CHAPTER 6

BMP STANDARDS AND SPECIFICATIONS FOR GENERAL LAND-DISTURBING ACTIVITIES

This chapter contains Standards and Specifications for planning, design and installation of erosion and sediment control measures. They are intended to provide minimum criteria for use at the local level. The many variations in climate, soils, topography, physical features and planned land use may require modifications at the local level. Local officials will assure that standards and specifications are implemented in harmony with existing ordinances, rules and regulations.

Variations of these standards have been in use since late 1930's, when Soil and Water Conservation Districts were first established. Continuing progress through experience and research will require periodic updating. The construction specifications contained herein are not intended to be complete. Detailed construction specifications should be prepared for each land-disturbing activity.

Information has been included on geotextiles based on the American Association of State Highway Transportation Officials (AASHTO). Information on Forestry Best Management Practices can be found in the Georgia Forestry Commission's publication entitled Georgia's Best Management Practices for Forestry.

Erosion control is of primary importance during land-disturbing activities, but sediment storage must be available on the site. Temporary sediment basins and retrofitted detention ponds most commonly achieve the required 67 cubic yards per acre of disturbed area of storage. Some situations may call for the use of practices other than those mentioned above. Appropriate sediment storage must be available on the site PRIOR to any land-disturbing activities. It is imperative that creative engineering practices are used to ensure that erosion and sediment control BMP's are appropriate for the situation and activity. Linear projects pose special treatment concerning erosion and sediment control. Guidelines for dealing with linear projects has been included.

Shall or Will, Should, and May are used in these specifications with the following definitions:

Shall or Will - A mandatory condition. When certain requirements are described with the "shall" or "will" stipulations, it is mandatory that the requirements be met.

Should - An advisory condition. Considered to be recommended but not mandatory.

May - A permissive condition. No requirement is intended.

Section I contains standards providing general instructions for the preparation of erosion and sediment control plans for land-disturbing activities.

Section II contains standards and specifications for vegetative type measures for general land-disturbing activities.

Section III contains standards for structural practices and provides instructions for the preparation of erosion and sediment control plans for land-disturbing activities.

Section IV contains tables for design of vegetated diversion, waterway or stormwater conveyance practices.

Waters of the United States and Erosion and Sediment Control

Wetlands are defined as areas that are inundated by surface or ground water for a long enough period of time that the area supports the growth of vegetation that can perpetuate in saturated soil. Wetlands are a valuable resource, and it is imperative that these areas are protected from damage caused by adjacent erosion and subsequent sedimentation. While state law does not necessarily require buffers adjacent to wetlands, these areas are still considered valuable, and all efforts must be made to protect these areas during land disturbing activities. Obviously, the best and most effective method for protecting wetlands is maintaining a buffer between and land-disturbing activity and the wetland. If this is not possible, standard erosion and sediment control devices can be utilized to protect these areas. As always, it is imperative that these devices be designed, installed, and properly maintained.

The Georgia Erosion and Sedimentation ~~Control (E&SC)~~ Act requires that land-disturbing activities in Georgia are protected from erosion and subsequent sedimentation up to and including a 25-year storm. Few realize that activities that impact Waters of the United States can mean stricter Federal requirements for erosion and sediment control. Waters of the United States are navigable waters as well as adjacent wetlands and tributaries to navigable waters. Discharge of dredged of fill material into Waters of the United States is regulated by the United States Army Corps of Engineers under Section 404 of the Clean Water Act (33 U.S.C. 1344).

While State Law requires E&SC protection for a 25-year storm, Federal Law requires that adequate erosion and sediment control must be implemented during land-disturbing activities where a section 404 permit (usually known as a wetland permit) is required. Few realize that minor activities of filling and dredging, while not requiring U.S. Army Corps of Engineers notification, still must meet the Federal requirement of “adequate erosion and sediment control” as if a permit had been issued. According to Federal Law, “adequate equates to “no failures tolerated.” In short, when filling or dredging activity impacts any Waters of the United States, adequate erosion control must occur at the site. Therefore, during land-disturbing activities regulated by the state, erosion and sediment control regulations fall under stricter Federal guidelines as well as the standard State guidelines if Waters of the United States are impacted.

