phase work to the extent practical to minimize concurrent areas of soil disturbance. For areas not subjected to traffic, vegetation provides the most practical method of dust control and should be established as early as possible. Wind barriers such as solid board fences, snow fences, burlap fences, crate walls, and similar materials can be used to control air currents and blowing soil. Barriers placed at right angles to prevailing wind currents at intervals of about 10 times their height are effective in controlling soil blowing. Paved areas that have soil on them from construction sites should be cleaned continuously, at least daily, utilizing a street sweeper or bucket type endloader or scraper. Mulching offers a fast and effective means of controlling dust when properly applied. Binders and tackifiers should be used on organic mulches. NOTE: If calcium chloride or spray-on adhesives are used for dust control, a permit may be required from MoDNR.

OPERATION AND MAINTENANCE PROCEDURES:

Check areas that have been protected to ensure coverage.

SITE CONDITIONS FOR REMOVAL:

Dust control should be implemented while soils are exposed at the project.

TYPICAL DETAILS:

Not Applicable



Water truck used for dust control

HYDRAULIC MULCH-BONDED FIBER MATRIX **EC-4**

DEFINITION AND PURPOSE:

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic bonded fiber matrix (BFM) and a stabilizing emulsion or tackifier with hydroseeding equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind. BFMs adhere directly to the soil, eliminating gaps between the product and the soil. A water-insensitive crust does not form, therefore plant growth is not inhibited. Mulch and BFMs biodegrade completely into material known to be beneficial to plant growth.

APPROPRIATE APPLICATIONS:

Hydraulic mulch and BFMs are applied to disturbed areas requiring temporary protection until permanent vegetation is established or disturbed areas that must be re-disturbed following an extended period of inactivity.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow only.

Wood fiber hydraulic mulches and BFMs are generally short-lived (only last part of a growing season) and need 24 hours to dry before rainfall occurs to be effective.

WHEN BMP IS TO BE INSTALLED:

Immediately after completion of a phase of grading.

STANDARDS AND SPECIFICATIONS:

Follow manufacturer's recommendations to maximize usefulness. Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation. Materials for wood fiber based hydraulic mulches and bonded fiber matrices shall meet environmental quality standards and not be a detriment to stormwater discharges from the site.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site until vegetation is fully established. Repair eroded areas and reapply product and vegetation.

SITE CONDITIONS FOR REMOVAL:

Typically left in place to degrade naturally.

TYPICAL DETAILS:

Not Applicable

MULCHING EC-5

DEFINITION AND PURPOSE:

A layer of organic material designed to protect exposed soil or freshly seeded areas from erosion by eliminating direct impact of precipitation and slowing overland flows. Mulch materials may include, but are not limited to, such things as grass, hay, straw, wood chips, wood fibers, and shredded bark.

APPROPRIATE APPLICATIONS:

Typically used for soil stabilization as a temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetation is established. Installed in landscape areas for permanent use.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow only

The use of appropriate mulch will help ensure the vegetation is established under normal conditions and is essential to seeding success under harsh site conditions. General mulch recommendations to protect disturbed soils from raindrop splash and sheet flow include: straw applied at 2-2.5 tons/acre, wood fiber or wood cellulose applied at 0.5-1 ton/acre, wood chips applied at 5-6 tons/acre, and bark applied at 35 yd³/acre. Where slopes are 33 percent (3:1) or greater grade, hydraulic mulch-bonded fiber matrix (EC- 4), erosion control blankets (EC-10), or turf reinforcement mats (EC-11) are required.

WHEN BMP IS TO BE INSTALLED:

Immediately after grading landscaped areas or seeding other areas.

STANDARDS AND SPECIFICATIONS:

Install upstream BMPs to protect area to be mulched. Rough grade area and remove all debris larger than 1 inch if area is to be vegetated and mowed in the future, larger than 2 inches if area is to be permanently mulched. If area is to be seeded, follow requirements of Seeding (EC-7). Spread mulch evenly and anchor by punching it into the ground, using netting, or tacking with liquid binder.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site until adequate vegetation is established; annually for permanent mulch. Protect from vehicular and foot traffic. Repair damaged, degraded or eroded areas-reseed as needed and replace mulch.

SITE CONDITIONS FOR REMOVAL:

Temporary mulch should be removed when adequate vegetation is established.

TYPICAL DETAILS:

Not Applicable

SOIL BINDERS EC-6

DEFINITION AND PURPOSE:

Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are material applied to the soil surface to temporarily prevent water-induced erosion of exposed soils on construction sites. Examples of materials used include: vegetable-based adhesives, copolymers, petroleum oils, and resin-emulsions. Soil binders also provide temporary dust, wind, and soil stabilization (erosion control) benefits. The useful life of most products is 3 to 6 months.

APPROPRIATE APPLICATIONS:

Soil binders are typically applied to disturbed areas requiring short-term temporary protection and in combination with other BMPs such as perimeter controls, seeding, and mulching. Because soil binders can often be incorporated into the work, they may be a good choice for areas where grading activities will soon resume. Application can occur on stockpiles to prevent water and wind erosion.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow only

Consider drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders shall not be applied during or immediately before rainfall. May not cure if low temperatures occur within 24 hours of application.

WHEN BMP IS TO BE INSTALLED:

Immediately after completion of a phase of grading.

STANDARDS AND SPECIFICATIONS:

Follow manufacturer's recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use. Use the recommendations to maximize usefulness and avoid formation of pools or impervious areas where stormwater cannot infiltrate.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site for damage from vehicles, runoff, or freeze-thaw conditions. Reapply product or utilize additional BMP.

SITE CONDITIONS FOR REMOVAL:

Typically left in place to degrade naturally.

TYPICAL DETAILS:

Not Applicable

SEEDING EC-7

DEFINITION AND PURPOSE:

Establishment of vegetation by spreading grass seed designed to protect exposed soil from erosion by eliminating direct impact of precipitation and slowing overland flow rates. Once established, the vegetative cover will also filter pollutants from the runoff.

APPROPRIATE APPLICATIONS:

Exposed soil after a phase of rough or finish grading has been completed, or areas where no activity will occur for 14 days.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow (additional stabilization is necessary).

Minimum Rates: See attached chart.

Acceptable Dates: See attached chart.

WHEN BMP IS TO BE INSTALLED:

Immediately after rough or finished grading is completed.

STANDARDS AND SPECIFICATIONS:

Install upstream BMPs to protect area to be seeded. Complete grading and remove all debris larger than 1 inch. Loosen compacted soils to a depth of 4 inches. Groove or furrow on the contour if necessary. Spread loose topsoil at a depth of 4 inches. Mix soil amendments (lime, fertilizer, etc.) into the top 4 inches of soil. Plant seed ¼ to ½ inches deep using a cyclone seeder, drill, cultipacker seeder, or hydroseeder. Roll lightly to firm surface. Cover seeded area with mulch. Install additional stabilization (erosion control blankets, netting, bonded fiber matrix, etc.) on slopes steeper than 3:1 and in areas of concentrated flow. Water immediately-enough to soak 4 inches into the soil without causing runoff.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least every two weeks and after every storm. Protect seeded areas from vehicular and foot traffic. Reseed and mulch areas that have not sprouted within 21 days of planting. Repair damaged or eroded areas and reseed/mulch and stabilize as needed. Do not mow until 4 inches of growth occurs.

During the first 4 months, mow no more than 1/3 the grass height. Seeded areas should be maintained for one year following permanent seeding to ensure a healthy lawn.

SITE CONDITIONS FOR REMOVAL:

Does not require removal, temporary vegetation may be removed prior to work returning to an area.

TYPICAL DETAILS:

Vegetation Requirements Chart EC-7

<p style="text-align: center;">Topsail Requirements</p> <p>Permanent and Temporary Seeding-Loosen compacted soils to a depth of 4 inches. If rainfall causes the surface to become sealed or crusted, loosen it just prior to seeding. Slopes steeper than 33 percent (3:1) grade should be grooved or furrowed on the contour before seeding. A good seedbed is well pulverized, loose, and uniform.</p> <p>Permanent Seeding-A minimum of 4 inches of loose topsoil should be spread on areas to be seeded.</p>
<p style="text-align: center;">Lime Requirements</p> <p>Permanent and Temporary Seeding-Lime should be applied according to soil test recommendations. If the pH of the soil is unknown, lime shall be incorporated into the top 4 inches of soil at the rate of 1500 pounds effective neutralizing material (ENM) per acre. Soils with a pH of six or higher need not be limed.</p>
<p style="text-align: center;">Fertilizer Requirements</p> <p>Permanent Seeding-Fertilizer should be applied based on soil tests. When these are not possible, a 13-13-13 grade fertilizer shall be incorporated into the top 4 inches of soil at the rate of 500 pounds per acre.</p> <p>Temporary Seeding-Fertilizer should be applied based on soil tests. When these are not possible, a 10-10-10 grade fertilizer shall be incorporated into the top 4 inches of soil at the rate of 200 pounds per acre.</p>
<p style="text-align: center;">Seed Requirements</p> <p>Permanent Seeding-Seed mix shall consist of ninety percent (90%) tall fescue and ten percent (10%) annual ryegrass. Seed mixture shall be applied at a rate of 400 pounds per acre.</p> <p>Temporary Seeding-Seed mix shall consist of any combination of tall fescue, annual ryegrass, sudan, millet, wheat, or oats. Seed mixture shall be applied at a rate of 200 pounds per acre.</p> <p>Dormant Season Seeding-Seed mix shall consist of 80 percent (80%) tall fescue, ten percent (10%) annual ryegrass, and ten percent (10%) spring oats. Seed mixture shall be applied at a rate of 600 pounds per acre.</p>
<p style="text-align: center;">Mulch Requirements</p> <p>Permanent and Temporary Seeding-Where slopes are less than 25 percent (4:1) grade, cereal grain mulch is required at the rate of 100 pounds per 1,000 square feet (4,500 lbs/acre). Cereal grain mulch shall meet the requirements of Section 802 of the Missouri State Specifications for Highway Construction for Type 1 mulch. Where slopes are 25 percent (4:1) or greater grade, Type 3 mulch ("hydromulch") meeting the requirements of Section 802 of the State specifications</p>
<p style="text-align: center;">Dates For Seeding</p> <p>Permanent Seeding-March 1 to June 1 and August 15 to November 1</p> <p>Temporary Seeding-Can occur during any season, however winter is the least tolerant.</p> <p>Dormant Season Seeding-December 15 to February 29</p>

*VEGETATION
REQUIREMENTS CHART*



Figure EC-7

HYDROSEEDING EC-8

DEFINITION AND PURPOSE:

Hydroseeding typically consists of applying a mixture of seed, wood fiber, fertilizer, and stabilizing emulsion with hydro-mulch equipment, which temporarily protects exposed soils from erosion by water and wind.



A hydroseeding operation in action.

APPROPRIATE APPLICATIONS:

Hydroseeding is applied on disturbed soil areas requiring temporary protection until permanent vegetation is established or disturbed soil areas that must be re-disturbed following an extended period of inactivity.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow only.

Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and erosion control. Otherwise, hydroseeding must be used in conjunction with a soil binder or mulching.

WHEN BMP IS TO BE INSTALLED:

Immediately after completion of a phase of grading.

STANDARDS AND SPECIFICATIONS:

To select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to: soil conditions, site topography, season and climate, vegetation types, maintenance requirements, sensitive adjacent areas, water availability, and plans for permanent vegetation. Hydroseeding can be accomplished using a multiple-step or one-step process. The multiple-step process ensures maximum direct contact of the seeds to soil. When the one-step process is used to apply the mixture of seed, fiber, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil. Follow-up applications shall be made as needed to cover weak spots.

OPERATION AND MAINTENANCE PROCEDURES:

All seeded areas shall be inspected for failures and re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates. After any rainfall event, the Permittee is responsible for maintaining all slopes to prevent erosion.

SITE CONDITIONS FOR REMOVAL:

Typically left in place to degrade naturally.

TYPICAL DETAILS:

Not Applicable

SODDING **EC-9**

DEFINITION AND PURPOSE:

A ¾ inch to 1 inch mat of vigorous turf, free from disease, insects and weeds. Sod prevents raindrops from disrupting the soil structure and causing erosion. Sod slows water runoff and acts as a filter when sediment laden runoff crosses over the sodded area.

APPROPRIATE APPLICATIONS:

Typically installed in areas requiring immediate erosion protection, such as swales or detention ponds and as filter strips, around inlets, and adjacent to curbs. Also installed in areas requiring immediate aesthetic appearance or function such as entrances to new subdivisions and off site construction areas.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and low concentrated flows with velocities less than 5 fps.

WHEN BMP IS TO BE INSTALLED:

Immediately after finish grading, installation of area inlets, and installation of underground services and foundations of new homes.

STANDARDS AND SPECIFICATIONS:

Rough grade area and remove all debris larger than 1 inch in diameter and concentrated areas of smaller debris. Soil preparation of area to be sodded shall be determined by tests to determine lime and fertilizer requirements. Level and roll soil lightly to provide an even grade and firm the surface. Soil should not be excessively wet or dry. Lay first row of sod perpendicular to the slope or direction of flow. Butt subsequent rows tight against previous rows with strips staggered in brick-like pattern. Fill minor gaps with good soil and roll entire surface to ensure contact. Stake, staple and/or net corners and centers of sod strips as required, especially areas of concentrated flow. Water immediately after installation, enough to soak 4 inches into the soil without causing runoff.

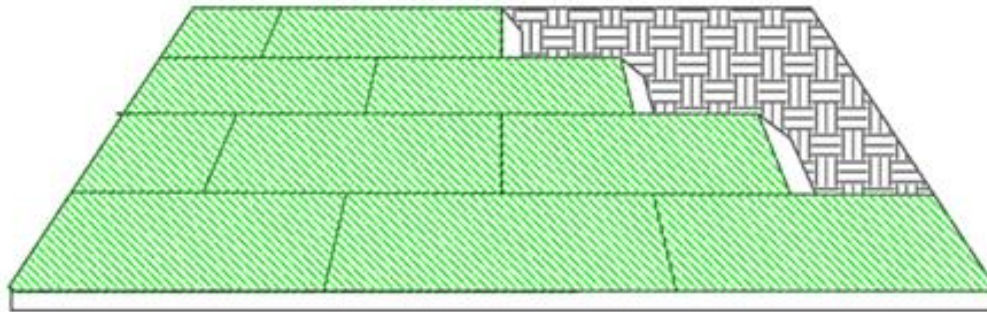
OPERATION AND MAINTENANCE PROCEDURES:

Water sod daily for 3 weeks, enough to soak 4 inches into the soil without causing runoff. Reposition areas of sod that have moved along the slope. Remove sediment accumulations, replace sod if necessary. Repair any eroded areas, replace sod, and stabilize as needed. Do not mow until 3 inches of new growth occurs. During the first 4 months, mow no more than 1/3 the grass height.

SITE CONDITIONS FOR REMOVAL:

Typically left in place to grow.

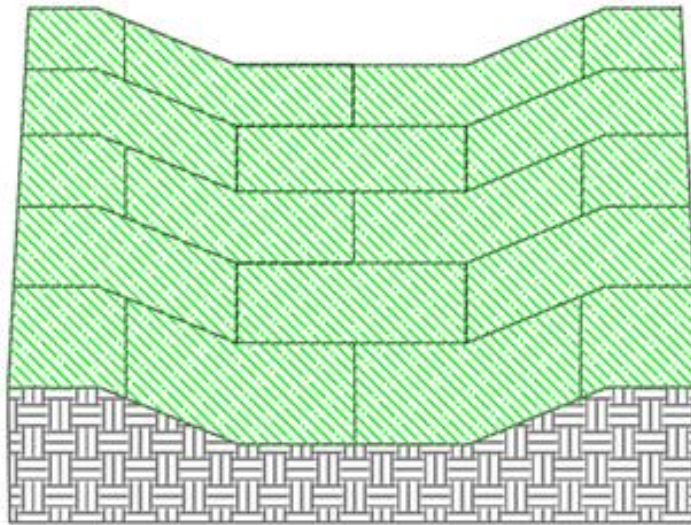
TYPICAL DETAILS: EC-9



LAY SOD IN A STAGGERED PATTERN WITH STRIPS BUTTED TIGHTLY AGAINST EACH OTHER

ON SLOPE > 3:1 USE PEGS OR STAPLES TO FASTEN SOD FIRMLY AT THE CORNERS AND CENTERS.

INSTALLATION OF GRASS SOD



LAY SOD PERPENDICULAR TO THE DIRECTION OF FLOW. USE PEGS OR STAPLES TO FASTEN SOD FIRMLY AT THE CORNERS AND CENTERS.

INSTALLATION OF SOD IN WATERWAYS

Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

SODDING



Figure EC-9

EROSION CONTROL BLANKETS **EC-10**

DEFINITION AND PURPOSE:

An erosion control blanket is a preformed protective blanket of plastic fibers, straw or other plant residue designed to protect soil from the impact of precipitation and overland flow, and retain moisture to facilitate establishment of vegetation. Erosion control blankets are sometimes referred to as Rolled Erosion Control Products (RECPs).

APPROPRIATE APPLICATIONS:

Typically installed on seeded areas for temporary use, and in landscaped areas for permanent use.

CONDITIONS FOR EFFECTIVE USE:

Several factors, such as soil conditions, steepness and length of slope, depth of flow, runoff velocities, and time required to establish desired vegetation influence the choice of product. Manufacturer's recommendations should be followed. Products are available for a variety of uses: Netting-synthetic or natural fiber mesh installed over disturbed areas to hold organic mulch and/or seed in place, biodegradable erosion control blanket-natural fiber blanket held together by netting to provide temporary erosion protection on slopes and channels, and permanent erosion control blanket-synthetic blanket material which provides permanent erosion control on slopes and channels with increased water flow velocities.

WHEN BMP IS TO BE INSTALLED:

Dependent upon intended use-immediately after completion of a phase of grading, or installation of vegetation.

STANDARDS AND SPECIFICATIONS:

Follow manufacturer's recommendations and specifications, particularly noting requirements for check slots, fastening devices (staples), and need for firm contact with soil.



Staking of an erosion control blanket

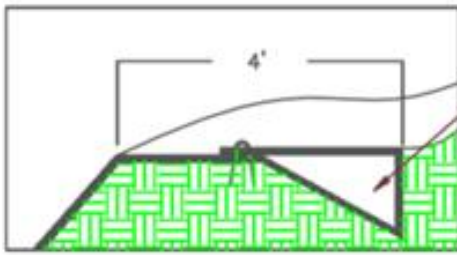
OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site until adequate vegetation is established. Repair erosion and/or undermining at top of slope. Repair undermining beneath blankets, pull back the blanket(s), fill compact eroded area, revegetate and then firmly secure the blanket(s). Reposition or replace blanket(s) that have moved along the slope or have been damaged.

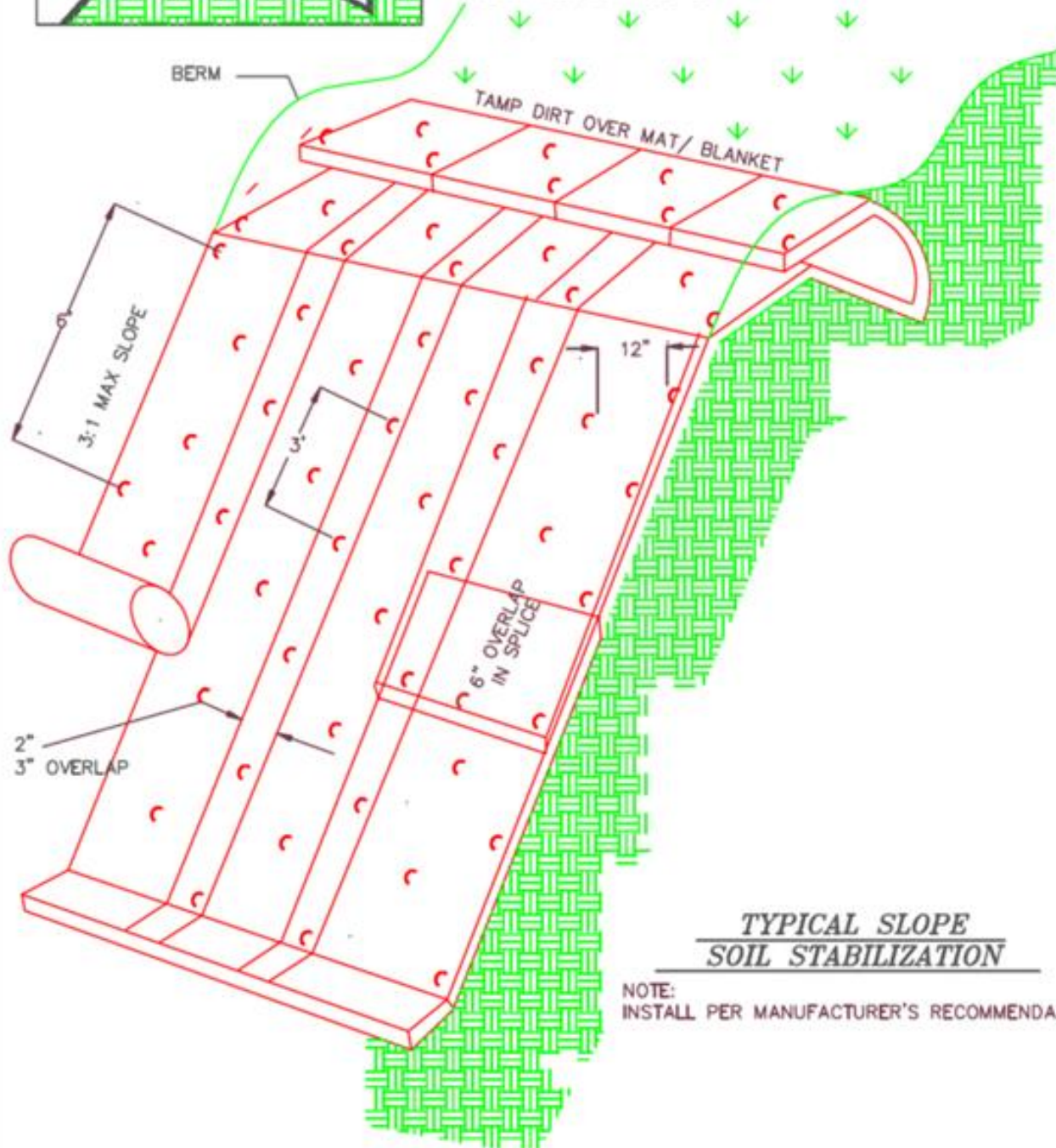
SITE CONDITIONS FOR REMOVAL:

Temporary blankets will generally degrade naturally; permanent blankets remain in place.

TYPICAL DETAILS: EC-10



6'X6' ANCHOR TRENCH
 NOTES:
 SLOPE SURFACE SHALL BE FREE OF
 ROCKS AND CLODS.
 MATS/BLANKET SHOULD BE INSTALLED
 VERTICALLY DOWNSLOPE.



**TYPICAL SLOPE
 SOIL STABILIZATION**

NOTE:
 INSTALL PER MANUFACTURER'S RECOMMENDATION

***EROSION CONTROL
 BLANKETS***



Figure EC-10

TURF REINFORCEMENT MAT EC-11

DEFINITION AND PURPOSE:

A turf reinforcement mat (TRM) is a 3-dimensional permanent synthetic mat that provides a matrix to greatly reinforce the root system of the desired vegetation for permanent erosion protection in high flow channels and on critical slopes. May provide erosion protection equivalent to stone or concrete liners.

APPROPRIATE APPLICATIONS:

Typically installed on seeded areas for permanent use. May be used on steep slopes or grass-lined channels with increased water flow velocities and increased shear stress.

CONDITIONS FOR EFFECTIVE USE:

Several factors, such as soil conditions, steepness and length of slope, depth of flow, runoff velocities, and time required to establish desired vegetation, influence the choice of product. Manufacturer's recommendations should be followed.

WHEN BMP IS TO BE INSTALLED:

Dependent on intended use-immediately after completion of a phase of grading, or seeding of vegetation.

STANDARDS AND SPECIFICATIONS:

Follow manufacturer's recommendations and specifications, particularly noting requirements for check slots, edge entrenchment, fastening devices (staples), and the need for firm contact with the soil.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site until adequate vegetation is established. Repair erosion and/or undermining at the top of the slope. Repair undermining beneath mats-pull back the mat(s), fill and compact eroded area, revegetate and then secure mat(s) firmly reposition or replace mats that have moved along the slope or channel and secure firmly. Replace damaged mats.

SITE CONDITIONS FOR REMOVAL:

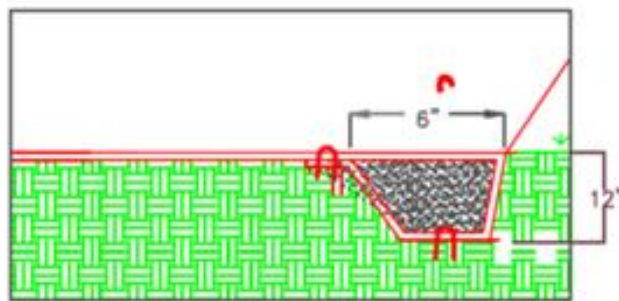
Typically turf reinforcement mats are permanently left in place.

TYPICAL DETAILS:

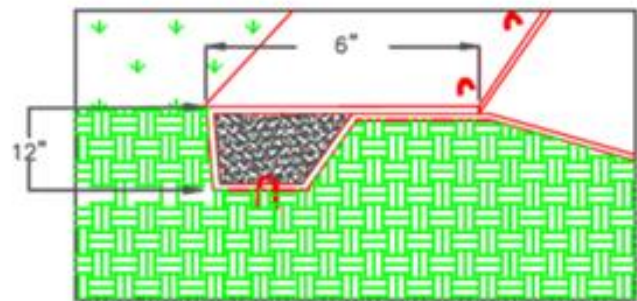
EC-11 & EC-11A



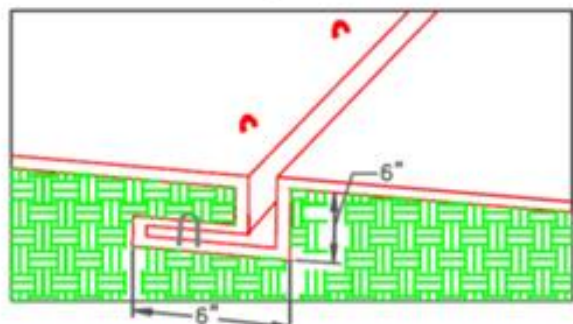
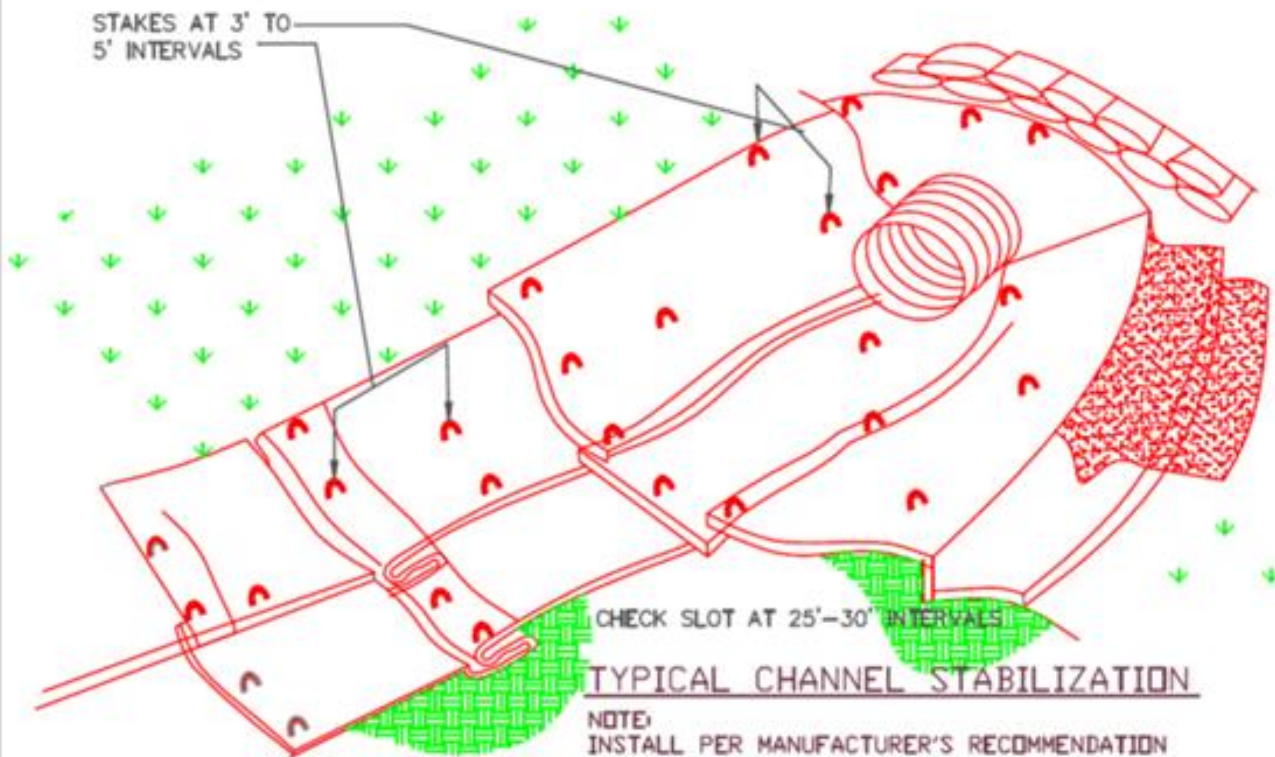
TRMs being used as a channel lining. Check dams are in place until vegetation is established



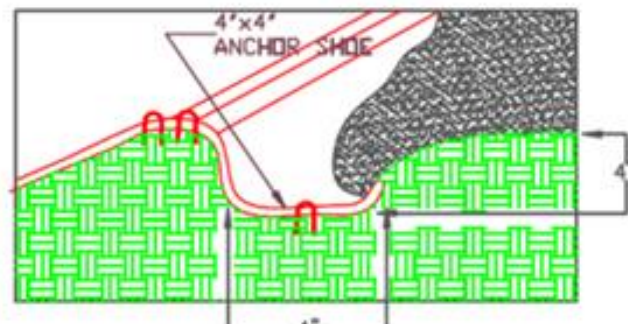
INITIAL CHANNEL ANCHOR TRENCH



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT



LONGITUDINAL ANCHOR TRENCH

Modified from California Stormwater BMP Handbook

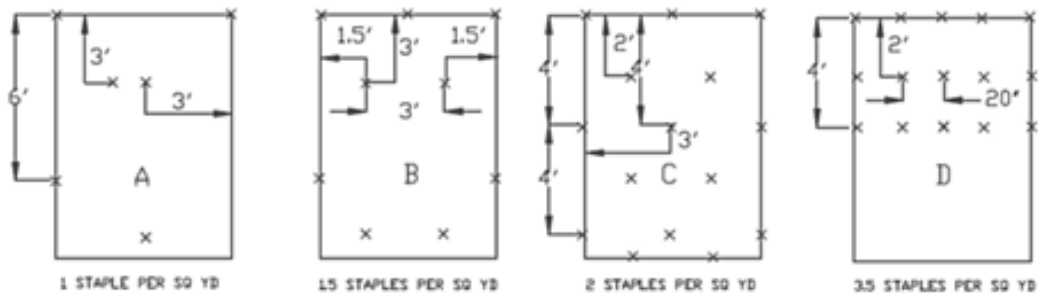
NTS

TURF REINFORCEMENT MATS



Figure EC-11

STAPLE PATTERN



LENGTH AND SLOPE TABLE

300	B		C	C		C	D
150	A		B	C			
FT	A		A	B	B		
	4:1		3:1	2:1	1:1	LDW FLOW CHANNEL	MED/HIGH FLOW

*MINIMUM STAPLE PATTERN GUIDE AND RECOMMENDATION
FOR SLOPE AND CHANNEL APPLICATION

NTS

STAPLE TABLE



Figure EC-11A

GEOTEXTILES AND PLASTIC COVERS **EC-12**

DEFINITION AND PURPOSE:

This BMP involves the placement of geotextiles or plastic covers to stabilize disturbed soil areas and protect soils from erosion by wind or water.

APPROPRIATE APPLICATIONS:

Limited applications include very small graded areas, stockpiles, and temporary channel linings.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet and concentrated flows.

Geotextiles and plastic covers have maximum flow rate limitations; consult the manufacturer for proper selection. The use of plastic covers shall be limited to covering stockpiles, or very small graded areas for short periods of time. The use of plastics and impermeable geotextiles may result in 100% runoff, which may cause serious erosion problems in the areas receiving the increased velocities and flow-Use With Caution. Plastic sheeting is easily vandalized, easily torn, and photodegradable.

WHEN BMP IS TO BE INSTALLED:

Dependent upon intended use-immediately after completion of a phase of grading.

STANDARDS AND SPECIFICATIONS:

Geotextile blankets shall be secured in place with wire staples or sandbags and by keying into tops of slopes and edges to prevent infiltration of surface water under the geotextile. Plastic sheeting shall be keyed in at the top of the slope and firmly held in place with sandbags or other weights placed no more than 10 feet apart. Seams are typically taped or weighted down their entire length. Anchoring the sheeting is crucial in keep the sheeting from becoming a very large kite in windy weather.

OPERATION AND MAINTENANCE PROCEDURES:

All geotextile and plastic sheeting shall be inspected at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site to check for erosion, undermining, and anchorage failure. Any failures shall be repaired immediately. If washout or breakages occur, the material shall be re-installed after repairing the damage to the slope.

SITE CONDITIONS FOR REMOVAL:

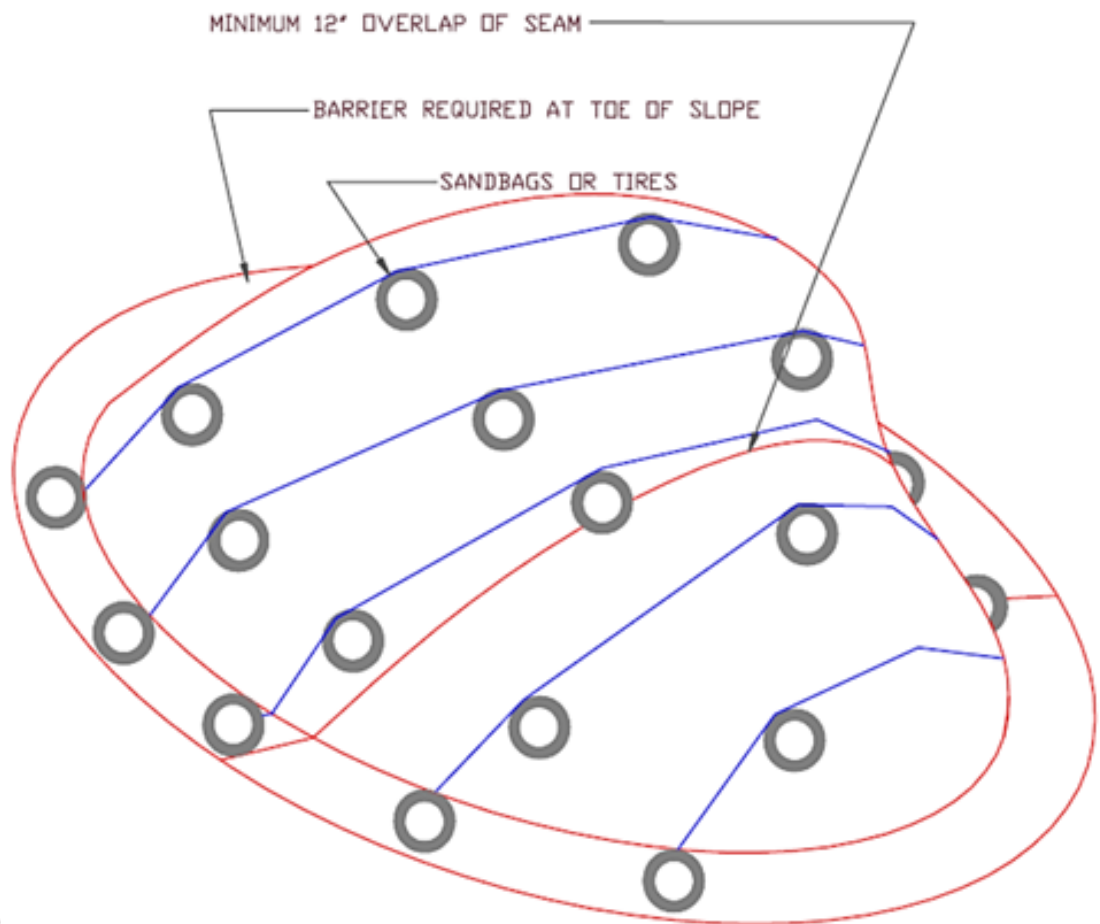
Upon establishment of other temporary stabilizations or after permanent stabilization has occurred.

TYPICAL DETAILS:

EC-12



Plastic cover protecting a stockpile from erosion.



NOTES:

1. MINIMUM 12' OVERLAP OF ALL SEAMS REQUIRED.
2. BARRIER REQUIRED AT TOE OF SLOPE
3. COVERING MAINTAINED TIGHTLY IN PLACE BY USING SANDBAGS OR TIRES ON ROPE WITH A MAXIMUM 10' SPACING IN ALL DIRECTION

Modified from California Stormwater BMP Handbook

NTS

PLASTIC SHEETING



Figure EC-12

OUTLETS/VELOCITY DISSIPATION DEVICES **EC-13**

DEFINITION AND PURPOSE:

These devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of storm water flows. These devices protect the receiving area from erosion.

APPROPRIATE APPLICATIONS:

These devices may be used at the following locations: outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, outlets located at the bottom of mild to steep slopes, discharge outlets that carry continuous flows of water, outlets subject to short, intense flows of water, such as flash floods, points where lined conveyances to unlined conveyances, and at emergency overflows or outlet pipes of a sediment basin.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Concentrated flow

Flow at Outlet: See Storm Water Design Criteria Manual

WHEN BMP IS TO BE INSTALLED:

With the construction of the upstream BMP that creates the concentrated discharge.

STANDARDS AND SPECIFICATIONS:

Install riprap, grouted riprap, concrete apron, etc. at selected outlet. Riprap aprons are best suited for temporary use during construction. Carefully place riprap to avoid damaging the filter fabric. Align the apron with the receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron. If the size of the apron riprap is comprised of large rocks, protect the underlying filter fabric with a gravel blanket.

OPERATION AND MAINTENANCE PROCEDURES:

During construction, inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment and trash accumulation. Inspect apron for displacement of the riprap and/or damage to the underlying fabric. Repair fabric and replace riprap that has washed away-larger rock may be required. Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes immediately-extend pad if necessary.

SITE CONDITIONS FOR REMOVAL:

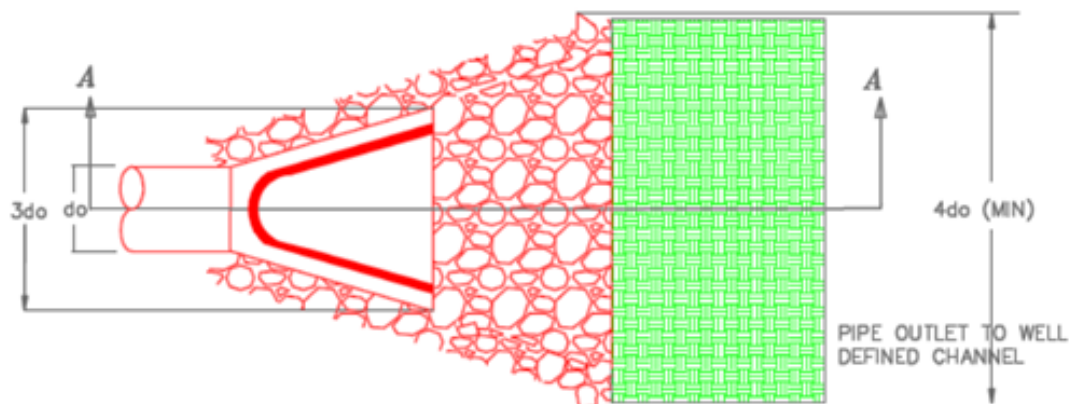
Temporary devices need to be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.

TYPICAL DETAILS:

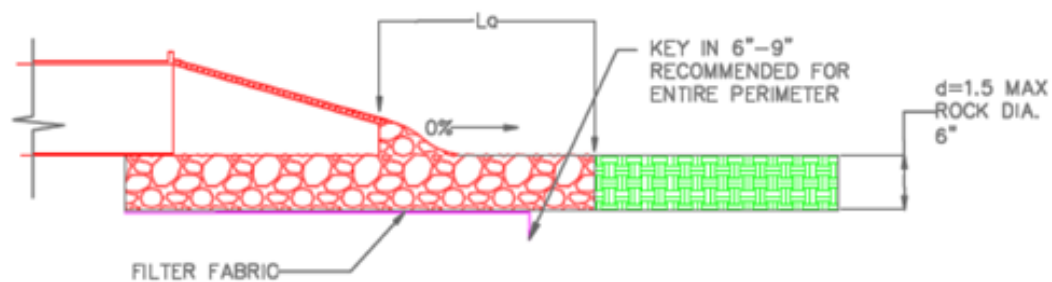
EC-13A, EC-13B, and EC-13C



Looking downstream, below a culvert outfall, at a riprap velocity dissipation pad.



PLAN



SECTION

PIPE DIAMETER INCHES	DISCHARGE ft ³ /s	APRON LENGTH, L_a ft	RIP RAP D50 DIAMETER MIN INCHES
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

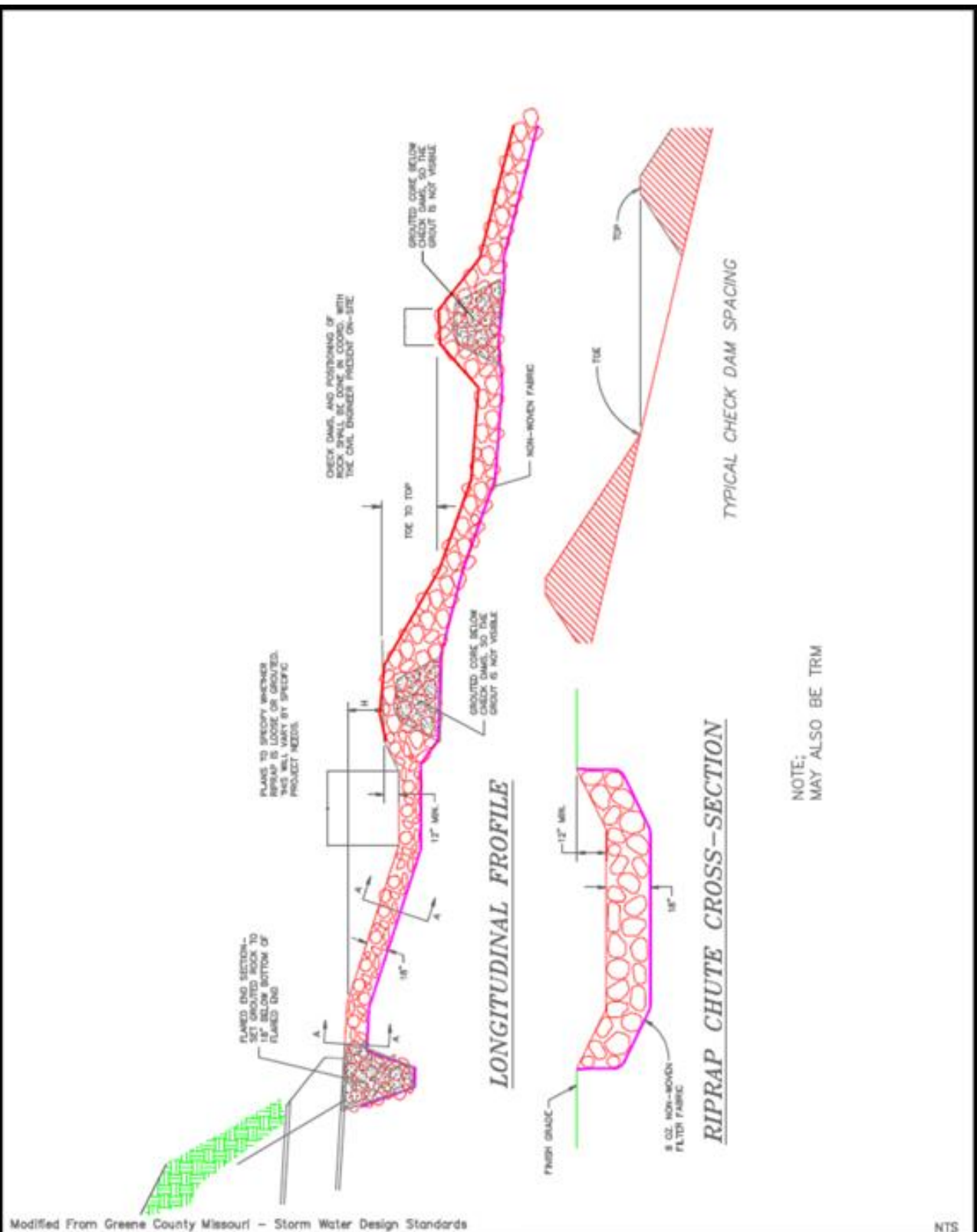
Modified from California Stormwater BMP Handbook

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VELOCITY DISSIPATION DEVICE



Figure EC-13A



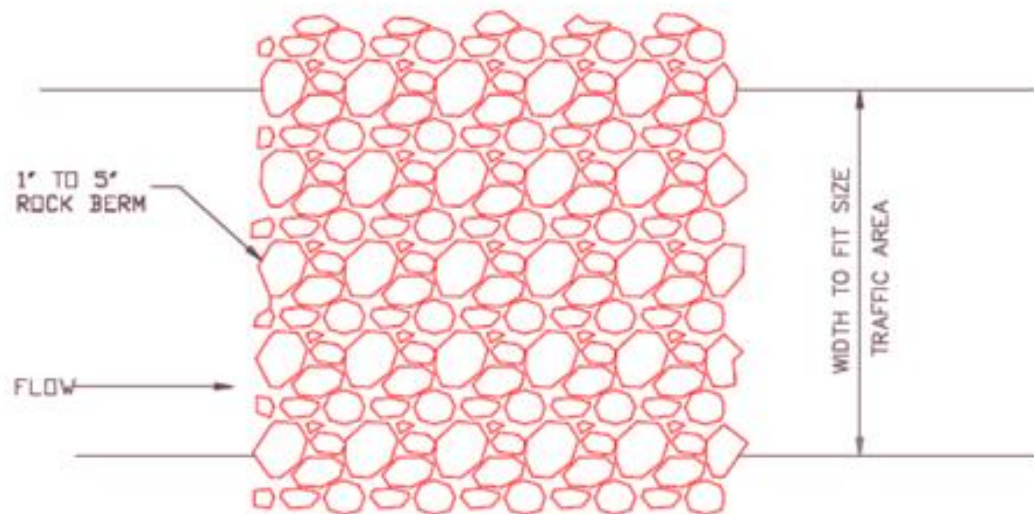
VELOCITY DISSIPATOR AT PIPE DAYLIGHT



Figure EC-13B



SECTION



PLAN

Modified from California Stormwater BMP

NTS

TYPICAL ROCK FILTER



Figure EC-13C

STREAMBANK STABILIZATION **EC-14**

DEFINITION AND PURPOSE:

A vegetative, structural or combination treatment of streams designed to stabilize the stream and reduce erosion. It is important to note that a systemic analysis of the entire reach of stream must be conducted in order to avoid unintended negative impacts on a stream as a result of a corrective action at an isolated location. A wide array of products and methodologies can be used to stabilize streams: live stakes, cellular confinement matrices, articulated block pavers, riprap, gabion baskets, turf reinforcement mats, revetments, large woody debris, grade controlling structures, stilling basins, etc.

APPROPRIATE APPLICATIONS:

All construction projects that disturb or occur within stream channels and their associated riparian areas.

CONDITIONS FOR EFFECTIVE USE:

Acceptable methods vary widely due to the unique nature of each reach of channel. Design considerations include: current and future watershed conditions, discharge, velocity, sediment load, channel slope, control of bottom scour (incising), soil conditions, compatibility with other improvements, changes in channel alignment, and protection and maintenance of fish and wildlife habitats and existing tree canopy. U.S. Army Corps of Engineers permits may be applicable.

WHEN BMP IS TO BE INSTALLED:

After streambank(s) have been disturbed.

STANDARDS AND SPECIFICATIONS:

Procedures are specific to materials used. Generally, stabilize the channel bottom first to prevent incising and knick points from undermining the bank protection. Start and stop bank protection at stable points along the channel. Minimize the size of all disturbed areas and stabilize as soon as each phase of construction is complete. Use other BMPs to prevent runoff from disturbing the streambank protection area until it has been completed. Store all construction materials well away from the stream. At the end of each workday, move all construction equipment out of and away from the stream to prevent flooding.

Avoid steep slopes on the streambank.

OPERATION AND MAINTENANCE PROCEDURES:

During construction, inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Repair, relocate, or add BMPs protecting channel until the streambank protection is operational. Remove sediment as needed.

SITE CONDITIONS FOR REMOVAL:

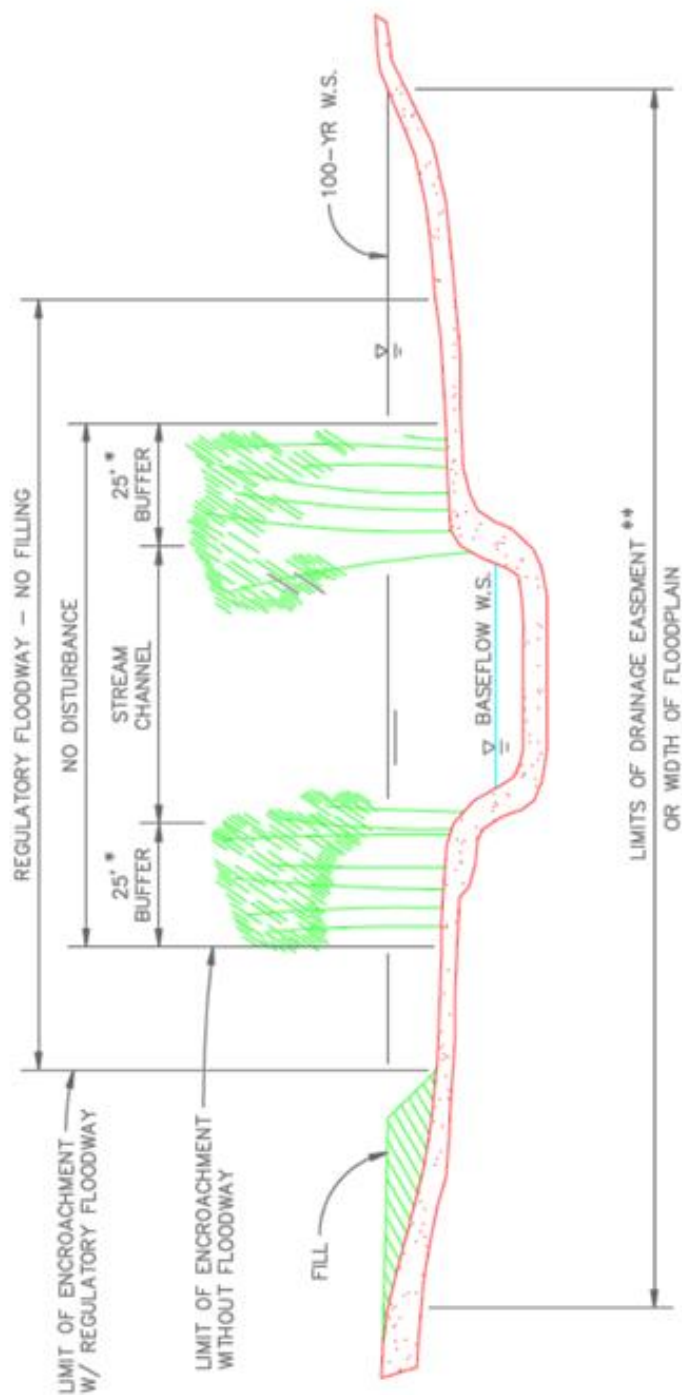
Not Applicable

TYPICAL DETAILS:

EC-14A and EC-14B



Multiple methods and products, including a retaining wall, large boulders, vegetation, and turf reinforcement mats, being used for a streambank stabilization project.