To get more information concerning discharge of dredged or fill material into Waters of the United States, permitting for these activities, and stipulations for permitting please contact the United States Army Corps of Engineers, Savannah District, Regulatory Branch, at 1-800-~~652-5065~~ 448-2402 or visit the web site at www.sas.usace.army.mil.

STANDARDS AND SPECIFICATIONS

SECTION I: LAND-DISTURBING ACTIVITY PLAN

SECTION II: VEGETATIVE MEASURES

SECTION III: STRUCTURAL PRACTICES

SECTION IV: TABLES FOR DESIGN OF VEGETATED DIVERSION, WATERWAY OR STORMWATER CONVEYENCE PRACTICES

SECTION I: LAND-DISTURBING ACTIVITY PLAN

LAND-DISTURBING ACTIVITY PLAN

DEFINITION

~~A plan for the control of soil erosion and sedimentation resulting from a land-disturbing activity.~~

A plan which has been properly designed for the control of erosion, sedimentation and pollution resulting from a land-disturbing activity.

PURPOSE

~~The purpose of this standard is to provide instructions for the preparation of detailed plans for a proposed land-disturbing activity in order to accomplish one or more of the following:~~

~~1. provide suitable sites for buildings, roadways, facilities and other land uses.~~
~~2. improve surface drainage.~~
~~3. control soil erosion and sediment deposition.~~

The proper design of a detailed plan which is in compliance with the Georgia E&S Act, and/or all requirements of the NPDES Permits for Construction Activities issued by the Georgia EPD when appropriate.

CONDITION

~~This standard is applicable where land-disturbing activities are undertaken for any of the purposes set forth above.~~

An ES&PC Plan is required for any land-disturbing activity which is not exempt in O.C.G.A § 12-7-17. Compliance with the NPDES Permits is required for all land-disturbing activities that result in a disturbance equal to or greater than acre, and all land-disturbing activities that result in less than one acre disturbed when the project is part of a larger common plan of development.

Many land-disturbing activities will require compliance with both the Act and NPDES, some will require compliance with the Act but are exempt from NPDES, some may be exempt from the Act but require compliance with NPDES, and others may be exempt from both the Act and NPDES. The certified design professional preparing the ES&PC Plan should be familiar with all the appropriate requirements.

PLANNING CRITERIA

~~This land-disturbing activity plan shall be based upon adequate surveys, resource data and investigations. Erosion and sediment control measures shall be designed in accordance with the applicable standard applied herein. Practical combinations of the following principles shall be utilized, as a minimum, in planning for any land-disturbing activity.~~

The ES&PC Plan shall be designed based upon adequate surveys and resource data, and a site visit by the design professional. Best Management Practices (BMPs) shall be designed in accordance with the applicable standards provided within this Chapter. Practical combinations of the following principles shall be utilized, as a minimum, in planning for any land-disturbing activity.

1. Fit the Activity to the Topography and Soils.

Detailed planning should be employed to assure that roadways, buildings and other permanent features of the activity conform to the natural characteristics of the site. Large graded areas should be located on the most level portion of this site. Areas subject to flooding should be avoided. Areas of steep slopes, erodible soils and soils with severe limitations for the intended uses should not be utilized without overcoming the limitations through sound engineering practices. *Erosion control, development and maintenance costs can be minimized if a site is selected for a specific activity.*

2. The Disturbed Area and the Duration of Exposure to Erosion Elements Should Be Minimized.

Clearing of natural vegetation should be limited to only those areas of the site to be devel-

oped at a given time. Natural vegetation should be retained, protected and supplemented with construction scheduling employed to limit the duration of soil exposure. Major land clearing and grading operations should be scheduled during seasons of low potential runoff.