- * EXISTING VEGETATION TO REMAIN, 100' WIDTH PREFERRED.
- ** USE FULLY URBANIZED CONDITIONS FOR PEAK FLOW RATE.

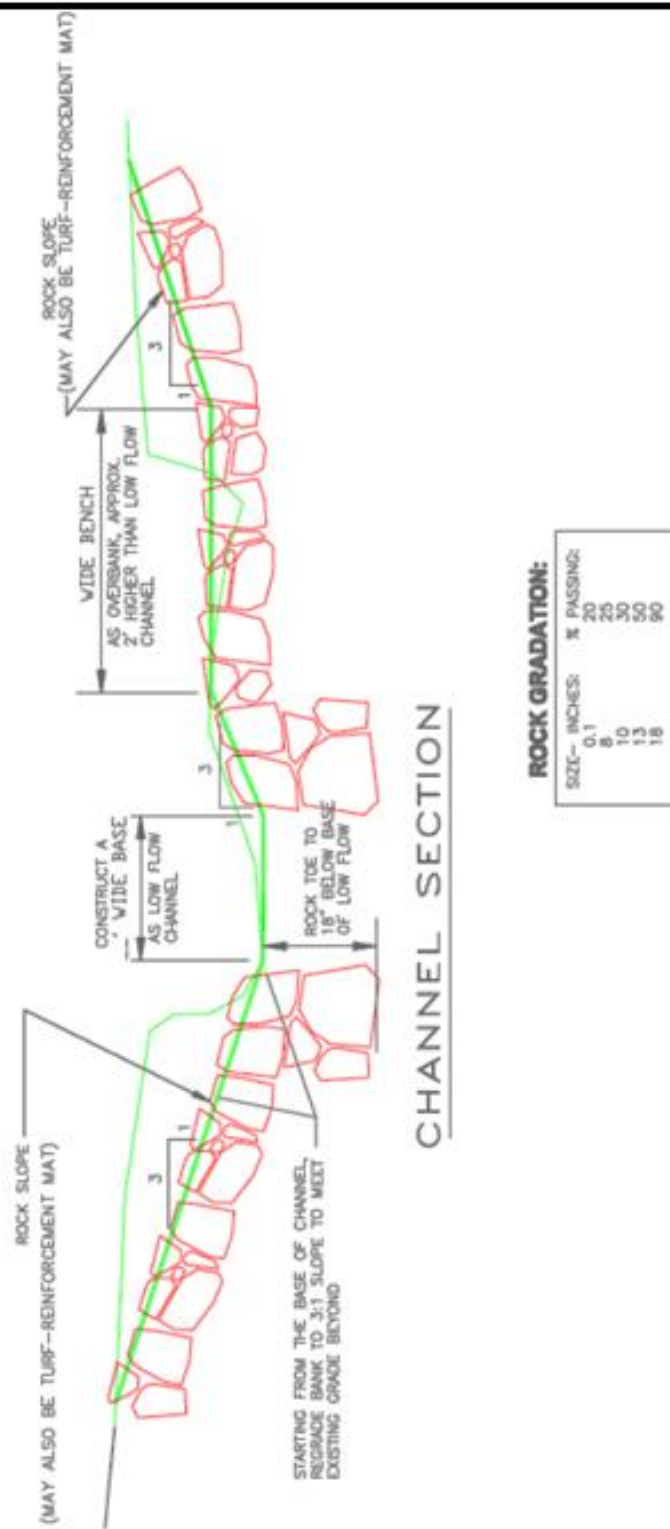
Modified From Greene County Missouri - Storm Water Design Standards

NTS

TYPICAL NATURAL CHANNEL



Figure EC-14A



Modified From Greene County Missouri — Storm Water Design Standards

NTS

MULTI-STAGE ROCK CHANNEL



Figure EC-14B

CHECK DAMS RM-1

DEFINITION AND PURPOSE:

Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment settlement. A check dam is a small device constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary product placed across a natural or man-made channel or drainage ditch. Not to be constructed from straw bales or silt fence.

APPROPRIATE APPLICATIONS:

Check dams can be placed at intervals along drainage swales or channels. The top of the downstream check dam should be level with the base of the upstream check dam. Check dams can also be used during the establishment of grass linings in drainage ditches or channels or in temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Moderate concentrated flow.

Contributing Area: Maximum of 10 acres.

Not to be used in perennial streams.

WHEN BMP IS TO BE INSTALLED:

Before disturbing vegetation in contributing drainage area; right after construction of drainage way.



Triangulated silt dikes used as check dams.

STANDARDS AND SPECIFICATIONS:

Check dams should be placed at a distance and height to allow small pools to form behind them. Install the first check dam approximately 5 meters (16 feet) from the outfall device and at regular intervals based on slope gradient and soil type. For multiple check dam installation, backwater from the downstream check dam should reach the toe of the upstream dam. High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding.

OPERATION AND MAINTENANCE PROCEDURES:

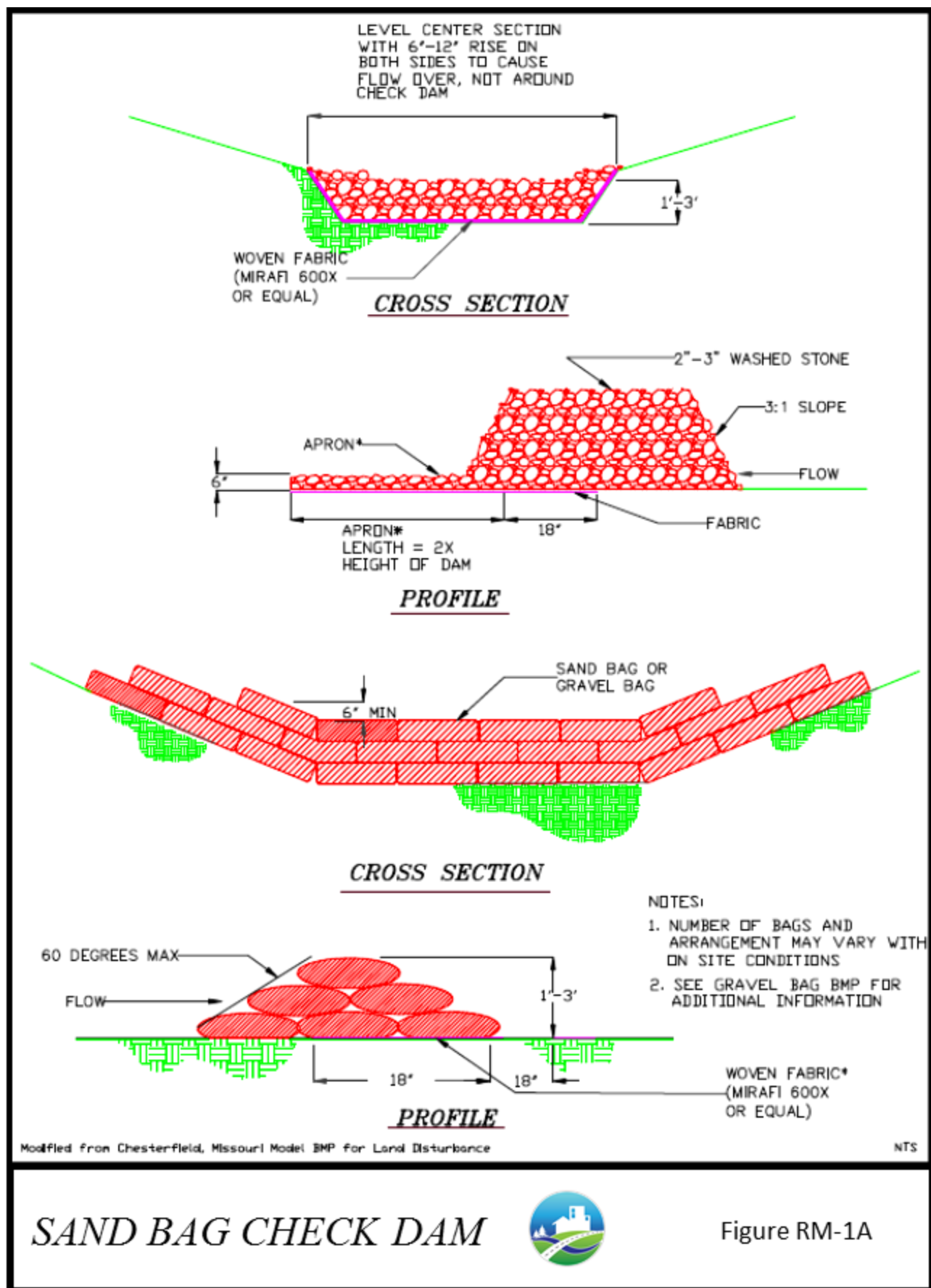
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove trash and leaf accumulation. Remove sediment when depth reaches one-half of the check dam height. Repair/restore dam structure, if necessary, to original configuration to protect the banks.

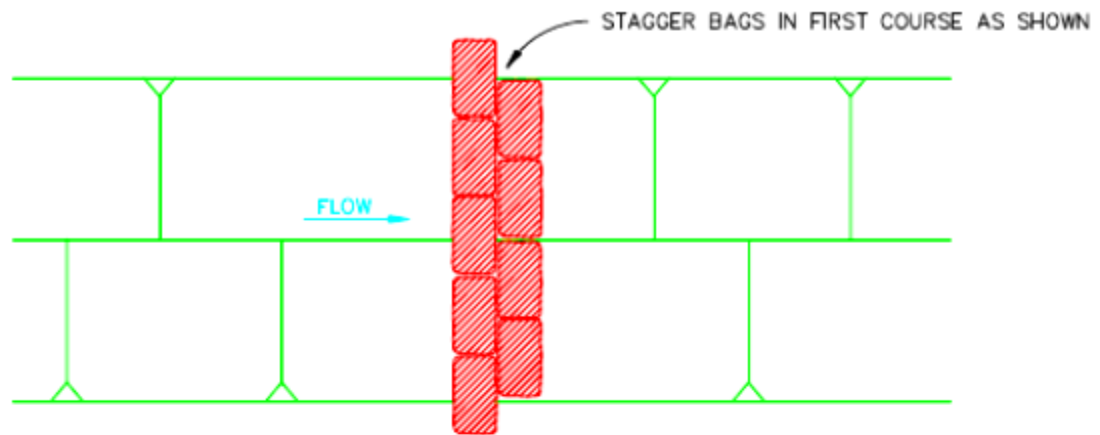
SITE CONDITIONS FOR REMOVAL:

Remove after contributing areas have been adequately stabilized and vegetation is adequately established in drainage way. Regrade and vegetate area of check dam.

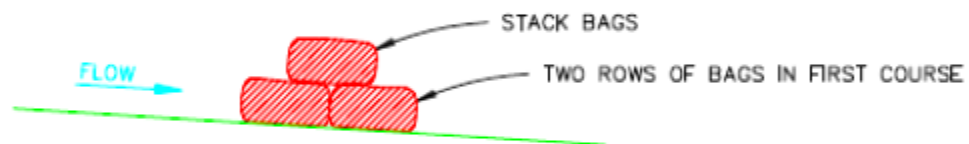
TYPICAL DETAILS:

RM-1A, RM-1B and RM-1C





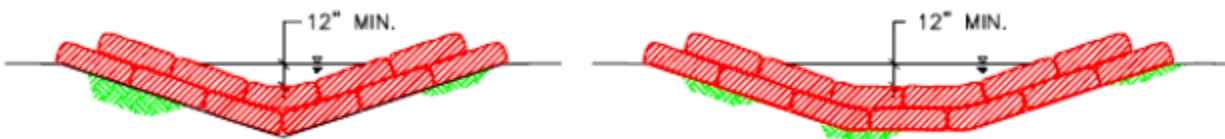
PLAN



PROFILE

NOTES:

FILL BAGS WITH 5/8" TO 1 1/2" CRUSHED LIMESTONE.
BAGS MAY BE BURLAP OR WOVEN PLASTIC.
SPACE CHECK DAMS ACCORDINGLY



TYPICAL CROSS-SECTIONS

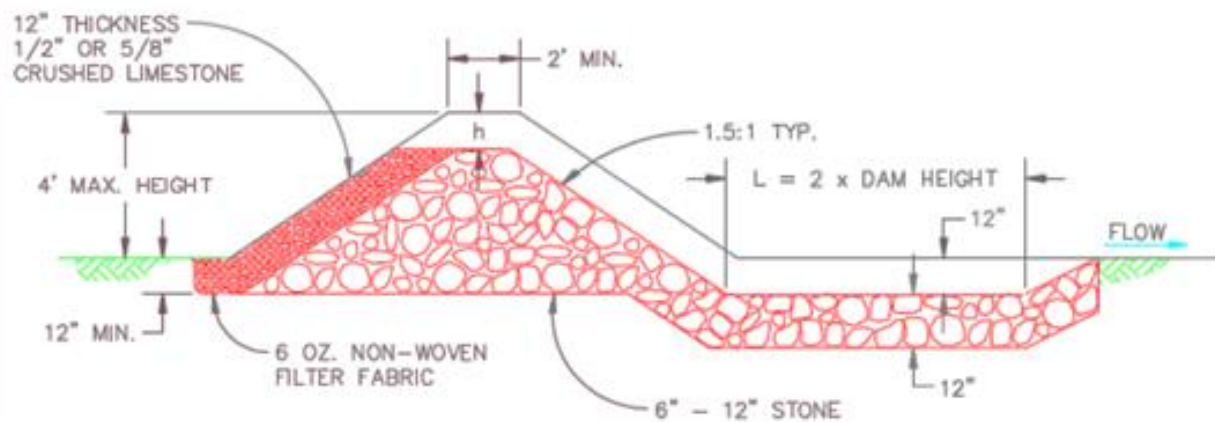
Modified From Greene County Missouri – Storm Water Design Standards

NTS

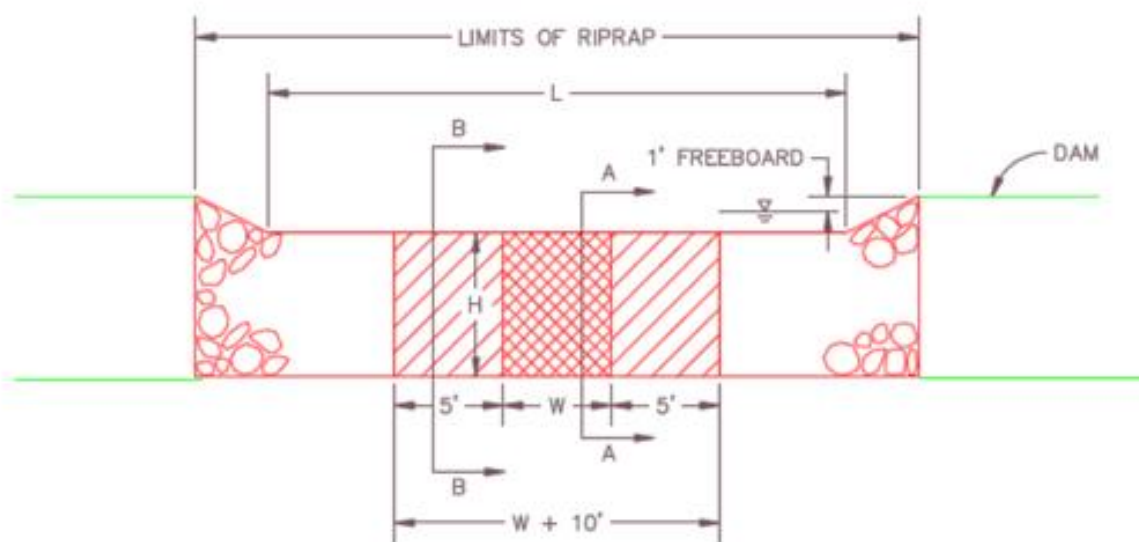
SAND BAG CHECK DAM



Figure RM-1B



SECTION



L = LENGTH REQUIRED TO PASS Q_{10} WHILE
MAINTAINING 1 FT. OF FREEBOARD

W = WIDTH OF ROCK FILTER AREA

MIN. WIDTH OF FILTER FABRIC

Modified From Greene County Missouri – Storm Water Design Standards

NTS

GRAVEL FILTER DAM



Figure RM- 1C

EARTH BERMS AND DRAINAGE SWALES RM -2

DEFINITION AND PURPOSE:

A compacted earth or gravel ridge, excavated channel or a combination of ridge and channel designed to direct runoff away from or around disturbed areas. Diversions built on a level contour are used in combination with temporary slope drains to provide adequate conveyance. Diversions built with positive drainage slopes release runoff into additional BMPs, such as sediment traps or level spreaders.

APPROPRIATE APPLICATIONS:

These features may be used to: convey surface runoff down sloping land, intercept and divert runoff to avoid sheet flow over sloped surfaces, divert and direct runoff towards a stabilized watercourse, drainage pipe or channel, and intercept runoff from paved surfaces. Berms, swales, and lined ditches also may be used: below steep grades where runoff begins to concentrate, along roadways and facility improvements subject to flood drainage, at the top of slopes to divert run-on from adjacent or undisturbed slopes. Also, at bottom and mid-slope locations to intercept sheet flow and convey concentrated flows.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and low-volume concentrated flows.

Contributing Area: Contributing slope length-300 feet maximum.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation on slopes and at intervals during construction of fill slopes.

STANDARDS AND SPECIFICATIONS:

Care must be applied to correctly size and locate berms, swales, and ditches. Excessively steep, unlined berms and swales are subject to gully erosion. Grade and compact channel and/or ridge. Conveyances should be stabilized with vegetation or a protective lining. Provide stabilized outfall areas. Other BMPs, such as check dams and erosion control blankets, may be necessary to prevent scour and erosion.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment.

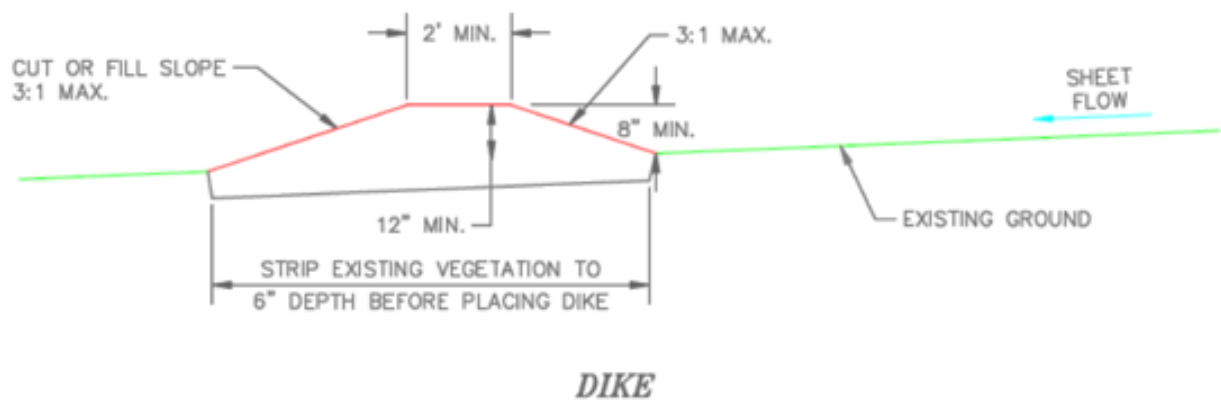
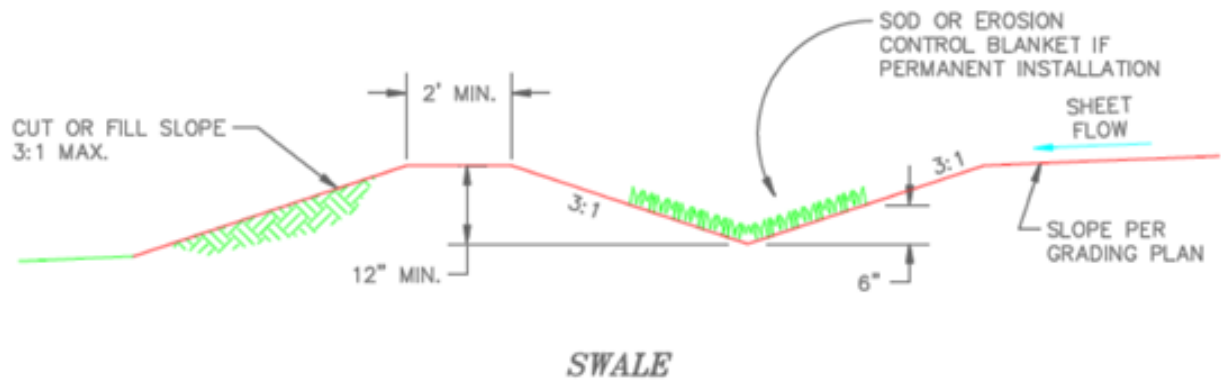
Remove debris and sediment, repair linings and embankments as needed-replace riprap, linings or soil stabilizers as needed.

SITE CONDITIONS FOR REMOVAL:

Temporary diversions should be removed as soon as the surrounding drainage area has been stabilized.

TYPICAL DETAILS:

RM-2A, RM-2B, and RM-2C



NOTES:

1. DIKE SHALL BE COMPACTED TO DENSITY EQUAL TO THAT SPECIFIED FOR ADJOINING AREA (90% STANDARD PROCTOR DENSITY, MINIMUM).
2. MINIMUM 1% GRADE MUST BE PROVIDED FOR SWALE OR ALONG UPSLOPE SIDE OF DIKE FOR PROPER DRAINAGE.

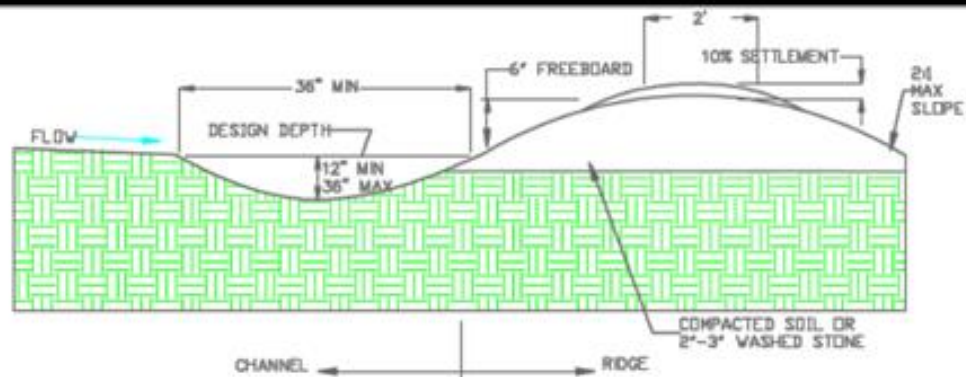
Modified From Greene County Missouri - Storm Water Design Standards

NTS

EARTH BERMS & SWALES

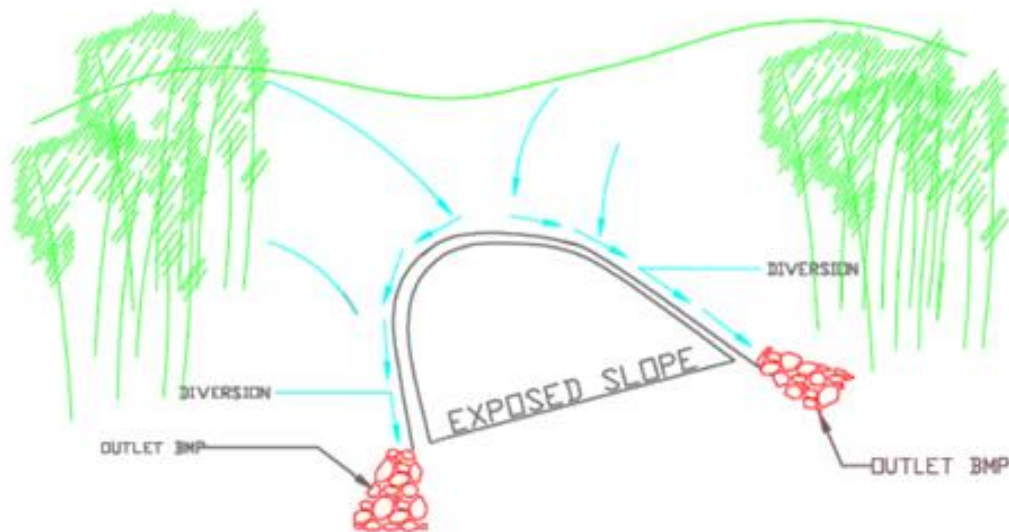


Figure RM- 2A

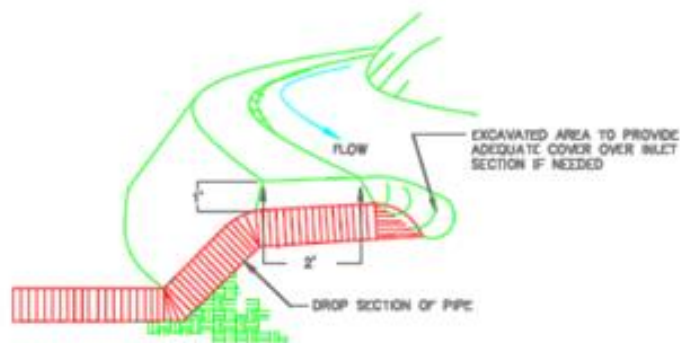


CROSS SECTION

ALL SURFACE STABILIZED WITH MULCH, SEED OR GRAVEL



TYPICAL PERIMETER PROTECTION



TYPICAL TOP OF SLOPE INSTALLATION

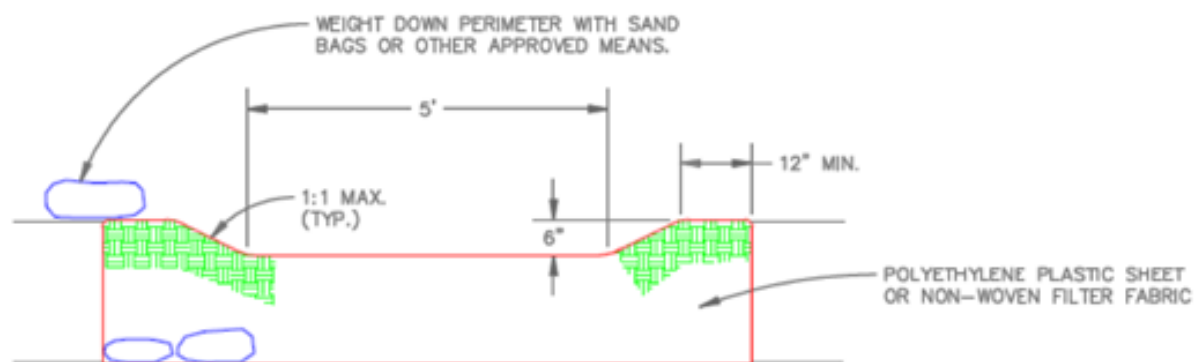
Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

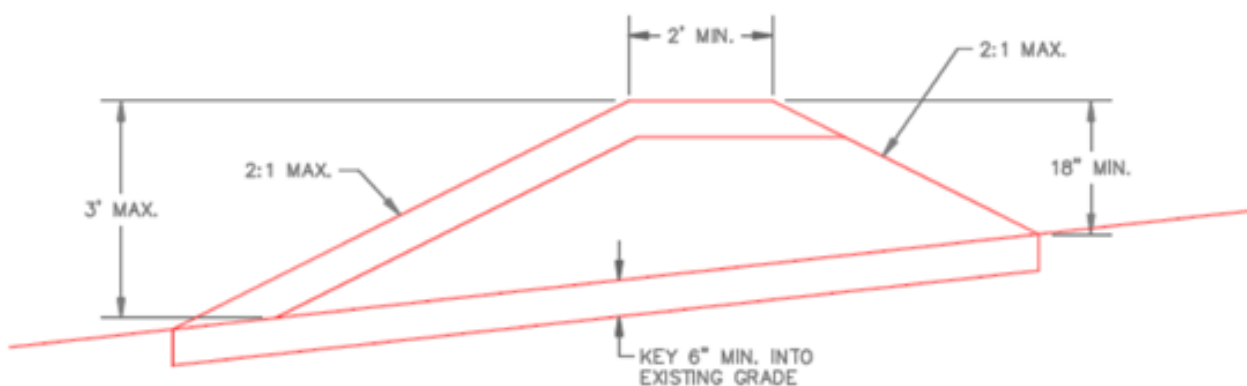
EARTH BERMS & SWALES



Figure RM- 2B



OVERFLOW AREA



NOTES:

1. SOIL IN BERM SHALL BE FIRMLY COMPACTED.
2. AT EACH END OF BERM, TURN BERM UPSLOPE AND EXTEND UNTIL GROUND SURFACE RISES TO TOP OF BERM ELEVATION.
3. PROVIDE OVERFLOW AREAS AT 200 FT. MAX. INTERVALS.

Modified From Greene County Missouri – Storm Water Design Standards

NTS

TEMPORARY SILT CONTAINMENT BERM



Figure RM- 2C

GRAVEL BAGS RM-3

DEFINITION AND PURPOSE:

Open mesh nylon or burlap bags of gravel designed to pond water and cause sediment to settle out.

Gravel bags can be used alone or as a part of other BMPs. A gravel bag berm consists of a single row of gravel bags that are installed end to end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide some sediment removal.

APPROPRIATE APPLICATIONS:

Gravel bags may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible. Generally, gravel bags can be used: along streams and channels, below the toe of exposed and erodible slopes, around stockpiles, across channels to serve as a barrier for utility trenches, parallel to roadways, in water diversions, as perimeter protection, as inlet protection, to create a temporary sediment basin, at grade breaks of exposed and erodible slopes to shorten slope lengths, or when site conditions require adjustments or relocation of a barrier.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow.

WHEN BMP IS TO BE INSTALLED:

Dependent upon function it is designed to perform.

STANDARDS AND SPECIFICATIONS:

Fill bags approximately 2/3 full with gravel. When used as a linear control for sediment removal: install along a level contour and turn ends of gravel bag row up slope (j-hook style) to prevent flow around the ends. When used for concentrated flows: stack gravel bags to required height using a pyramid approach, the upper rows of gravel bags should overlap joints in lower rows. Construct gravel bag barriers with a set-back of at least 3 feet from the toe of a slope to allow for cleaning out of accumulated sediment.

OPERATION AND MAINTENANCE PROCEDURES:

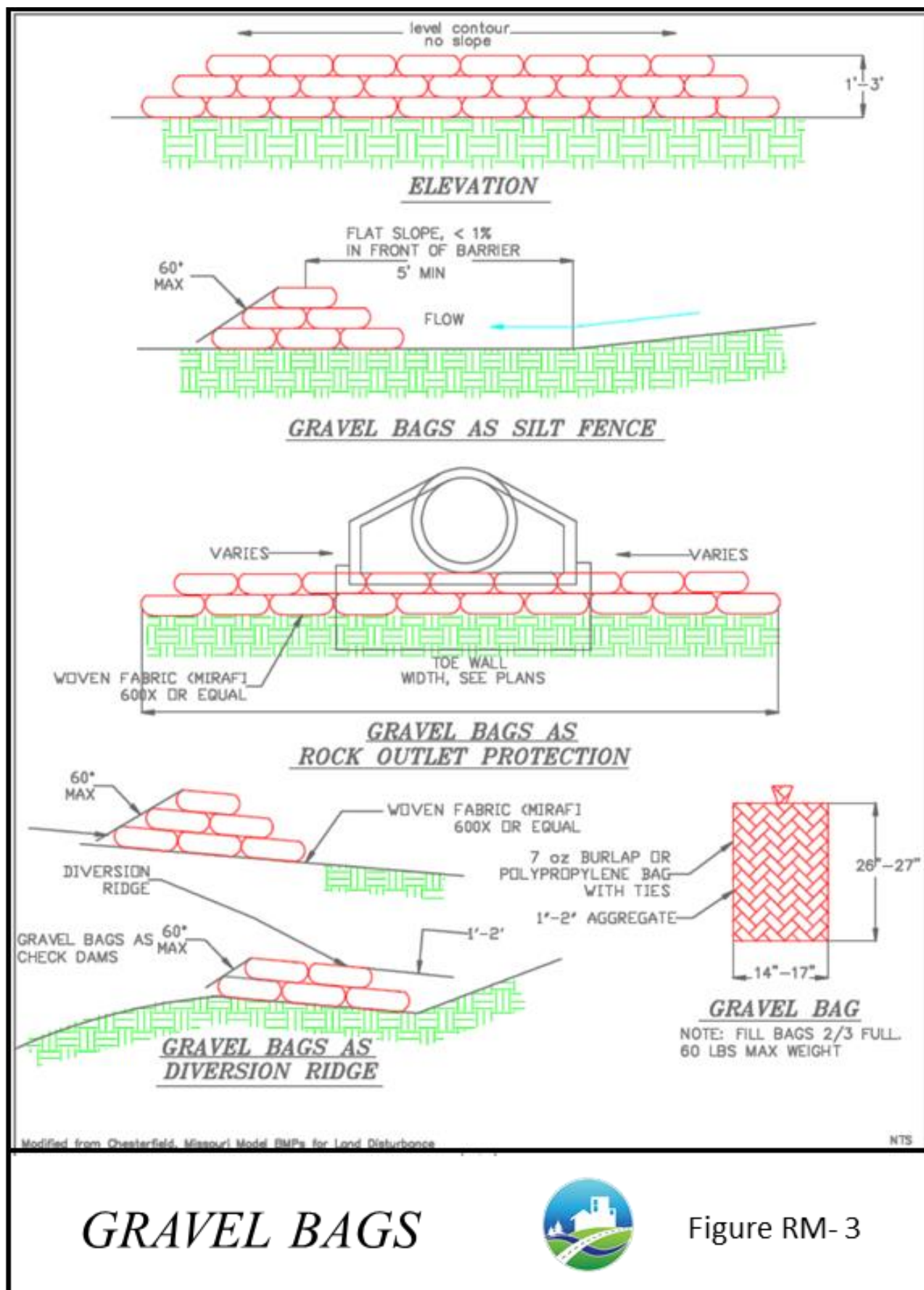
During construction, inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Replace and stabilize any damaged bags or bags that have moved out of place. Repair washouts or other damages as needed. Inspect gravel bags for sediment accumulations and remove sediment when accumulation reaches ½ the height of the structure.

SITE CONDITIONS FOR REMOVAL:

Completion of upstream/upslope work and vegetation/stabilization of contributing runoff areas.

TYPICAL DETAILS:

RM-3



GRAVEL BAGS



Figure RM-3

SOIL ROUGHENING **RM-4**

DEFINITION AND PURPOSE:

Soil roughening is a temporary erosion control practice often used in conjunction with grading. Soil roughening involves increasing the relief of a bare soil surface with horizontal grooves by either stairstepping (running parallel to the contour of the land) or using construction equipment to track the surface. Slopes that are not fine-graded and left in a roughened condition can also reduce erosion. Soil roughening reduces runoff velocity, increases infiltration, reduces erosion, traps sediment, and prepares the soil for seeding and planting by giving seed an opportunity to take hold and grow.

APPROPRIATE APPLICATIONS:

Soil roughening is appropriate for all slopes but works especially well on: slopes greater than 4:1, on piles of excavated soil, and in areas with highly-erodible soils. This technique is especially appropriate for soils that are frequently disturbed because roughening is relatively easy.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow.

Contributing Area: Unlimited on slopes <10%, slopes >10% may require additional BMPs (such as a diversion channel, slope drain, fiber rolls/wattles, etc.).

WHEN BMP IS TO BE INSTALLED:

Immediately after rough grading and prior to seeding or mulching.

STANDARDS AND SPECIFICATIONS:

Depending on the type of slope and the available equipment, use different methods for roughening soil on a slope. These include stair-step grading, grooving, and tracking. When choosing a method, consider factors such as slope steepness, mowing requirements, whether the slope is formed by cutting or filling, and available equipment. Soil roughening is not appropriate for rocky slopes. Tracked machinery can excessively compact the soil, therefore light weight machinery should be considered.

OPERATION AND MAINTENANCE PROCEDURES:

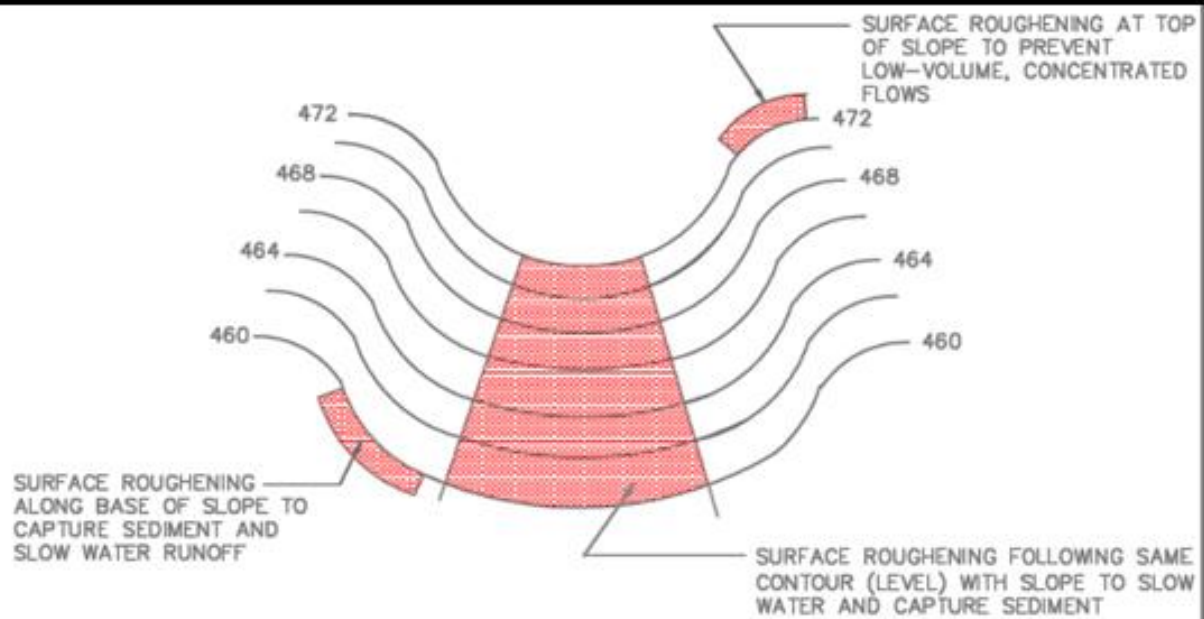
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Rework the slope and regroove after sediment buildup is deeper than ½ the groove depth. Rework the slope and regroove if rills have cut across the roughened surface.

SITE CONDITIONS FOR REMOVAL:

The slope should be reworked to the design grades immediately prior to final stabilization.

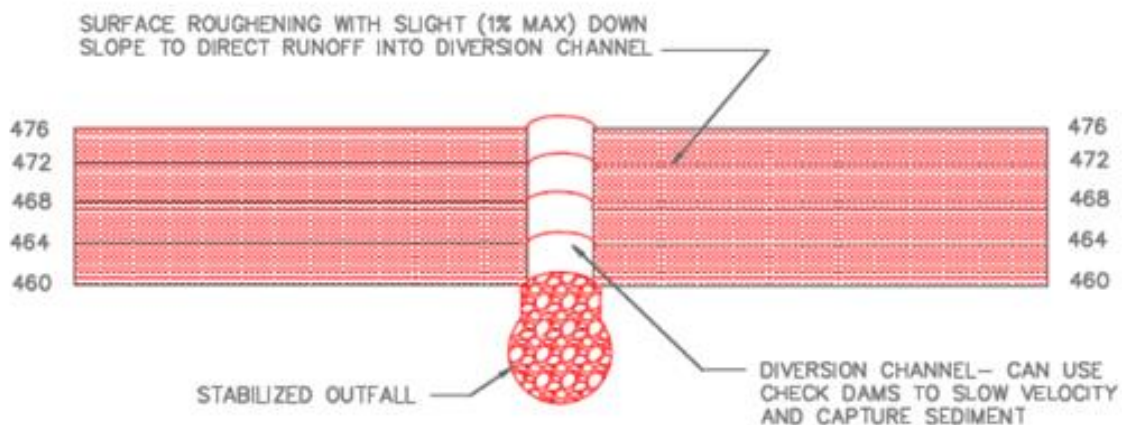
TYPICAL DETAILS:

RM-4

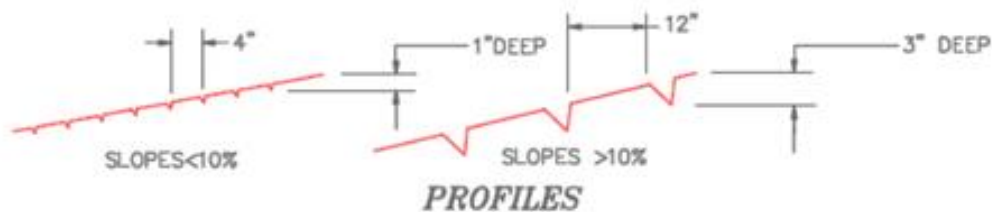


TOP/BOTTOM/ALONG SLOPES SURFACE ROUGHENING TYPES

*TYPES CAN BE USED INDIVIDUALLY OR IN COMBINATIONS TO INCREASE EFFECTIVENESS



DOWN SLOPE SURFACE ROUGHENING WITH DIVERSION CHANNEL



Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

SOIL ROUGHENING



Figure RM- 4

FIBER ROLLS/WATTLES **RM-5**

DEFINITION AND PURPOSE:

Fiber rolls (also called “coir logs” or “straw wattles”) are tube-shaped erosion-control devices filled with straw, flax, rice, coconut fiber material, or composted material. Each roll is wrapped with UVdegradable polypropylene netting for or with 100 percent biodegradable materials like burlap, jute, or coir. These devices reduce the effects of long or steep slopes by breaking up the slope length.

APPROPRIATE APPLICATIONS:

Fiber rolls can be used in areas of low shear stress including; (1) along the toe, top, face, and at grade breaks consisting of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow, (2) at the end of a downward slope where it transitions to a steeper slope, (3) along the perimeter of a project or stockpile, (4) as check dams in unlined ditches, and (5) downslope of exposed soil areas.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow.

WHEN BMP IS TO BE INSTALLED:

Immediately after rough grading; prior to seeding or mulching.

STANDARDS AND SPECIFICATIONS:

On slopes, install fiber rolls along the contour with a slight downward angle at the end of each row to prevent ponding at the midsection. Turn the ends of each fiber roll upslope (like a j-hook) to prevent runoff from flowing around the roll. Determine the vertical spacing for slope installations on the basis of the slope gradient and soil type. A good rule of thumb is: 1:1 slopes=10 feet apart, 2:1 slopes=20 feet apart, 3:1 slopes=30 feet apart, and 4:1 slopes=40 feet apart. Stake fiber rolls securely into the ground and orient them perpendicular to the slope. Fiber rolls can also be used on projects with minimal slopes. Typically, the rolls are installed along sidewalks, on the bare lot side, to keep sediment from washing onto sidewalks and streets and into gutters and storm drains.

OPERATION AND MAINTENANCE PROCEDURES:

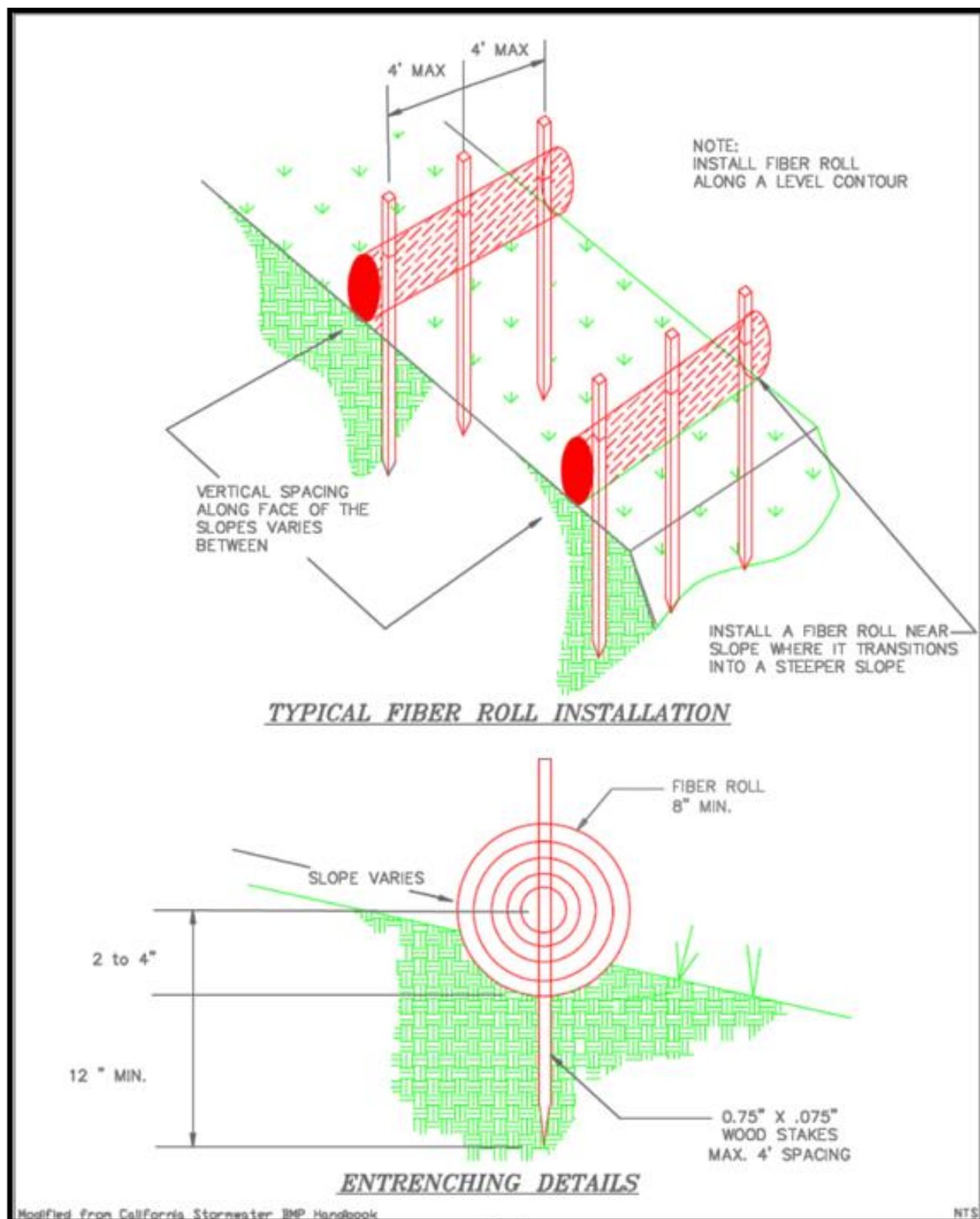
During construction, inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment accumulation when it reaches ½ the height of the roll/wattle. Repair or replace split, torn, unraveled, or slumping fiber rolls.

SITE CONDITIONS FOR REMOVAL:

Fiber rolls are typically left in place on slopes. If they are removed after stabilization has been achieved, collect and dispose of the accumulated sediment.

TYPICAL DETAILS:

RM-5



FIBER ROLLS & WATTLES



Figure RM-5

DEWATERING OPERATIONS R-6

DEFINITION AND PURPOSE:

Dewatering operations are practices, such as dewatering bags, filter socks, and pump trucks, that manage the discharge of pollutants when non-stormwater and accumulated precipitation must be removed from a work location so that construction work may be accomplished. Water cannot be directly pumped into the County's storm sewer system, streams, or lakes.

APPROPRIATE APPLICATIONS:

These practices are implemented for removing standing stormwater and non-stormwater from construction sites. Non-stormwaters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (stormwater) from depressed areas at a construction site.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Standing water.

WHEN BMP IS TO BE INSTALLED:

Prior to work being done in or adjacent to standing water.

STANDARDS AND SPECIFICATIONS:

Site conditions will dictate the design. A dewatering plan should be submitted as part of the SWPPP detailing the location of dewatering activities, equipment, and discharge point. Additional permits or permissions from other agencies may be required for some dewatering operations. Sediment control and other appropriate BMPs (e.g outlet protection/energy dissipation, sediment trap, weir tank, gravity bag filter, sand media particulate filter, pressurized bag filter, etc.) need to be employed when water is discharged. Dewatering discharges must not cause erosion at the discharge point.