3. Stabilize Disturbed Areas Immediately.

Permanent structures, temporary or permanent vegetation, and mulch, or a combination of these measures, should be employed as quickly as possible after the land is disturbed. Temporary vegetation and mulches can be most effective on areas where it is not practical to establish permanent vegetation. These temporary measures should be employed immediately after rough grading is completed if a delay is anticipated in obtaining finished grade. The finished slope of a cut or fill should be stable and ease of maintenance considered in the design. Stabilize all roadways, parking areas, and paved areas with the gravel subbase, temporary vegetation or mulch. *Mulch, temporary vegetation, or permanent vegetation shall be completed on all exposed areas within 14 days after disturbance*. Mulch and/or temporary grassing may be used up to six months; permanent vegetation shall be planted if the area is to be left undisturbed for greater than six months.

4. Retain or Accommodate Runoff.

Runoff from the development should be safely conveyed to a stable outlet using storm drains, diversions, stable waterways or similar conservation measures. Consideration should also be given to the installation of storm water retention structures to prevent flooding and damage to downstream facilities resulting from increased runoff from the site. Temporary or permanent facilities for conveyance of storm water should be designed to withstand the velocities of projected peak discharges. These facilities should be operational as soon as possible after the start of construction, and if possible before the disturbance of the surrounding areas.

5. Retain Sediment.

~~Sediment basins, sediment barriers and related structures should be installed to filter or trap sediment on the site to be disturbed. The most effective method of controlling sediment, however, is to control erosion at its source. Sediment retention structures should be planned to retain sediment when erosion control methods are not practical, or insufficient, or in the process of being installed, or have failed due to some unforeseen factor. If possible, the structures should be installed before the disturbance of surrounding areas.~~

Appropriate sediment storage providing 67 cubic yards of storage per acre drained for each common drainage location shall be provided until final stabilization of the site. The appropriate sediment storage must be available on the site PRIOR to any land-disturbing activities.

6. Do Not Encroach Upon Watercourses.

Permanent buildings should not be subjected to flooding, sediment damages or erosion hazards. Earth fills should not be constructed in flood-prone areas so as to adversely obstruct water flows or increase downstream velocity of water flows. When necessary to span a flood prone area or watercourse, bridge or culvert openings should be sized to permit passage of peak discharges without causing undue restrictions in water flows or without creating excessive downstream velocities. Uses of flood prone areas should be limited to activities which would not suffer excessive damages from flooding, scour, and sediment damages. Temporary bridges or culverts should be employed when construction equipment is required to cross natural or constructed channels.

PLAN REQUIREMENTS

~~The land-disturbing activity plan should contain a narrative description of the project, maps, drawings, computations and supportive data in accordance with the following guidelines.~~

The ES&PC Plan shall be designed by a “Design Professional” as defined in the NPDES Permits, and must have successfully completed a Level II Certification Course approved by the GSWCC.

The signature, seal, and level II certification number of the Design Professional who prepared the plan must be on each sheet of the ES&PC Plan.

The GSWCC provides checklists containing the minimum requirements to be shown on the ES&PC Plans to ensure the plans are in compliance with the E&S Act and the NPDES Permits. The appropriate checklist must be properly completed and included with the ES&PC Plan when plans are submitted for review

Narrative Description

A brief description of the overall project containing:

1. Location, nature, size, and zoning classification of the overall project.
2. Location, nature and size of each phase of development.
3. Size, type of structural units, paved areas and green-belt area.
4. Starting dates of initial land-disturbing activities and date expected final stabilization will be completed.
5. Existing and proposed erosion and sediment control problems for the proposed site.
6. Purpose, nature and extent of proposed sediment control program.
7. Proposed storm water management program for the development and the effect of the development on downstream facilities.
8. Major topographic features, streams, existing soil types and vegetation located on the project site.
9. Maintenance programs for the sediment control facilities including inspection frequencies, vegetative programs, repair procedures, frequency of removal and disposition of solid waste and disposition of temporary sediment structural measures.