OPERATION AND MAINTENANCE PROCEDURES:

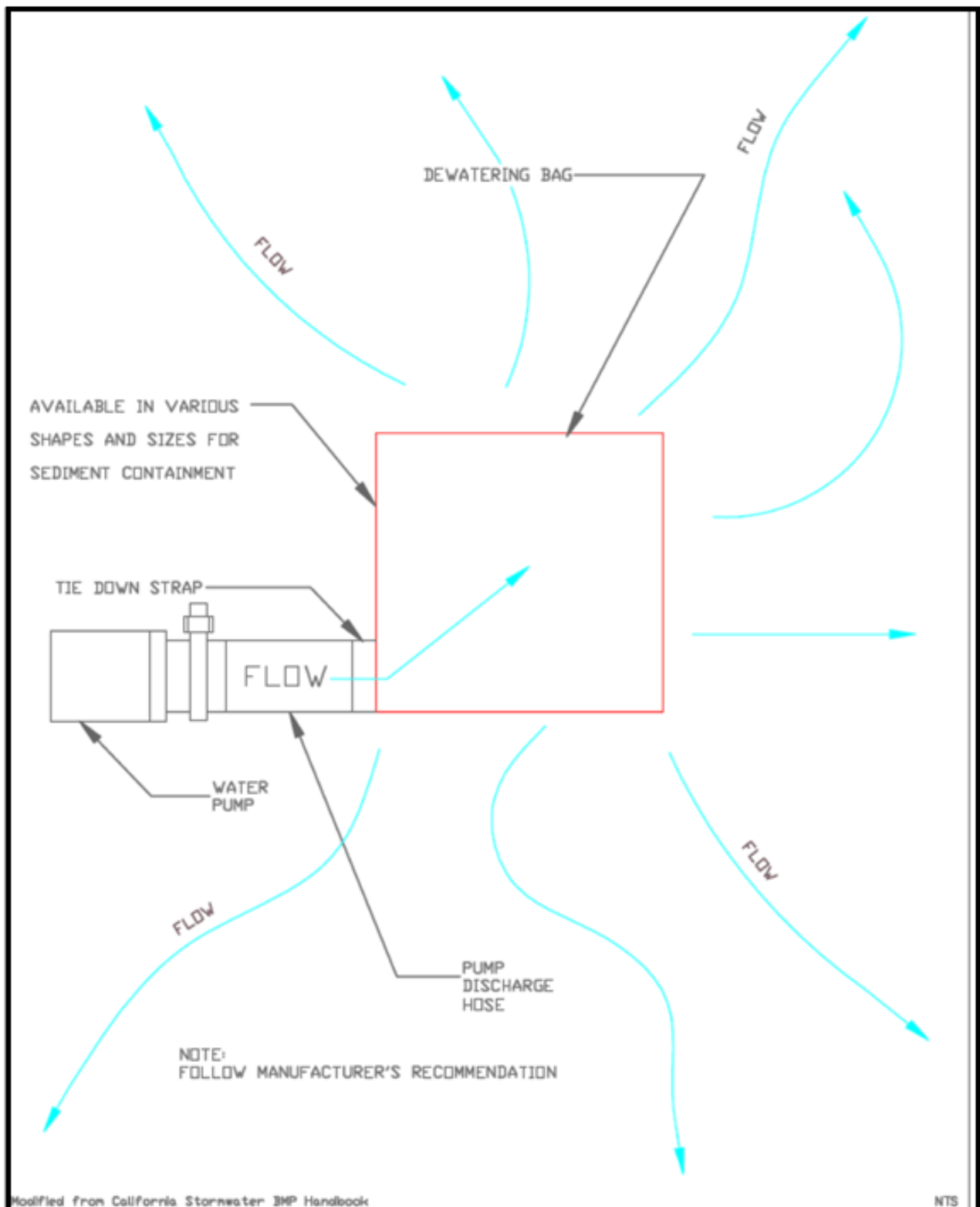
Inspect all BMPs associated with the dewatering, repair or replace to ensure the BMPs function as designed. Accumulated sediment removed during the maintenance of a dewatering device can be incorporated into the site. Accumulated sediment that is co-mingled with other pollutants must be disposed of in accordance with all applicable laws and regulations.

SITE CONDITIONS FOR REMOVAL:

Remove the dewatering operation when work in or adjacent to the standing water has ceased.

TYPICAL DETAILS:

RM-6



DEWATERING BAG



Figure RM - 6

VEGETATED FILTER STRIP SC-1

DEFINITION AND PURPOSE:

Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighboring areas. Buffer zones slow stormwater runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevent soil erosion and streambank collapse.

APPROPRIATE APPLICATIONS:

Vegetated buffers can be used in any area able to support vegetation. They are most effective and beneficial on floodplains, near wetlands, along streambanks, and on unstable slopes. Filter strips can be used adjacent to low or medium density residential areas on gently sloping ground.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Overland sheet flow only-cannot treat high velocity flows.

WHEN BMP IS TO BE INSTALLED:

Immediately after rough grading to trap sediment during construction and/or immediately after final grading as a permanent measure to control surface runoff.

STANDARDS AND SPECIFICATIONS:

Determine buffer widths after carefully considering slope, vegetation, soils, depth to impermeable layers, runoff sediment characteristics, type and amount of pollutants, and annual rainfall. Make sure buffer widths increase as slope increases. In areas where flows are more concentrated and fast, combine buffer zones with other practices such as level spreaders, infiltration areas, or diversions to prevent erosion and rilling. Fence off any undisturbed vegetated strips to be preserved. No activity, including parking/storing vehicles or equipment, shall be permitted in the vegetated/woody strip. If a grass filter strip is constructed, it must be completed and vegetated before construction in a contributing area is started.

OPERATION AND MAINTENANCE PROCEDURES:

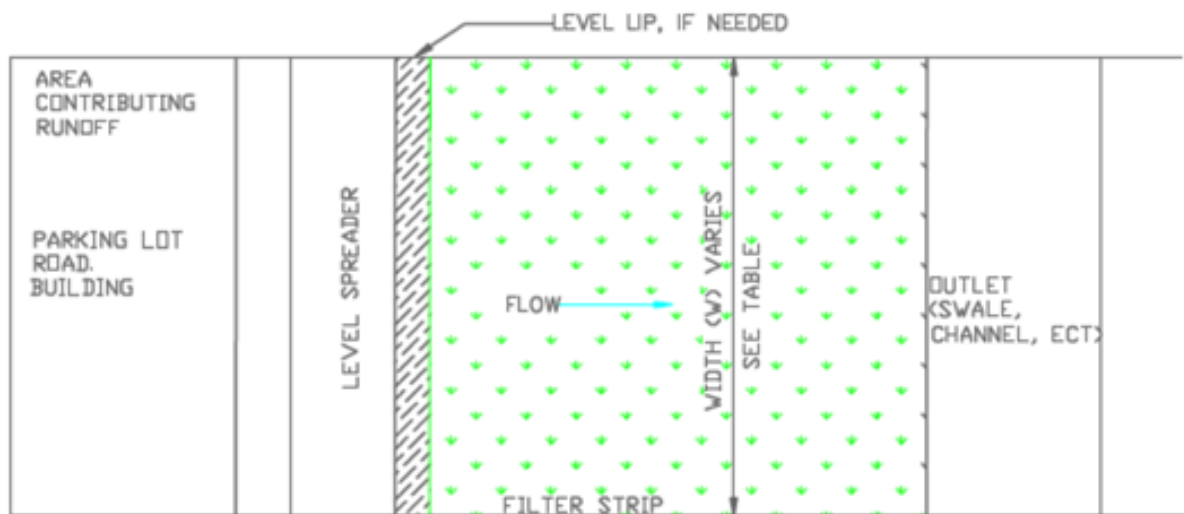
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment accumulation as it becomes noticeable. Fill and compact eroded areas and reseed, mulch and fertilize or establish other vegetation in the affected areas. After improvements are complete, regrade and reseed the top edge of the filter strip to remove sediment trapped during construction and prolong the effective use of the filter strip.

SITE CONDITIONS FOR REMOVAL:

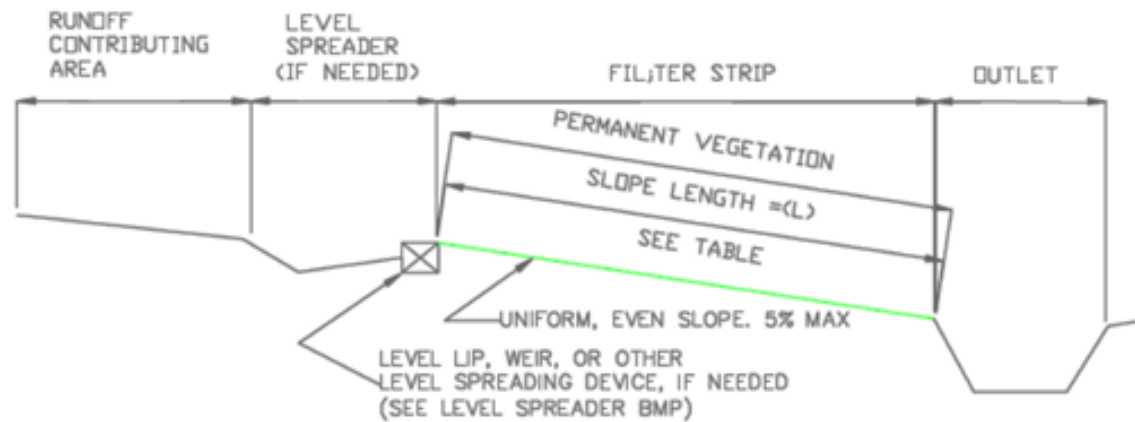
Not Applicable

TYPICAL DETAILS:

SC-1A and SC-1B



PLAN VIEW



SECTION VIEW

SLOPE OF LAND %	WIDTH (W) OF FILTER STRIP FOR GRASS AREA	WIDTH (W) OF FILTER STRIP FOR WOODED AREA	SLOPE LENGTH (L) OF FILTER STRIP
0	10	25	$L_{min} = \text{LENGTH OF CONTRIBUTING AREA 50 MIN}$ $L_{min} + 8'$ $L_{min} + 16'$ $L_{min} + 24'$ $L_{min} + 32'$ $L_{min} + 40'$ $L_{min} + 60'$
2	12	29	
4	14	33	
6	16	37	
8	18	41	
10	20	45	
15	25	55	

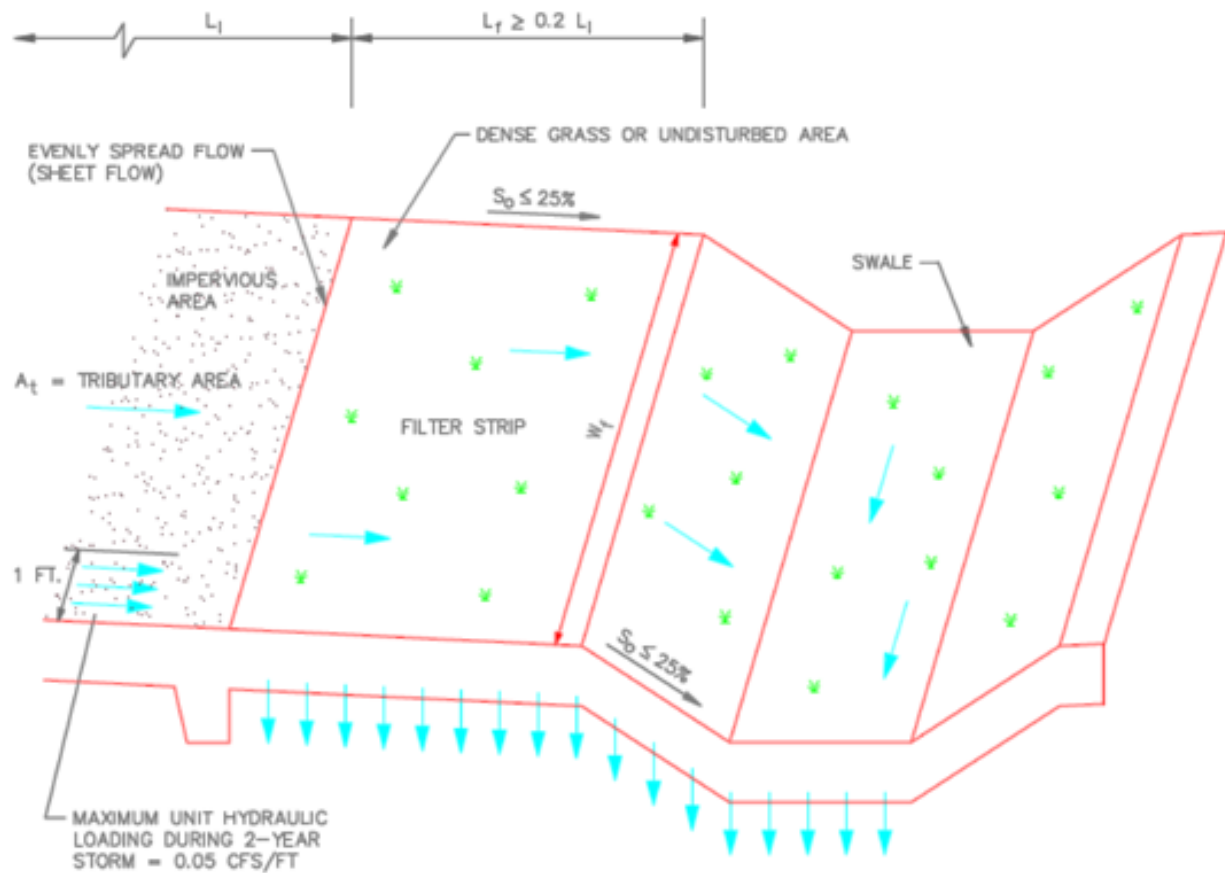
Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

VEGETATED FILTER STRIP



Figure SC – 1A



Modified From Greene County Missouri - Storm Water Design Standards

NTS

VEGETATED FILTER STRIP



Figure SC – 1B

SILT FENCE SC-2

DEFINITION AND PURPOSE:

A silt fence consists of a length of filter fabric stretched between anchoring posts spaced at regular intervals along the site at low/downslope areas. The filter fabric should be entrenched in the ground between the support posts. When installed correctly and inspected frequently, silt fences encourage the ponding of runoff and settling of sediment. Silt fence should not be placed perpendicular to a slope.

APPROPRIATE APPLICATIONS:

Installed along slopes, at bases of slopes, and around the perimeter of a site as a final barrier to sediment being carried off site. Silt fence should not be used in areas of concentrated flow or as check dams.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow only

Contributing Area: Drainage area should not exceed 0.25 acres per 100-foot fence length.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation and at intervals during construction of fill slopes.



Silt fence used as a perimeter control.

STANDARDS AND SPECIFICATIONS:

If a standard-strength fabric is used, it can be reinforced with wire mesh behind the filter fabric. This increases the effective life of the fence. The maximum life expectancy for synthetic fabric silt fences is about 6 months, depending on the amount of rainfall and runoff. The fence should be designed to withstand the runoff from a 10-year peak storm event. Generally, drive posts for fence line, dig trench to required dimensions in front of posts for fabric burial, attach wire mesh to posts (if necessary), attach fabric to posts-allowing required length below ground level to run fabric along bottom of trench, and backfill and compact soil in trench to protect and anchor fabric. Alternate construction procedures include installing the fence by slicing it into the ground with specialized equipment.

OPERATION AND MAINTENANCE PROCEDURES:

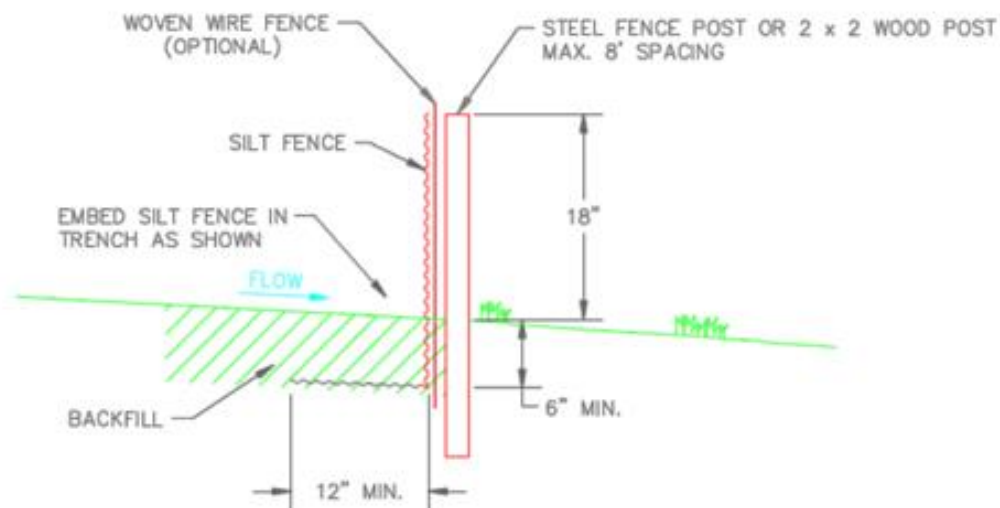
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment buildup once it accumulates to 6 inches. Replace torn/clogged fabric; repair loose fabric. Repair unstable or broken posts. Stabilize any areas susceptible to undermining. Add additional fencing if necessary to provide adequate protection.

SITE CONDITIONS FOR REMOVAL:

After permanent vegetation of slope is established. Remove fence, regrade trench area and vegetate.

TYPICAL DETAILS:

SC-2A and SC-2B



NOTES:

1. PLACE SILT FENCE AT DOWNSLOPE LIMIT OF AREA TO BE GRADED.
2. SILT FENCE SHALL BE PLACED ALONG A LEVEL CONTOUR WITH AN ALLOWANCE OF ± 4 INCHES.
3. SEDIMENT TRAPPED BY THIS PRACTICE SHALL BE DISPOSED OF IN AN APPROVED SITE IN A MANNER THAT WILL NOT CONTRIBUTE TO ADDITIONAL SILTATION.
4. SILT FENCE SHOULD BE SECURELY FASTENED TO EACH SUPPORT POST OR TO WOVEN WIRE, WHICH IS IN TURN ATTACHED TO THE STEEL FENCE POSTS.
5. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. SILT FENCE SHALL BE REMOVED WHEN IT HAS SERVED ITS USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
7. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES.
8. AT EACH END OF SILT FENCE, TURN FENCE UPSLOPE AND EXTEND UNTIL GROUND SURFACE RISES 18 INCHES.

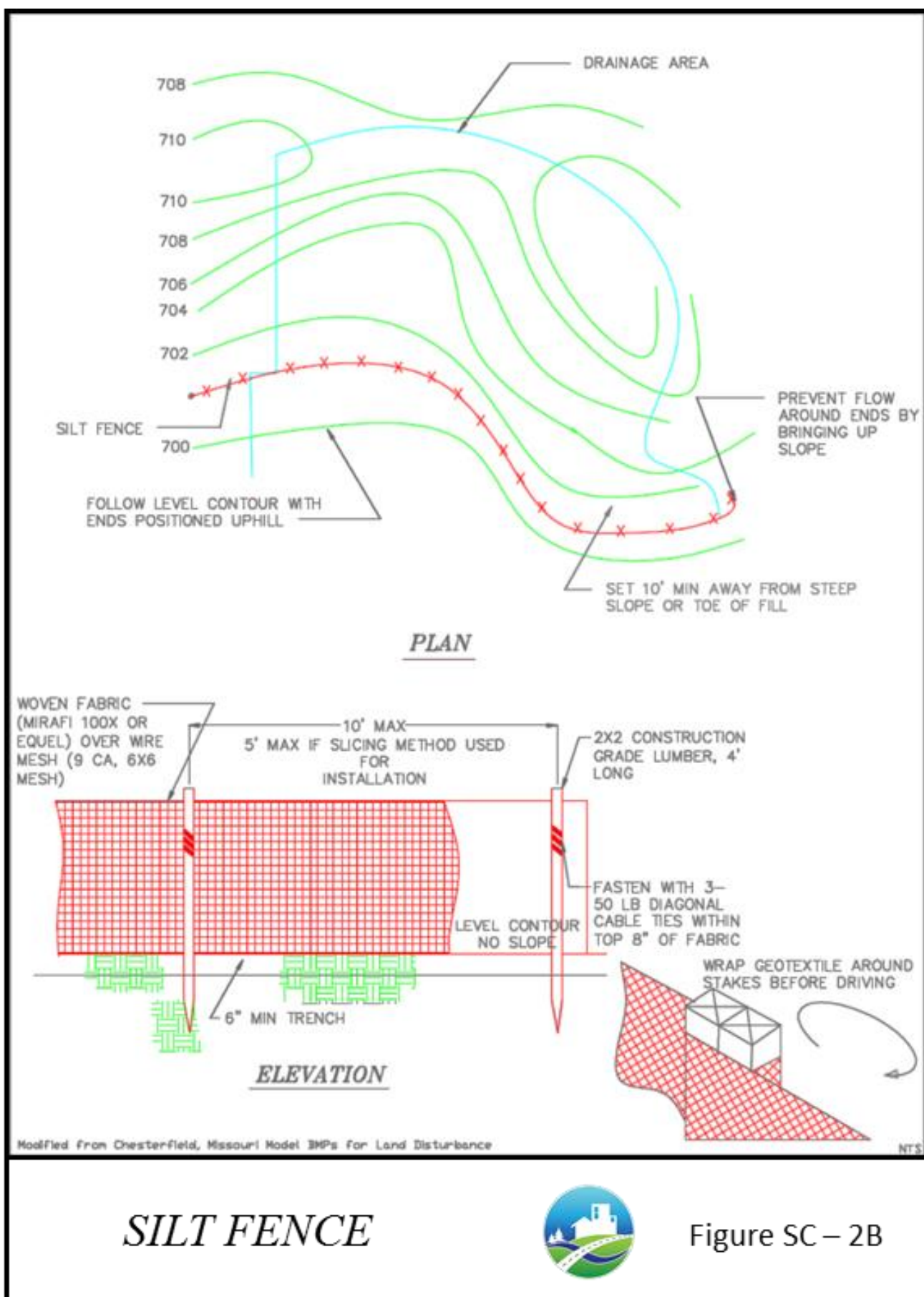
Modified From Greene County Missouri - Storm Water Design Standards

NTS

SILT FENCE



Figure SC – 2A



COMPOST FILTER SOCKS SC-3

DEFINITION AND PURPOSE:

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas.

APPROPRIATE APPLICATIONS:

Compost filter socks are generally placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and as small check dams to slow water flow in ditches. Filter socks used for perimeter control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch— diameter socks are used in some applications.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and small concentrated flow

Contributing Area: Drainage area should not exceed 0.25 acres per 100-foot sock length.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation and at intervals during construction of fill slopes.



Compost filter sock used as a perimeter control.

STANDARDS AND SPECIFICATIONS:

The diameter of the filter sock used will vary depending upon the steepness and length of the slope. In areas of concentrated flow filter socks are sometimes placed in an inverted V going up the slope, to reduce the velocity of water running down the slope. The project engineer may also consider placing filter socks at the top and base of the slope or placing a series of filter socks every 15 to 25 feet along the vertical profile of the slope. Generally, the filter sock is filled, put in place, and anchored using stakes; no trenching is required. During installation, the ends of the sock should be directed upslope.

OPERATION AND MAINTENANCE PROCEDURES:

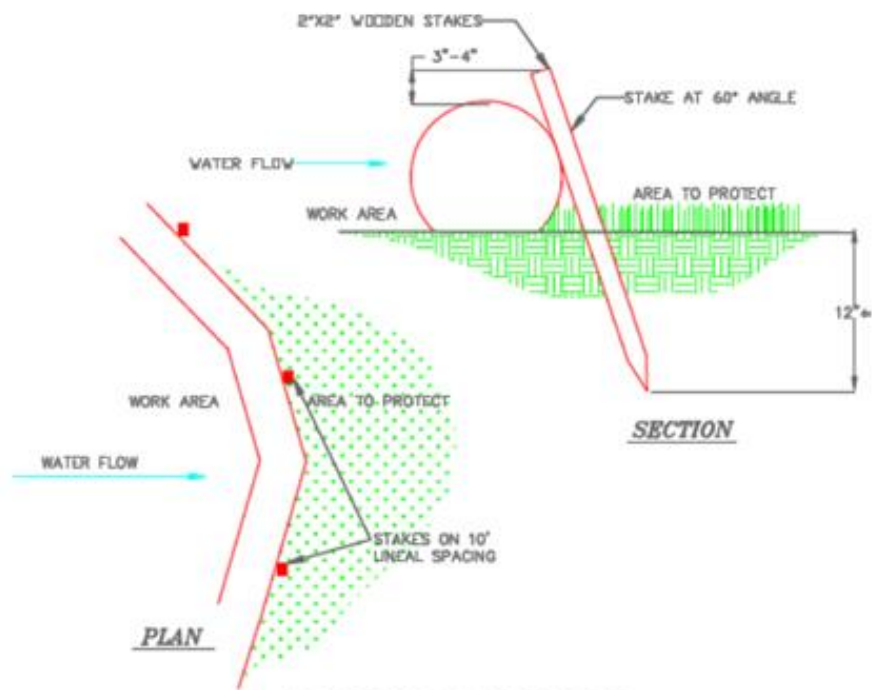
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment buildup deeper than ½ the height of the sock. Repair/replace unstable/broken posts and sections of sock. Stabilize any areas susceptible to undermining. Add additional socks if necessary to provide adequate protection.

SITE CONDITIONS FOR REMOVAL:

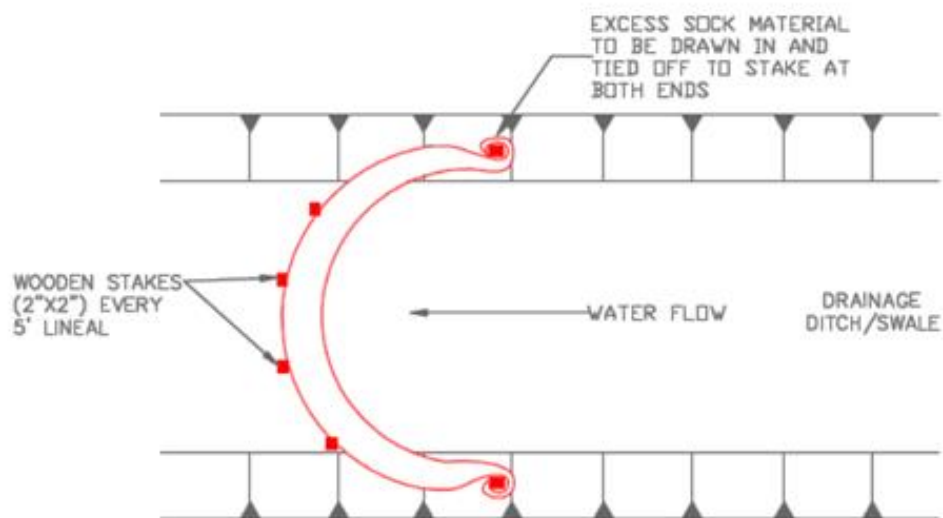
After permanent vegetation of slope is established. Remove socks, regrade trench area and vegetate.