Maps

Detailed maps, drawings and sketches showing:

1. A location sketch of the project relative to roadways, municipalities, major streams and other identifiable landmarks.
2. A boundary line survey or detailed boundary sketch of the proposed project.
3. Contours, existing and proposed, for that portion of the activity being developed.
4. Soils boundaries including name, texture, slope, depth, drainage and structure.
5. Streams and drainage areas, lakes or ponds, flood prone areas, vegetation and existing structures.
6. The proposed alteration of the area including limits of clearing and grading, roads, buildings and structures.
7. Location and extent of temporary and permanent erosion and sediment control measures including both vegetative and structural practices.
8. Location and extent of storm water management facilities.
9. Other significant features including legend, map scales, north arrow, title blocks, seals and signatures.

Activity Schedules

For each phase or stage of land-disturbing activity, an activity schedule will be included. The activity schedule will show the anticipated starting and completion date for all land development activities including:

1. Timber salvage operations
2. Installation of construction exit, sediment barriers, and other perimeter controls
3. Clearing and grubbing of areas necessary for the installation of sediment retention basins and related structures
4. Installation of sediment retention basins and related structures
5. Clearing and grubbing of remaining areas
6. Rough grading
7. Installation of stormwater management system
8. Permanent stabilization of areas at final grade and temporary stabilization of remaining areas
9. Installation of curb and gutter
10. Installation of gravel subbase for roads and parking areas (construction road stabilization)
11. Building construction
12. Final grading
13. Permanent stabilization/landscaping
14. Removal of erosion and sediment control measures.

Supportive Data

Supportive data shall include reference to the applicable standards and specifications, calculations, charts, graphs, maps and any other data used in the design and layout of the measures installed.

CONSTRUCTION SPECIFICATIONS

All timber having a marketable value shall be salvaged. Timber logs, brush, rubbish, and vegetable matter which will interfere with the grading operations or affect the planned stability of fill areas shall be removed and disposed of according to the plan and in accordance with all local and state laws.

Topsoil is to be stripped and stockpiled in amounts necessary or available on site to complete final grading of all exposed areas.

Fill material is to be free of brush, rubbish, rocks, logs, and stumps in amounts that are detrimental to constructing stable fills.

Cut slopes which are to be top soiled will be scarified to a minimum depth of 3 inches prior to placement of topsoil.

Compaction of fills will be as required to reduce slipping, erosions or excess saturation.

Frozen mixtures of soft, mucky or easily compressible materials are not to be incorporated in fills intended to support buildings, parking lots, road, structures, sewers, or conduits.

Maximum thickness of layers to be compacted by sheeps foot rollers are not to exceed 9 inches.

All disturbed areas shall be left with a neat and finished appearance and stabilized with the appropriate permanent protective cover.

EROSION AND SEDIMENT CONTROL PLAN REVIEW CHECKLIST FOR LINEAR PROJECTS

Project Name _____ Address _____

City/County _____ Date on Plans _____

Site Plan:

1) Show graphic scale and north arrow.
2) Provide vicinity map showing site's relation to surrounding area.
3) Provide both existing and planned contours in accordance with the following:
   - Existing contours: USGS 1" : 2000' topographical sheets
   - Proposed contours: 1" : 400' centerline profile
4) Delineate on-site drainage and off-site watersheds using USGS 1" : 2000' topographical sheets.
5) Delineate all state waters located on or within 200 feet of the project site - refer to 1" : 2000' USGS topographical sheets, published soil surveys, GIS information, etc.
6) Show location of erosion and sediment practices using uniform coding symbols from the Manual for Erosion and Sediment Control in Georgia, Chapter 6, with legend.
7) Delineate 25-foot undisturbed buffers of state waters and 50-foot management zones along designated trout streams. Clearly note areas of impact.
8) Delineate all wetlands and provide regulatory documentation permitting any proposed impacts.
9) Include soil series and their delineation.
10) Describe adjacent areas - neighboring areas such as streams, lakes, residential areas, etc., which might be affected.