TYPICAL DETAILS:

SC-3



PERIMETER CONTROL



DITCH CHECK

NOTE: FOLLOW MANUFACTURER'S SPECIFICATION

Modified from Filtrexx Standard Specification and Design Manual, Version 5.0, 2006

NTS

COMPOST FILTER SOCK



Figure SC-3

COMPOST FILTER BERMS SC-4

DEFINITION AND PURPOSE:

A compost filter berm, trapezoidal in cross section, is a dike of compost or a compost product that is placed perpendicular to sheet flow runoff to control erosion in disturbed areas and retain sediment. It can be used in place of a traditional control tool such as a silt fence or compost filter socks.

APPROPRIATE APPLICATIONS:

Vegetated compost filter berms are generally placed along the perimeter of a site, or at intervals along a slope. A filter berm also can be used as a check dam in low-slope, small drainage ditches.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and small concentrated flow.

Contributing Area: Drainage area should not exceed 0.25 acres per 100-foot berm length.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation and at intervals during construction of fill slopes.

STANDARDS AND SPECIFICATIONS:

The compost filter berm dimensions should be modified based on site-specific conditions, such as soil characteristics, existing vegetation, site slope, and climate, as well as project-specific requirements. Generally the berms are trapezoidal in cross section with the base twice the height of the berm. The compost should be uniformly applied to the soil surface, compacted, and shaped to into a trapezoid. Compost filter berms can be installed on frozen or rocky ground. The filter berm may be vegetated by hand, by incorporating seed into the compost prior to installation, or by hydraulic seeding following berm construction.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove sediment buildup deeper than ½ the filter berm. Any areas that have been washed away should be replaced. If the berm has experienced significant washout, a filter berm alone may not be the appropriate BMP for this area or the size of the berm may need to be increased.

SITE CONDITIONS FOR REMOVAL:

Vegetated filter berms are normally left in place and provide long-term filtration of stormwater as a post-construction best management practice (BMP). If temporary, break down the berm once construction is complete and spread the compost around the site as a soil amendment or mulch.

TYPICAL DETAILS: Not Applicable

SEDIMENT BASIN SC-5

DEFINITION AND PURPOSE:

A temporary settling pond designed to slowly release runoff, detaining it long enough to allow most of the sediment to settle out. Basins should be used in conjunction with additional BMPs, such as temporary seeding, velocity dissipaters, perimeter controls, inlet protection, etc., to reduce the total amount of sediment washing into them. Sediment basins may also be designed to be converted to permanent storm water detention basins after construction has ended.

APPROPRIATE APPLICATIONS:

Should be located as close to the sediment source as possible. A sediment basin should not be used in areas of continuously running water (live streams) or areas where failure of the embankment will result in loss of life, damage to homes or structures, or prevent the use of roadways or utilities.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow.

Basin Volume: See Storm Water Detention design criteria within the Stormwater and Erosion Control Regulations Manual.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation.

STANDARDS AND SPECIFICATIONS:

A qualified professional engineer experienced in designing dams should complete the basin design. Excavate basin to length, width, depth and slopes specified on plans. Place and compact fill to construct dam to elevation at least 1 foot above crown of outlet pipe. Install outlet pipe and compact clayey soil around pipe. Install the perforated riser pipe, wrap with fabric, and surround with uniformly graded gravel. Install BMP at downstream end of outlet pipe. Grade and stabilize spillway. Install monitoring post near outlet of basin. Mark maximum allowable sediment depth.

OPERATION AND MAINTENANCE PROCEDURES:

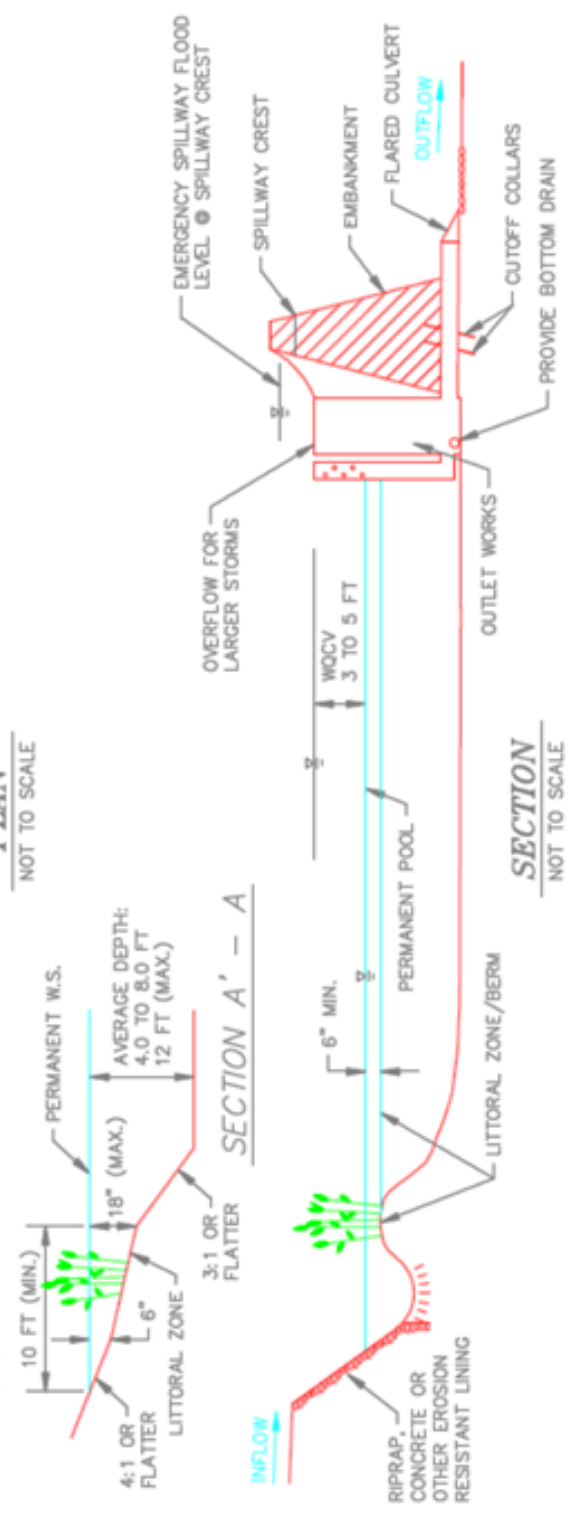
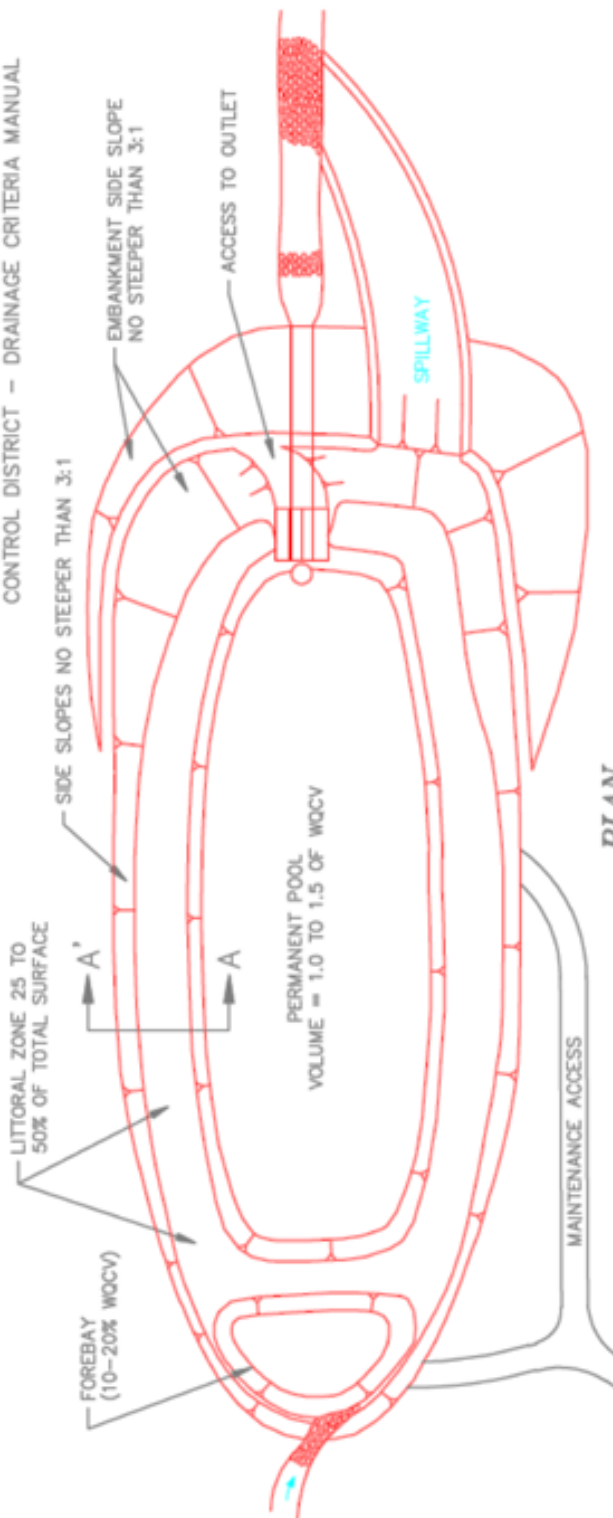
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove trash accumulation at outlet. Remove sediment accumulations once sediment reaches design depth, as indicated on monitoring posts. Repair and revegetate any erosion damage on spillway. Repair settlement, cracking, piping holes, or seepage at embankment. Replace gravel around riser if basin does not drain properly.

SITE CONDITIONS FOR REMOVAL:

Remove after upstream areas are stabilized. Regrade as appropriate and vegetate immediately.

TYPICAL DETAILS:

SC-5A, SC-5B, SC-5C, and SC-5D



Modified From Greene County Missouri - Storm Water Design Standards

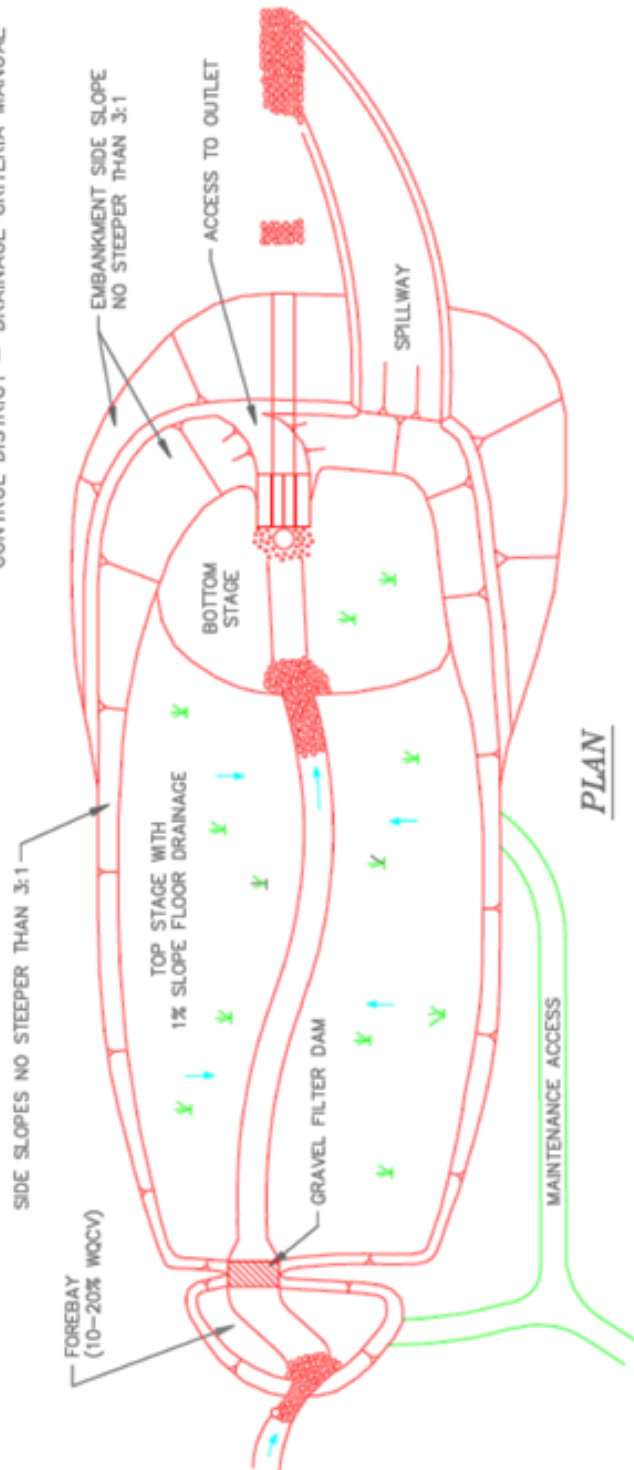
NTS

SCHEMATIC PLAN & SECTION OF A WET EXTENDED SEDIMENT BASIN

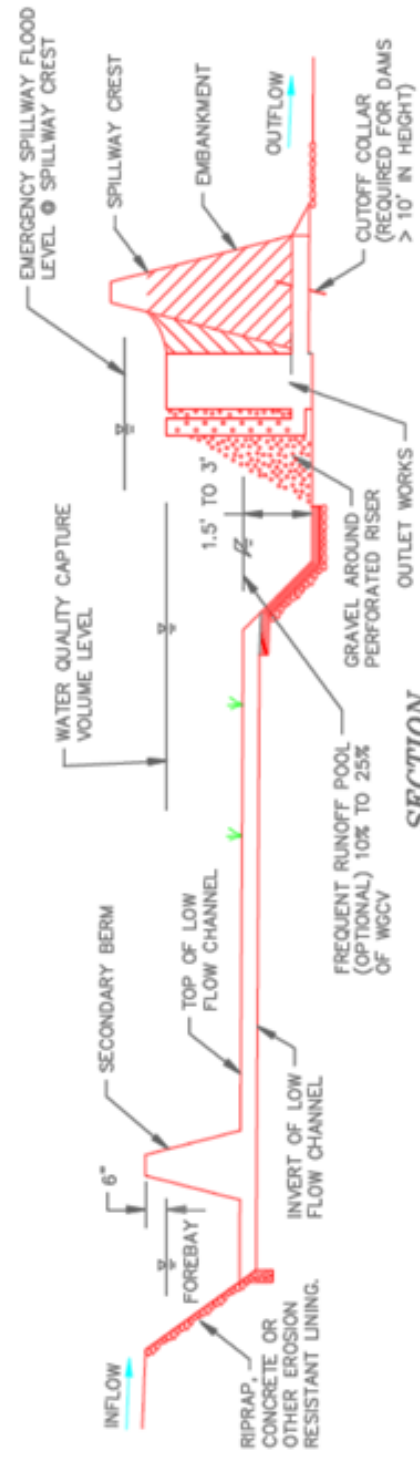


Figure SC - 5A

ADAPTED FROM DENVER URBAN DRAINAGE & FLOOD
CONTROL DISTRICT — DRAINAGE CRITERIA MANUAL



PLAN



SECTION

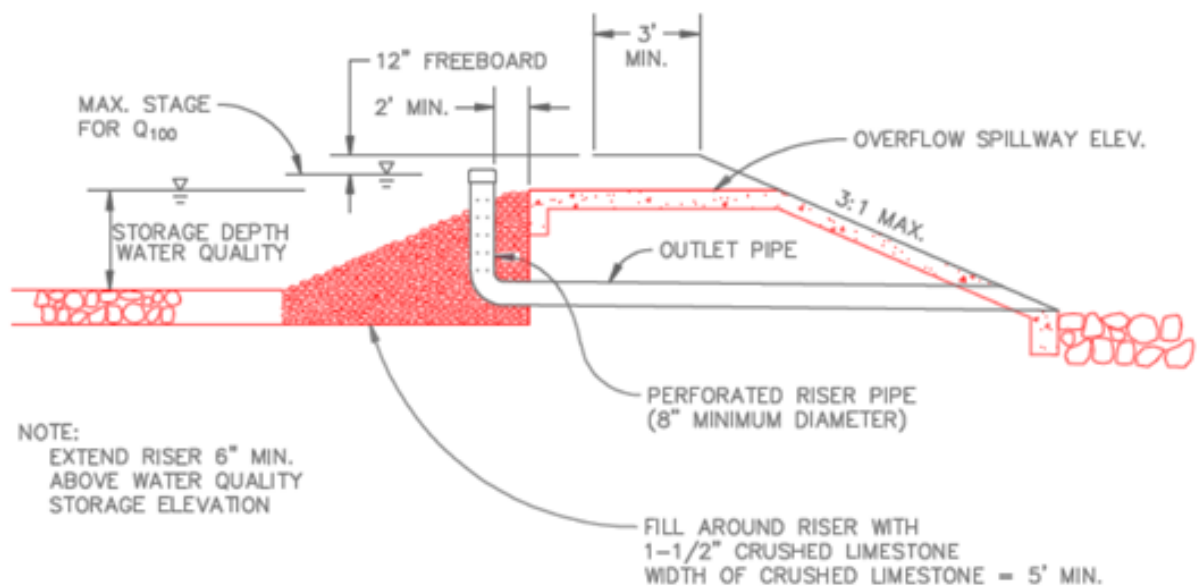
Modified From Greene County Missouri — Storm Water Design Standards

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SCHEMATIC PLAN & SECTION OF A DRY EXTENDED SEDIMENT BASIN



Figure SC – 5B



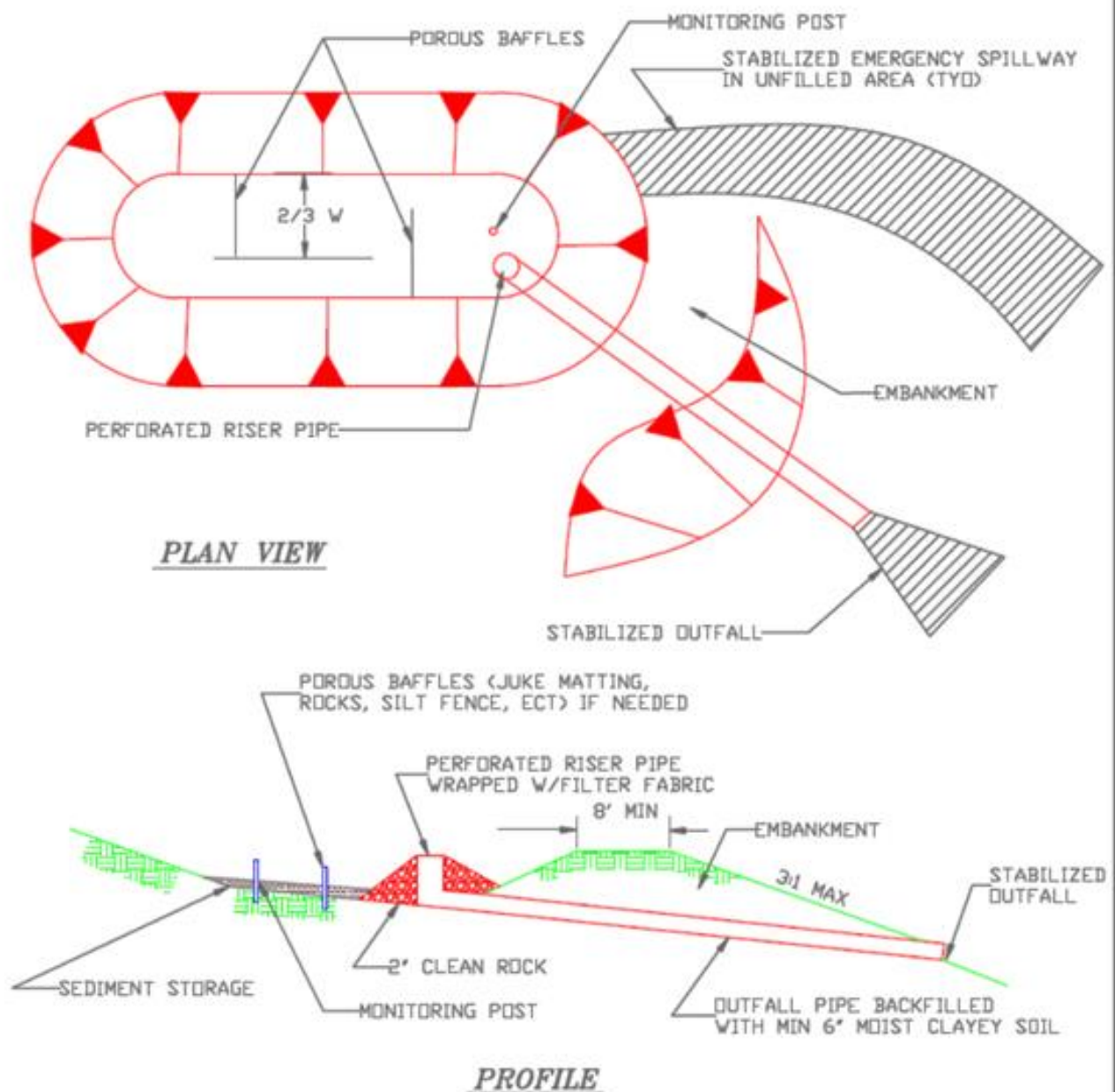
Modified From Greene County Missouri – Storm Water Design Standards

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DRY EXTENDED SEDIMENT BASIN DAM & OUTLET CONFIGURATION



Figure SC – 5C



GENERAL NOTES:

1. TOP OF RISER PIPE SHOULD BE A MIN OF 1' BELOW THE TOP OF THE EMBANKMENT AND 6" BELOW THE FLOW LINE OF ANY EMERGENCY SPILLWAY
2. IF NO EMERGENCY SPILLWAY IS PROPOSED THERE SHALL BE A MIN OF 1.5' OF FREEBOARD
3. BAFFLE HEIGHT SHOULD BE GREATER THAN TOP OF RISER PIPE AND LESS THAN TOP OF EMBANKMENT
4. SILT MONITORING POST (S) SHALL BE INSTALLED NEAR OUTLET OF BASIN AND BE MARKED WITH MAXIMUM PERMISSIBLE LEVEL OF SEDIMENT

Modified From Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

SEDIMENT BASIN



Figure SC – 5D

SEDIMENT TRAP SC-6

DEFINITION AND PURPOSE:

A sediment trap is a temporary containment area that allows sediment in collected storm water to settle out during infiltration or before the runoff is discharged through a stabilized spillway/dewatering pipe.

APPROPRIATE APPLICATIONS:

Sediment traps are commonly used at the outlets of stormwater diversion structures, channels, slope drains, construction site entrances, vehicle wash areas, or other runoff conveyances.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow.

Contributing Area: Maximum of 5 acres.

Trap Volume: Silt load of 1800 cf/acre.

WHEN BMP IS TO BE INSTALLED:

Prior to disturbance of natural vegetation.

STANDARDS AND SPECIFICATIONS:

Take care to situate sediment traps for easy access by maintenance crews. Excavate an area for a sediment trap-make sure the side slopes are no steeper than 2:1 and the embankment height no more than 5 feet from the original ground surface. Install dewatering pipe, if necessary. Place and compact fill to construct embankments and the spillway. To reduce flow rate from the trap, line the outlet with rip rap and gravel over the dewatering pipe, if necessary. The spillway weir for each temporary sediment trap should be at least 4 feet long for a 1-acre drainage area and increase by 2 feet for each additional drainage acre added, up to a maximum drainage area of 5 acres. Install monitoring posts in the trap which mark $\frac{1}{2}$ the design depth for sediment accumulation.

OPERATION AND MAINTENANCE PROCEDURES:

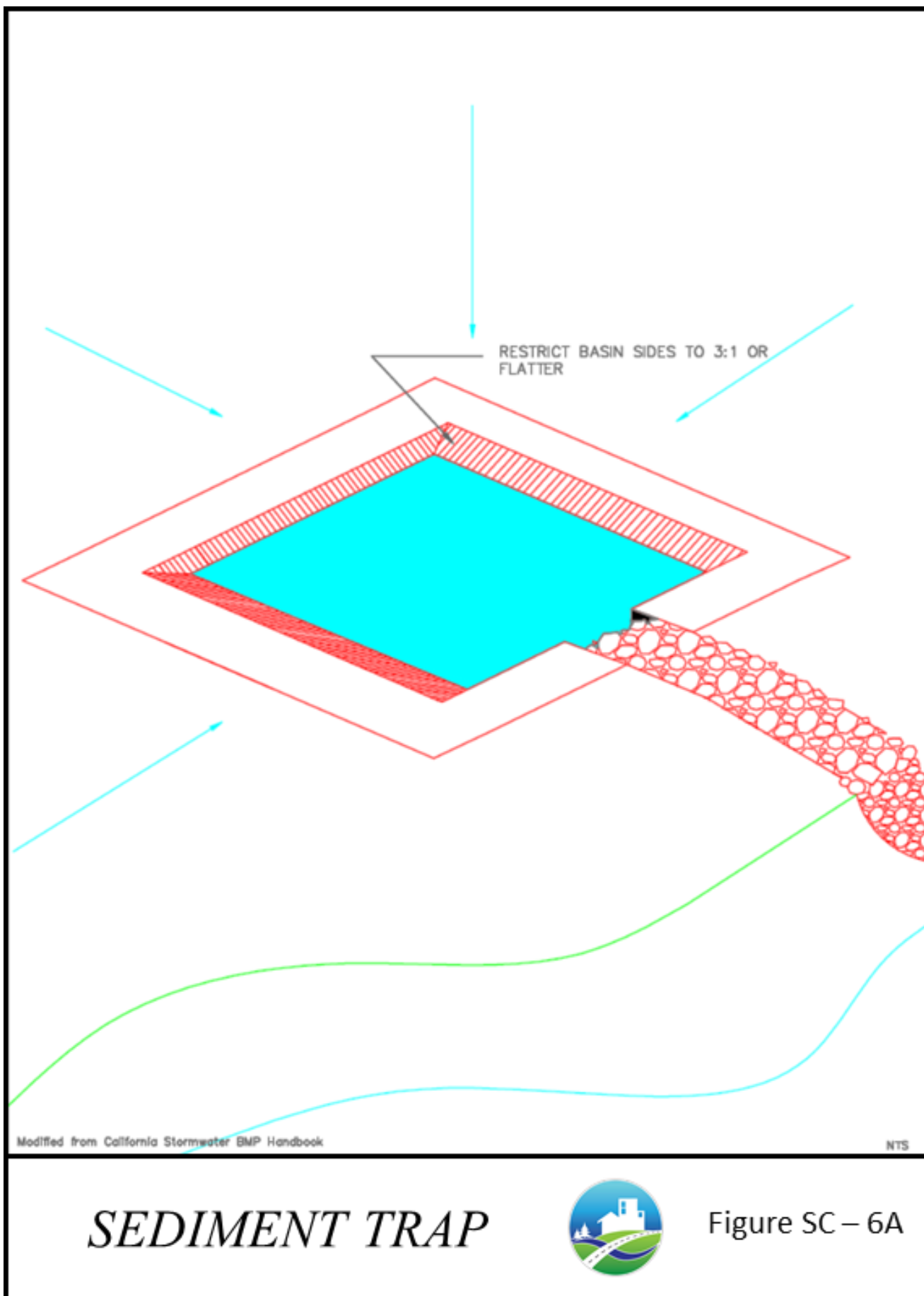
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove trash accumulation. Remove sediment accumulations once sediment reaches $\frac{1}{2}$ the design depth, as indicated on monitoring posts. Repair and revegetate any erosion damage. Repair settlement, cracking, piping holes, or seepage at embankment.

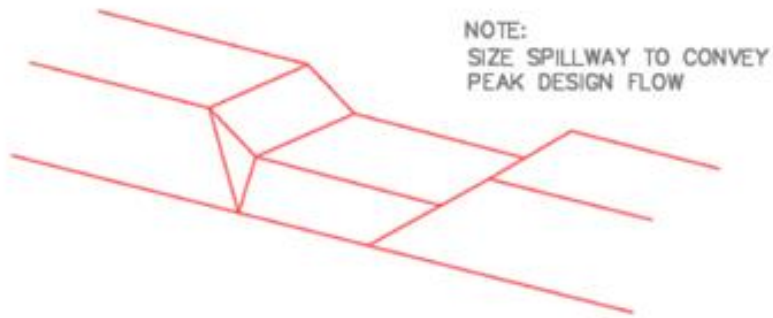
SITE CONDITIONS FOR REMOVAL:

Remove after upstream areas are stabilized. Regrade as appropriate and vegetate immediately.

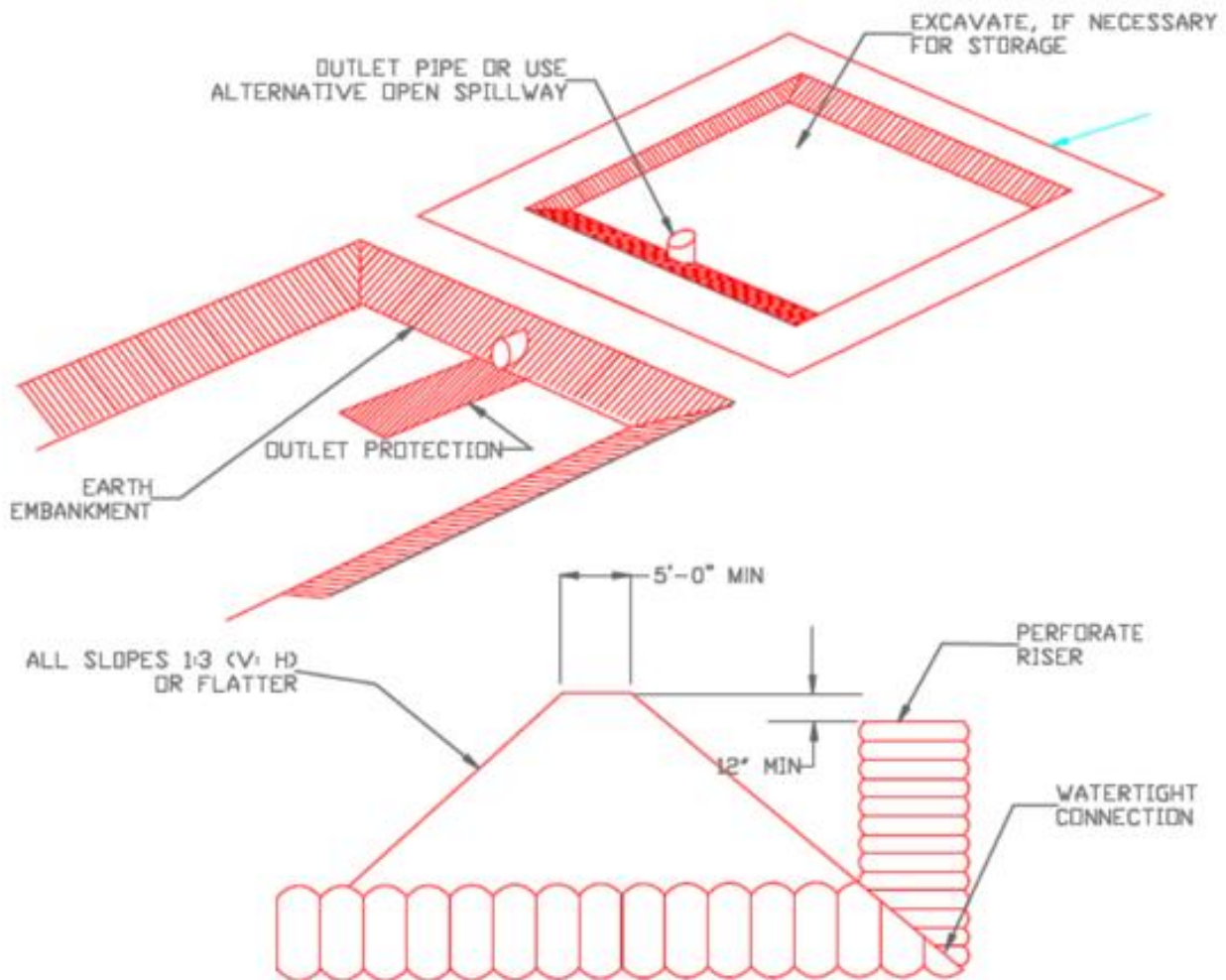
TYPICAL DETAILS:

SC-6A, SC-6B, and SC-6C





TYPICAL OPEN SPILLWAY



EMBANKMENT SECTION THRU RISER

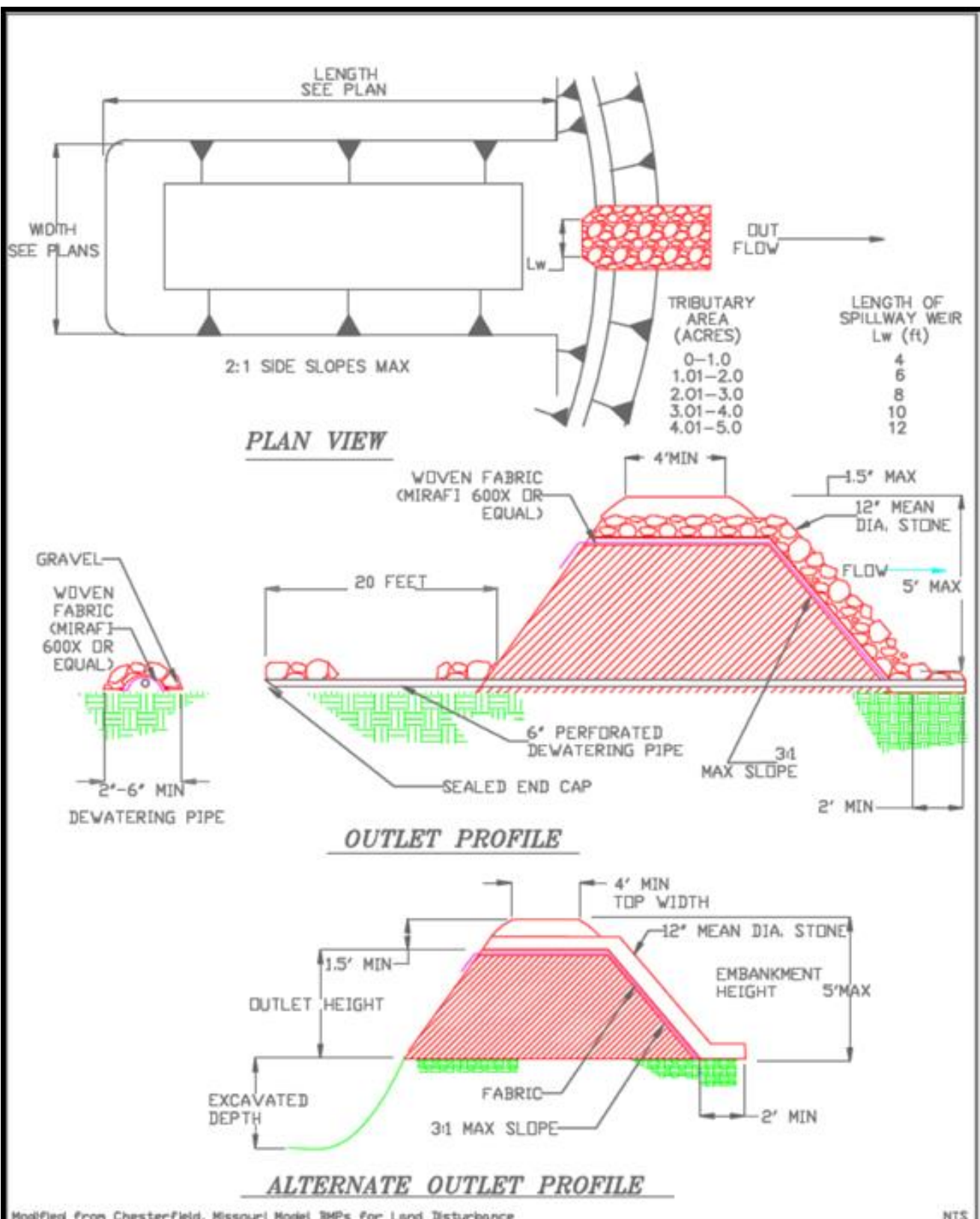
Modified from California Stormwater BMP Handbook

SC-6B

SEDIMENT TRAP



Figure SC – 6B



SEDIMENT TRAP



Figure SC-6C

INLET PROTECTION-CURB AND GUTTER **SC-7**

DEFINITION AND PURPOSE:

A temporary sediment control barrier consisting of a filter media, such as compost filter socks, gravel and mesh, sandbags, gravel bags, etc., around a curb and gutter inlet designed to prevent sediment from entering the storm sewer. Shallow temporary ponding during and after rainfall should be expected.

APPROPRIATE APPLICATIONS:

At inlets where runoff may contain sediment-laden water.

CONDITIONS FOR EFFECTIVE USE:

Type of Flow: Sheet flow and concentrated flow.

Contributing Area: Maximum of 1 acre.

WHEN BMP IS TO BE INSTALLED:

Immediately after installation of the inlet, or prior to land disturbing activities beginning on the contributing upstream area to the inlet.

STANDARDS AND SPECIFICATIONS:

Typical types of curb and gutter inlet protection include:

fabricated inlet filters (follow manufacturer's instructions), compost filter sock (make sure that both ends of the sock are anchored accordingly), gravel and wire mesh (construct and anchor wood frame, fasten wire mesh and fabric to frame, and place the gravel on top of the entire structure), and sandbags and gravel bags (may be placed either as a j-hook on the upstream end of the inlet or as a full barrier, sometimes stacked 2 bags high, across the entire opening of the inlet). Incorporate an overflow bypass into the inlet protection structure in areas, such as heavy traffic streets, where excessive ponding of water around the inlet may become a safety issue.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect inlet protection of all media types weekly, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site, to make sure they are functioning properly. Remove trash and debris. Remove sediment from the inlet protection when half of the protection structure height has been filled. Repair elements to original configuration as needed.

SITE CONDITIONS FOR REMOVAL:

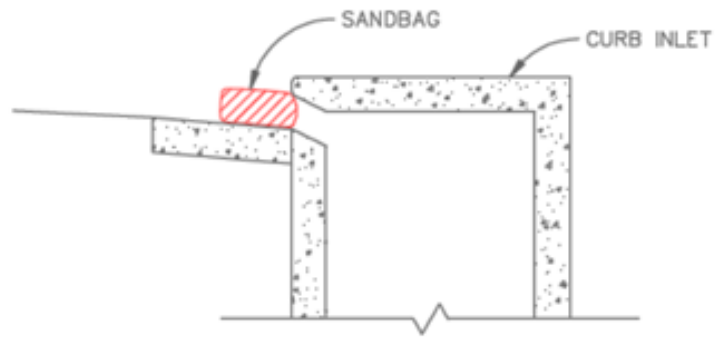
Remove after contributing drainage areas have been adequately stabilized.

TYPICAL DETAILS:

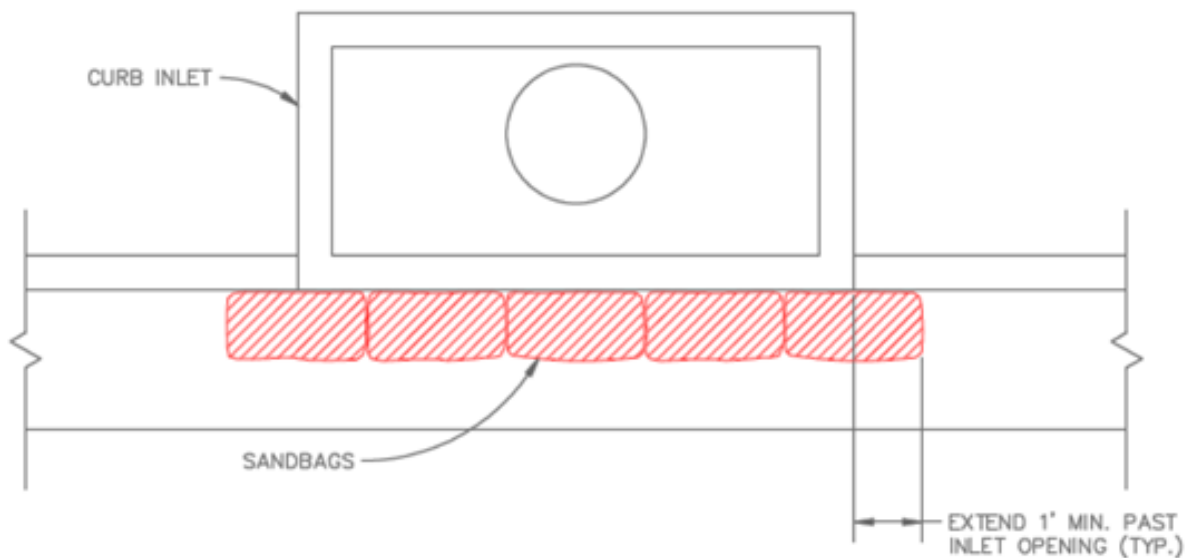
SC-7A, SC-7B, and SC-7C



Compost fiber sock used as a curb and gutter inlet protection.



CROSS-SECTION



PLAN

NOTES:

1. FILL BAGS WITH 5/8" CRUSHED LIMESTONE.
2. BAGS SHALL BE BURLAP OR BIODEGRADABLE PLASTIC.
3. BAGS SHALL BE INSPECTED AND REPLACED AS NEEDED.

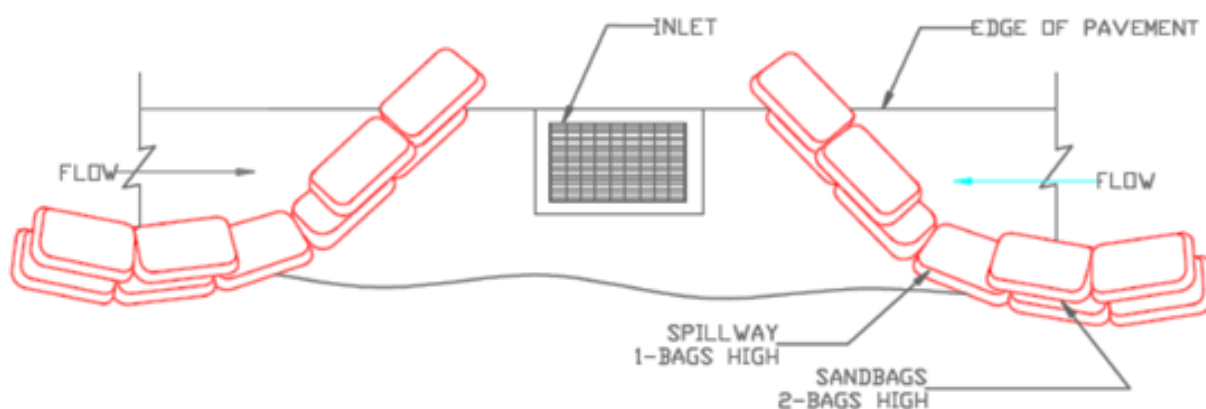
Modified From Greene County Missouri – Storm Water Design Standards

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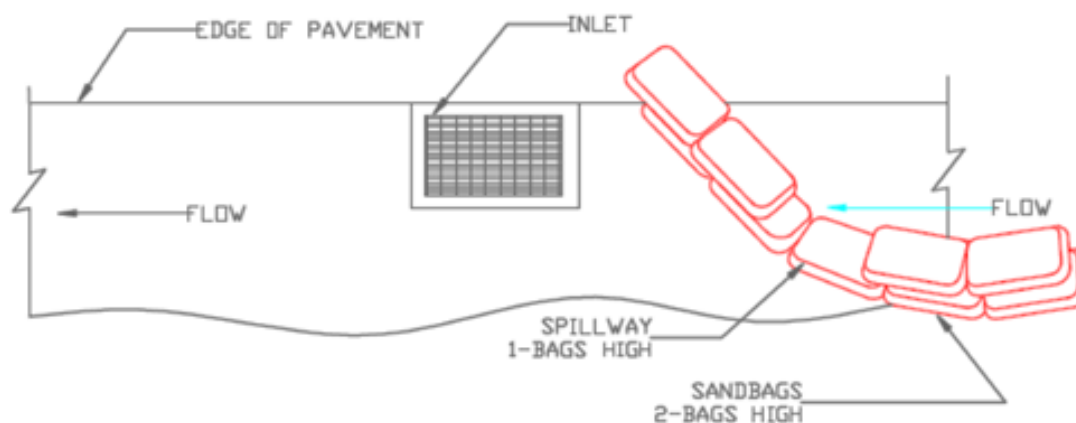
*SAND BAG SEDIMENT TRAP
FOR CURB INLETS*



Figure SC– 7A



TYPICAL PROTECTION FOR INLET ON SUMP



TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. INTENDED FOR SHORT TERM USE.
2. USE TO INHIBIT NON-STORM WATER FLOW
3. ALLOW FOR PROPER MAINTENANCE AND CLEANUP.
4. BAGS MUST BE REMOVED AFTER ADJACENT OPERATION IS COMPLETED.
5. NOT APPLICABLE IN AREAS WITH HIGH SILTS AND CLAYS WITHOUT FILTER FABRIC.

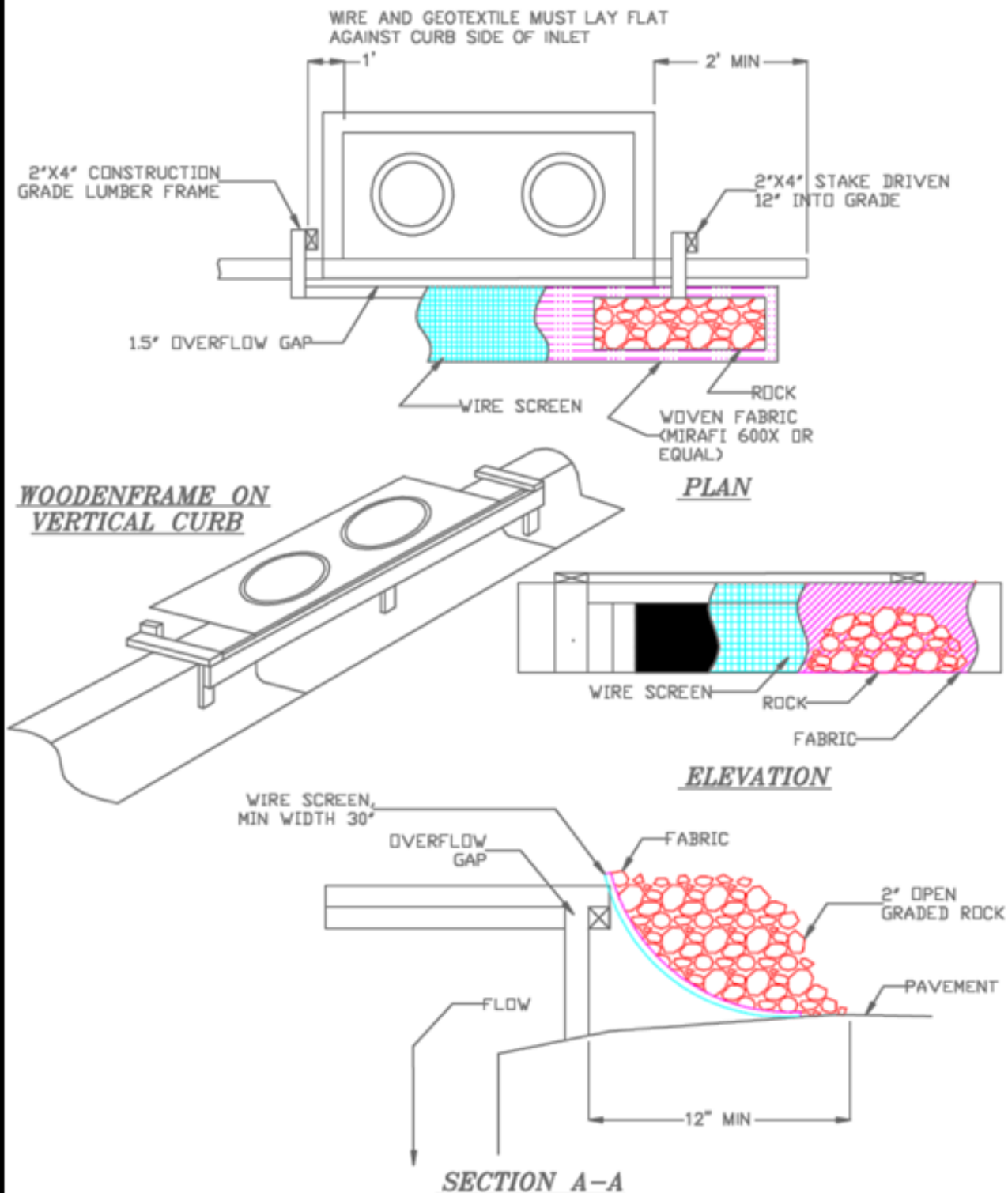
Modified from California Stormwater BMP Handbook

NTS

CURBED INLET PROTECTION - BAGS



Figure SC – 7B



Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

NTS

CURBED INLET PROTECTION – GRAVEL & WIRE MESH



Figure SC – 7C

CONSTRUCTION ENTRANCE / EXIT TC-1

DEFINITION AND PURPOSE:

A stabilized entrance to a construction site is designed to minimize the amount of sediment tracked from the site on vehicles and equipment. Mud and sediment fall off of tires as they bounce along the stabilized entrance. Additional measures in the form of a washdown area could also be included on site.

APPROPRIATE APPLICATIONS:

At locations where it is safe for construction vehicles and equipment to access existing streets-preferably at location of future streets or drives.

CONDITIONS FOR EFFECTIVE USE:

Site conditions will dictate design and need. Ditches or pipes, if needed, sized for 2 year rainfall intensity event; HGL 6" below surface of entrance.

WHEN BMP IS TO BE INSTALLED:

One of the first things done, prior to vehicles or equipment accessing unpaved areas.

STANDARDS AND SPECIFICATIONS:

Limit the points of entrance/exit to the construction site. Properly grade and compact each construction entrance/exit to prevent runoff from leaving the site. Install culvert under entrance if needed to maintain positive drainage. Place fabric and cover with aggregate (minimum of 3"-6" shotrock), forming a diversion across the entrance, if needed, to direct runoff away from the roadway. Require all employees, subcontractors, and suppliers to utilize the stabilized construction access.

OPERATION AND MAINTENANCE PROCEDURES:

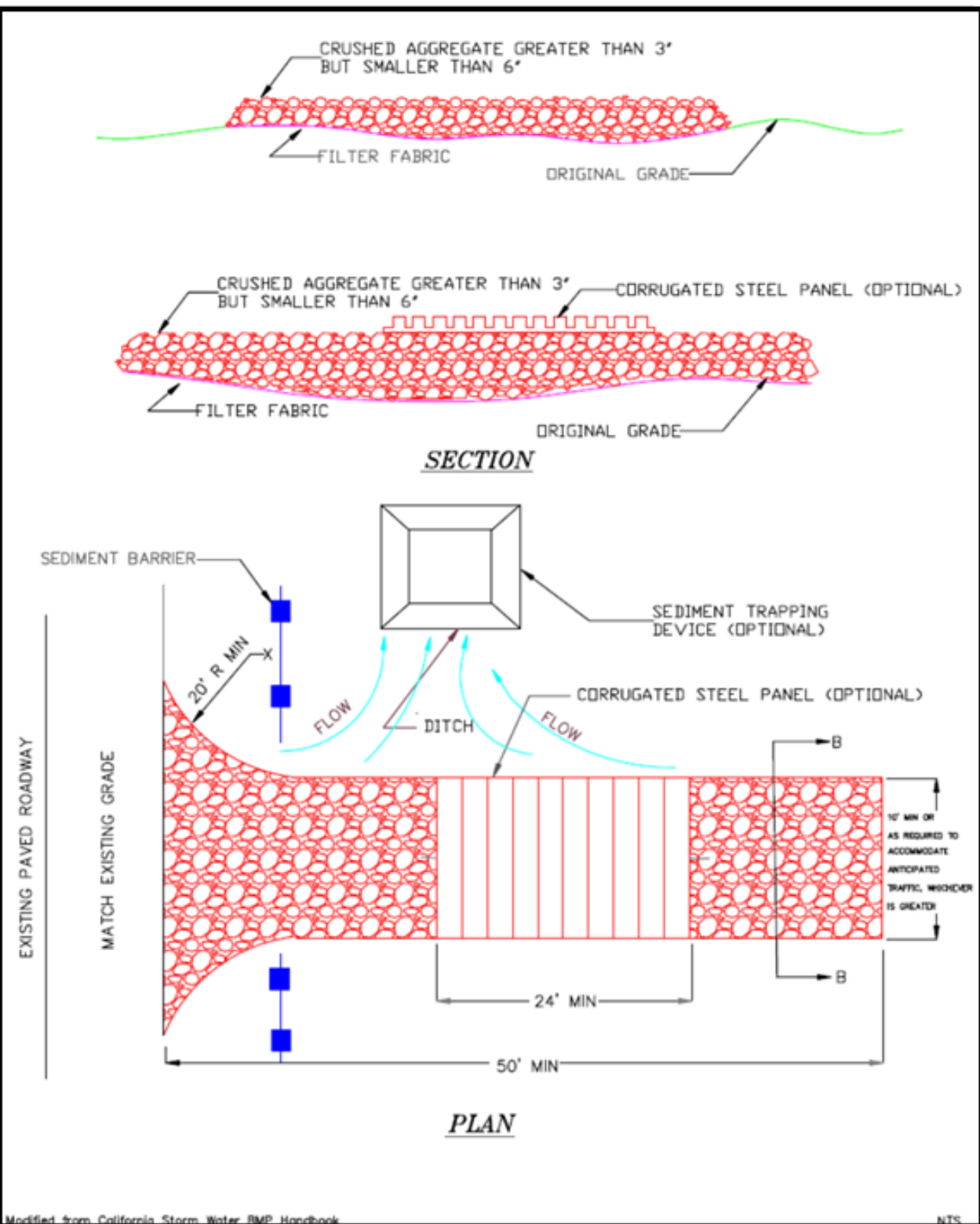
Inspect routinely, every week and within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site, for damage and assess effectiveness of the BMP. Remove sediment and clods of dirt from construction entrance continuously. Replace rock, if necessary, to maintain a clean surface. Repair any areas that have settled. Keep all temporary roadway ditches clear. Immediately remove any mud or debris tracked onto paved surfaces.

SITE CONDITIONS FOR REMOVAL:

Remove when vehicles and equipment will no longer access unpaved areas.

TYPICAL DETAILS:

TC-1



CONSTRUCTION ENTRANCE / EXIT



Figure TC – 1

CONSTRUCTION PARKING TC-2

DEFINITION AND PURPOSE:

A stabilized pad designed to: provide off street parking for construction related vehicles, eliminate parking on non-surfaced areas, and minimize the amount of sediment tracked from the site. Stabilization generally consists of aggregate over woven fabric. The stabilized pad also distributes the axle load of vehicles over a larger area; thereby mitigating the rutting impact vehicles normally have on unpaved areas.

APPROPRIATE APPLICATIONS:

At locations close to related work zones that have access along continuous paved or stabilized surfaces. Parking may be distributed in clusters and/or relocated with different phases of construction.

CONDITIONS FOR EFFECTIVE USE:

Ditches or pipes, if needed, sized for 2 year rainfall intensity event; HGL below parking surface. Aggregate size should be a minimum of 2"-3" washed stone. Minimum of 6" thick and sized to handle anticipated number of employee and visitor vehicles.

WHEN BMP IS TO BE INSTALLED:

Immediately after, or concurrently with, installation of construction entrance and washdown station.

STANDARDS AND SPECIFICATIONS:

Grade and compact area of pad and ditches, if needed. Install culverts if needed to maintain positive drainage. Place fabric and aggregate, and compact. Install signage indicating the designated parking area.

OPERATION AND MAINTENANCE PROCEDURES:

Inform drivers of inappropriately parked vehicles that they need to be moved. If necessary to ensure compliance on an ongoing basis, contact employers of violators. Install No Parking signage in areas where vehicles are being parked inappropriately. Remove sediment and clods of dirt. Repair areas that have settled. Replace rock if necessary to maintain clean surface.

SITE CONDITIONS FOR REMOVAL:

Remove/relocate when vehicles can legally park on paved areas without impeding non-construction related traffic.

TYPICAL DETAILS:

Not Applicable

STABILIZED CONSTRUCTION ROADWAY TC-3

DEFINITION AND PURPOSE:

A stabilized pathway providing vehicular access to a remote construction area designed to reduce rutting, tracking of mud in wet weather, and creation of dust in dry weather. The “roadway” can be constructed of aggregate over fabric, asphaltic concrete or Portland cement concrete based on the longevity of the project, required performance, and site conditions.

APPROPRIATE APPLICATIONS:

On long travel paths on unstable areas, adjacent to bodies of water, in areas where poor soil is encountered, and where there are steep grades and additional traction is needed. Roadways should follow the natural terrain to the extent possible. Site conditions will dictate design and need.

CONDITIONS FOR EFFECTIVE USE:

Ditches or pipes, if needed, sized for 2 year rainfall intensity events; HGL 6” below parking surface.

WHEN BMP IS TO BE INSTALLED:

Prior to vehicles or equipment accessing remote areas.

STANDARDS AND SPECIFICATIONS:

Properly grade roadway to prevent runoff from leaving the construction site. Design stabilized access to support the heaviest vehicles and equipment that will use it. Install culvert(s) under road, if needed, to maintain positive drainage. Place and compact roadway materials. Coordinate materials with those used for stabilized construction entrance/exit points. Vegetate road ditches.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect routinely for damage and repair as needed. Remove sediment and clods of dirt from road daily. Keep all temporary roadway ditches clear of sediment and debris. Repair areas that have settled. Replace rock if necessary to maintain a clean surface.

SITE CONDITIONS FOR REMOVAL:

Remove when vehicles and equipment will no longer access remote areas; regrade area and vegetate.

TYPICAL DETAILS:

Not applicable

WASHDOWN STATION TC-4

DEFINITION AND PURPOSE:

An area located at stabilized construction access points to remove sediment from tires and undercarriages, and to prevent sediment from being transported onto public roadways.

APPROPRIATE APPLICATIONS:

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

CONDITIONS FOR EFFECTIVE USE:

Downstream BMP sized appropriately to treat dirty runoff from the washdown station. Requires a supply of wash water. Requires a turnout or doublewide exit to avoid having entering vehicles drive through the wash area.

WHEN BMP IS TO BE INSTALLED:

Installed along with the stabilized construction entrance/exit, prior to vehicles or equipment accessing unpaved areas.

STANDARDS AND SPECIFICATIONS:

Grade and compact area for drainage under washdown pad. Install wash rack, which should be designed and constructed/manufactured for anticipated traffic loads. Provide a drainage ditch, grade that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff. Install water supply and hose. Post sign in advance of station indicating that all exiting vehicles and equipment must use the station prior to exiting the site.

OPERATION AND MAINTENANCE PROCEDURES:

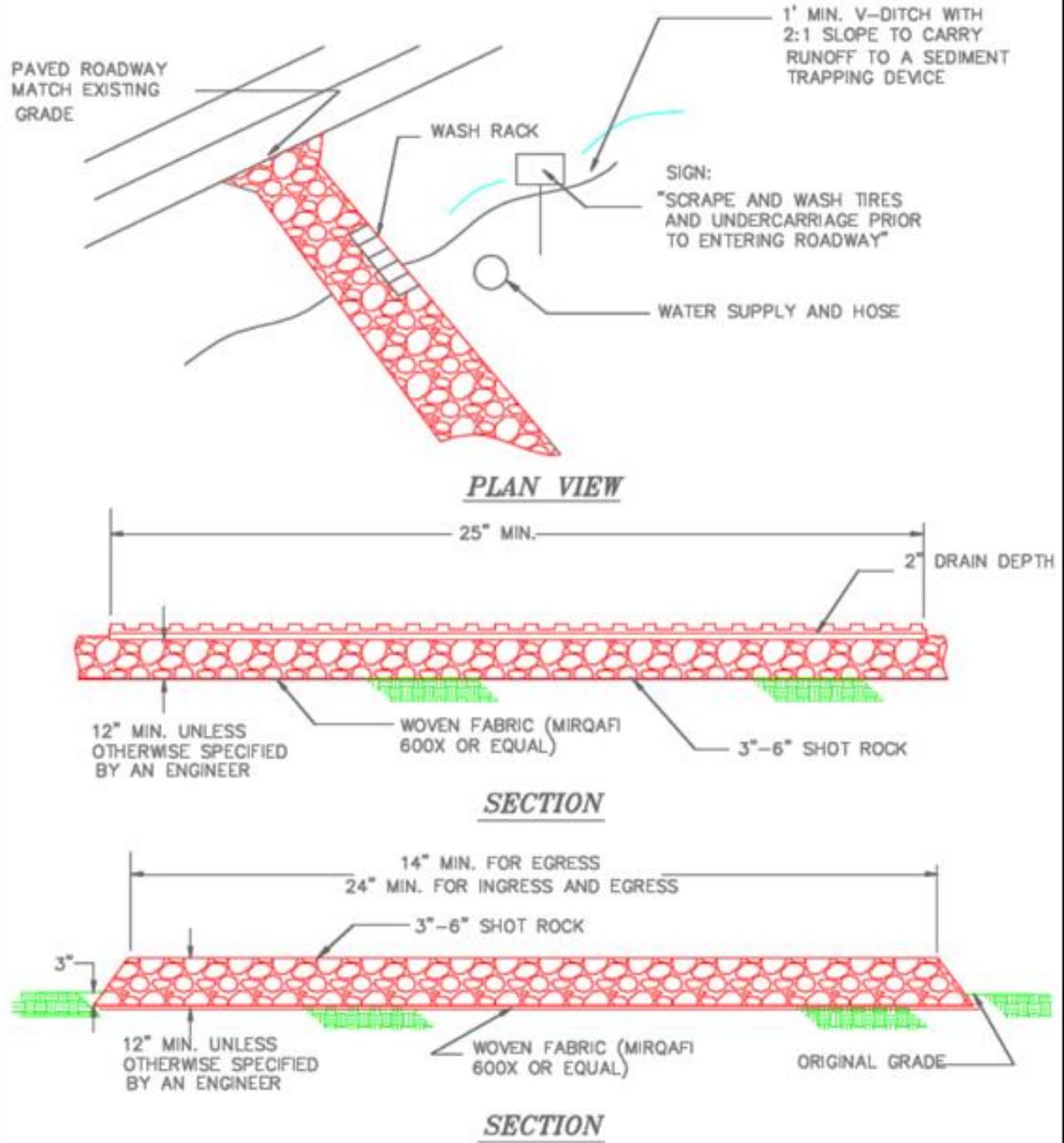
Remove accumulated sediment in wash rack and/or sediment trap on a daily basis to maintain system performance. Repair any areas that have settled. Replace rock if necessary to maintain a clean surface.

SITE CONDITIONS FOR REMOVAL:

Remove when vehicles and equipment will no longer access unpaved areas.

TYPICAL DETAILS:

TC-4



Modified from Chesterfield, Missouri Model BMPs for Land Disturbance

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WASHDOWN STATION



Figure TC – 4

NON-SEDIMENT POLLUTION CONTROL PP-1 (HOUSEKEEPING)

DEFINITION AND PURPOSE:

Control measures designed to prohibit chemicals, hazardous materials, solid waste, human waste and construction debris from polluting stormwater. Pollutants carried in solution or as surface films on runoff will be carried through most erosion control and sediment capture BMPs. Keeping substances like fuel, oil, asphalt, paint, solvents, fertilizer, soil additives, concrete wash water, solid waste, human waste and construction debris from polluting runoff can be accomplished to a large extent through good housekeeping on the site and following the manufacturer's recommendations for disposal.

APPROPRIATE APPLICATIONS:

Temporary sanitary facilities (do not place on top of storm inlets or near waterways), collection, storage and fueling areas should be located onsite in an area that does not receive a substantial amount of runoff from upland areas and does not drain directly to lakes, creeks, streams, rivers, sewers, groundwater, wetlands, or road ditches.

CONDITIONS FOR EFFECTIVE USE:

An effective management system requires training and signage to promote proper storage, handling and disposal of materials, and follow up observations of actions and inspection of storage areas by management. Plans should contain notes clearly stating requirements for addressing potential pollutants.

WHEN BMP IS TO BE INSTALLED:

Immediately following installation of construction entrance.

STANDARDS AND SPECIFICATIONS:

Place waste receptacles (empty on a regular basis) near area of work. All fueling facilities present on the site shall adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers. Hazardous wastes shall be managed according to Missouri Hazardous Waste Laws and Regulations. Install appropriate signage. Post guidelines for proper handling, storage and disposal of materials, and emergency spill cleanup on site. Provide sufficient temporary toilet facilities to serve the number of workers on the site.

OPERATION AND MAINTENANCE PROCEDURES:

Inspect activities, storage areas, and control devices weekly and within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Maintenance of temporary toilet facilities should be frequent and thorough. Make necessary corrections and repairs.

SITE CONDITIONS FOR REMOVAL:

Remove after contributing drainage areas have been adequately stabilized.

TYPICAL DETAILS: See general pollution notes attached.

POLLUTION PREVENTION PROCEDURES (GENERAL POLLUTION NOTES)

1. Handling and disposal of hazardous materials:

- DO: Prevent spills
- Use products up
- Follow label directions for disposal
- Remove lids from empty bottles and cans when disposing in trash
- Recycle wastes whenever possible
- DON'T: Don't pour waste into sewers or waterways on the ground
- Don't pour waste down the sink, floor drain or septic tanks
- Don't bury chemicals or containers, or dispose of them with other waste
- Don't burn or mix chemicals or containers
- Don't wash sediment down storm sewer inlets

2. Containers shall be provided for collection of all waste material including construction debris, trash, petroleum products and any hazardous materials to be used onsite. All waste material shall be disposed of at facilities approved for that material.

3. No waste materials shall be buried on-site.

4. Mixing, pumping, transferring or otherwise handling construction chemicals such as fertilizer, lime, asphalt, concrete drying compounds, and all other potentially hazardous materials shall be performed in an area away from any watercourse, ditch or storm drain.

5. Equipment fueling and maintenance, oil changing, etc., shall be performed only in an area designated for that purpose. The designated area is equipped for recycling oil and catching spills.

6. Concrete wash water shall not be allowed to flow directly to storm sewers, streams, ditches, lakes, etc without being treated. A sump or pit shall be constructed to contain concrete wash water.

7. All paint, solvents, petroleum products and petroleum waste products, and storage containers (such as drums, cans, or cartons) shall be stored according to BMPs. The materials exposed to precipitation shall be stored in watertight, structurally sound, closed containers. All containers shall be inspected for leaks or spillage during the once per week inspection of BMPs. If substances such as oil, diesel fuel, hydraulic fluid, antifreeze, etc. are spilled, leaked, or released onto soil, the soil shall be dug up and properly disposed of. Spills on pavement shall be absorbed with sawdust, kitty litter or product designed for that purpose and disposed of at a licensed sanitary landfill. Hazardous or industrial wastes such as most solvents, gasoline, oil-based paints, and cement curing compounds require special handling. These materials will be removed from the site and recycled or disposed of in accordance with MoDNR requirements.

8. State law requires the party responsible for a petroleum product spill in excess of 50 gallons to report the spill to MoDNR (573-634-2436) as soon as practical after discovery. Federal law requires the responsible party to report any release of oil if it reaches or threatens a sewer, lake, creek, stream, river, groundwater, wetland, or area, like a road ditch, that drains into one of the above.

9. Sufficient temporary toilet facilities to serve the number of workers on the site shall be provided. The facilities shall be serviced frequently to maintain a sanitary condition.

CONCRETE WASHOUT **PP-2**

DEFINITION AND PURPOSE:

Concrete waste management prevents the discharge of pollutants to stormwater from concrete waste by conducting washout off-site, performing on-site washout in a designated area (concrete washout BMP), and training employees and subcontractors.

APPROPRIATE APPLICATIONS:

Concrete washouts are implemented on construction projects where slurries containing Portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, and grooving. Also where concrete trucks and other concrete-coated equipment are washed on-site.

CONDITIONS FOR EFFECTIVE USE:

Washout should be located a minimum of 50 feet from storm drains, open drainage facilities, and watercourses. Avoid mixing excess amounts of fresh concrete.

WHEN BMP IS TO BE INSTALLED:

Installed before the start of any concrete activities or deliveries.

STANDARDS AND SPECIFICATIONS:

Temporary concrete washouts should be designed with sufficient quantity and volume to contain all liquid and concrete waste. Plastic lining material should be a minimum of 10 mil. polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.

OPERATION AND MAINTENANCE PROCEDURES:

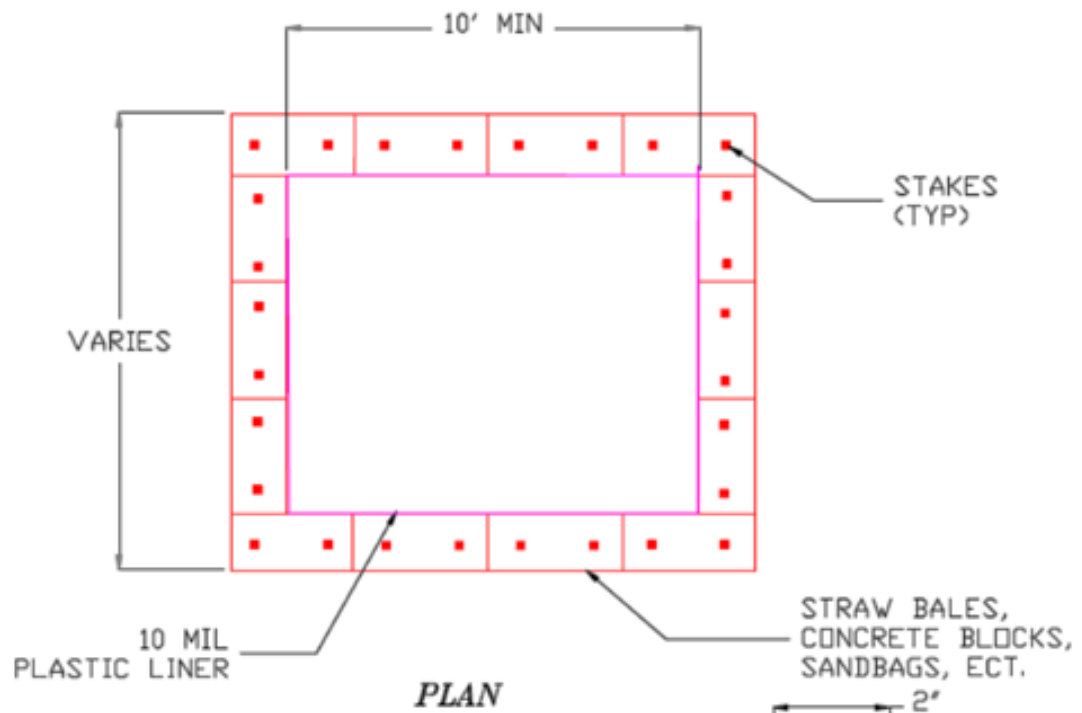
Inspect at least once per seven calendar days, or within a reasonable time period (not to exceed 48 hours) of a rainfall event which causes stormwater runoff to occur on-site. Remove and dispose of hardened concrete and return the facility to a functional condition. Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

SITE CONDITIONS FOR REMOVAL:

When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and disposed of. Materials used to construct temporary concrete washout facilities should be removed from the site and disposed of. Holes, depressions or other ground disturbance caused by the removal of the washout should be backfilled and repaired.

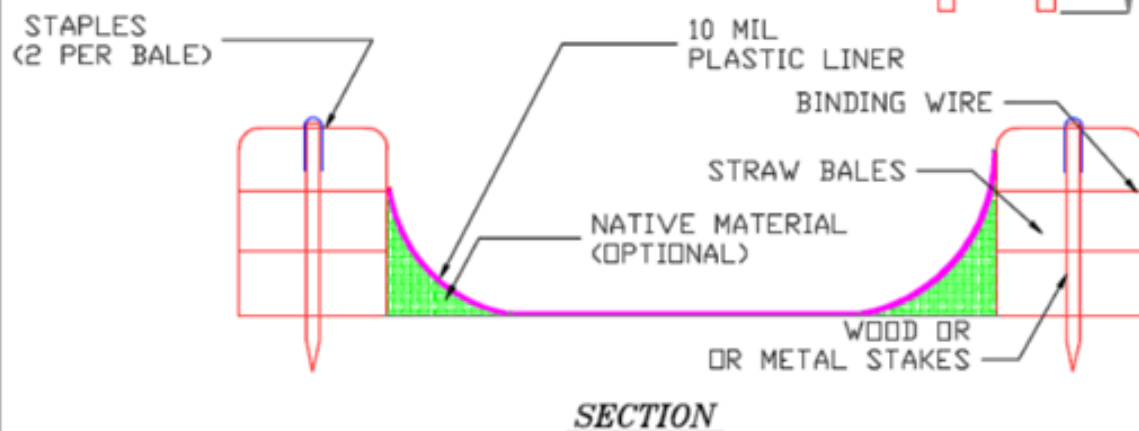
TYPICAL DETAILS:

PP-2



NOTES:

1. ACTUAL LAYOUT DETERMINED IN FIELD
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY



NTS

CONCRETE WASHOUT – ABOVE GRADE



Figure PP – 2

ACRONYMS

ASTM – American Society of Testing Materials

BAT – Best Available Technology

BCT – Best Conventional Technology

BFM – Bonded Fiber Matrix

BMP – Best Management Practice

CFR – Code of Federal Regulations

CGP – Construction General Permit

CSR – Code of State Regulations (Missouri)

CMP – Corrugated Metal Pipe

CPESC – Certified Professional in Erosion and Sediment Control

CWA – Clean Water Act

DSA – Disturbed Soil Area

ECB – Erosion Control Blanket

ECRM – Erosion Control Revegetation Mat

ECTC – Erosion Control Technology Council

ENM – Effective Neutralizing Material

EOS – Equivalent Opening Size

EPA (USEPA) – United States Environmental Protection Agency

ESA – Environmentally Sensitive Area

FEMA – Federal Emergency Management Agency

HDPE – High-Density Polyethylene

IECA – International Erosion Control Association

MCWL – Missouri Clean Water Law

MDNR (DNR, MoDNR) – Missouri Department of Natural Resources

MoDOT – Missouri Department of Transportation

A C R O N Y M S APPENDIX

MOGP – Missouri General Permit

MSDS – Material Safety Data Sheet

NOI – Notice of Intent

NOT – Notice of Termination

NOV – Notice of Violation

NPDES – National Pollution Discharge Elimination System

NPS – Nonpoint Source Pollution

NRCS – Natural Resources Conservation Service

OSHA – Occupation Safety and Health Association

PCC – Portland Cement Concrete

PVC – Polyvinyl Chloride

PW – Public Works Department of the City of Springfield

RECP – Rolled Erosion Control Product

RUSLE – Revised Universal Soil Loss Equation

SWCS – Soil and Water Conservation Society

SWPPP – Storm Water Pollution Prevention Plan

SWSD – Storm Water Services Division (City of Springfield)

TRM – Turf Reinforcement Mat

USACE – United States Army Corp of Engineers

USLE – Universal Soil Loss Equation

USDA – United States Department of Agriculture

USDOT – United States Department of Transportation

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

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Land Disturbance Checklist

CHRISTIAN COUNTY RESOURCE MANAGEMENT
1106 W. JACKSON
OZARK, MO 65721
417-581-7242

Inspection Checklist	Satisfactory?	Corrective Actions Needed/Notes
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SWPPP & Site Sign – Is SWPPP on site and updated with records attached? Is sign posted on construction site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
ESC Plan – Do erosion and sediment control BMP's in the field match specifications and SWPPP?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Construction Exit – Is sediment trackout controlled at the construction exit? Are streets substantially free of sediment?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Stockpiles – Are stockpiles stabilized or controlled by a BMP? Are borrow/fill areas identified on the SWPPP?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Housekeeping – Are construction debris and construction chemicals controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
BMP Maintenance – Have all BMP's been repaired/sediment accumulation removed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
BMP Removal – Have all temporary BMP's that are no longer needed been removed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Stabilization – Has temporary stabilization been achieved on areas inactive for more than 14 days? Has final stabilization been implemented where possible?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Additional Comments:		