Narrative Notes and Other Information: (Notes or narrative should be located on the site plan under general notes or under erosion and sediment control notes.)

1) Provide description of existing land use at project site and description of proposed project. Include land lot and district numbers for site location.
2) Provide name, address and phone number of utility/contractor.
3) Provide name and phone number of 24-hour local contact that is responsible for erosion and sediment controls.
4) Show signature and seal of qualified plan preparer.
5) Note total and disturbed acreage of the project or phase under construction.
6) Provide detailed construction activity schedule - show anticipated starting and completion dates for project events, include vegetation and mulching timeline.
7) Clearly note the statement in bold letters: **"The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land-disturbing activities."**
8) Provide 67 cubic yards per acre sediment storage. Include specific design information and calculations for structural measures on site.
9) Show storm-drain pipe and weir velocities and provide appropriate outlet protection to accommodate discharges without erosion.
10) Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime, and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.
11) Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
12) Clearly note maintenance statement - "Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."

EROSION AND SEDIMENT CONTROL PLAN REVIEW CHECKLIST

Project Name _____ Address _____

City/County _____ Date on Plans _____

Site Plan:

1) Show graphic scale and north arrow.
2) Provide vicinity map showing site's relation to surrounding area, including designation of specific phase, if necessary.
3) Provide both existing and planned contours with contour lines drawn at an interval in accordance with the following:
4) Delineate contributing drainage areas both on and off site. Include hydrology study and maps of drainage basins for both the pre- and post-developed conditions.
5) Delineate all state waters located on or within 200 feet of the project site.

Map Scale	Ground Slope	Contour interval, ft.
1 inch= 100 ft. or larger scale	Flat 0-2% Rolling 2-8% Steep 8% +	0.5 or 1 1 or 2 2, 5 or 10

6) Show location of erosion and sediment practices using uniform coding symbols from the Manual for Erosion and Sediment Control in Georgia, Chapter 6, with legend.
7) Delineate 25-foot undisturbed buffers of state waters and 50-foot management zones along designated trout streams. Clearly note areas of impact.
8) Delineate all wetlands and provide regulatory documentation permitting any proposed impacts.
9) Include soil series and their delineation.
10) Describe adjacent areas - neighboring areas such as streams, lakes, residential areas, etc., which might be affected.

Narrative Notes and Other Information: (Notes or narrative should be located on the site plan under general notes or under erosion and sediment control notes.)

1) Provide statement from local tax official that all ad valorem taxes owed and due have been paid.
2) Provide description of existing land use at project site and description of proposed project. Include land lot and district numbers for site location.
3) Provide name, address and phone number of developer/owner.
4) Provide name and phone number of 24-hour local contact that is responsible for erosion and sediment controls.
5) Show signature and seal of qualified plan preparer.
6) Note total and disturbed acreage of the project or phase under construction.
7) Provide detailed construction activity schedule - show anticipated starting and completion dates for project events, include vegetation and mulching timeline.
8) Clearly note the statement in bold letters: **"The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land-disturbing activities."**
9) Provide 67 cubic yards per acre sediment storage. Include specific design information and calculations for all structural measures on site, such as temporary sediment basins, retrofitted detention ponds, and channels.
10) Show storm-drain pipe and weir velocities and provide appropriate outlet protection to accommodate discharges without erosion.
11) Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime, and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.
12) Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
13) Clearly note maintenance statement - "Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."

EROSION, SEDIMENTATION & POLLUTION CONTROL PLAN CHECKLIST
STAND ALONE CONSTRUCTION PROJECTS

Updated Checklist

SWCD:_____

Project Name:_____ Address:_____

City/County:_____ Date on Plans:_____

Plan Page #	Included Y/N		TO BE SHOWN ON ES&PC PLAN
		1.	The applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Commission as of January 1 of the year in which the land-disturbing activity was permitted. (The completed Checklist must be submitted with the ES&PC Plan or the Plan will not be reviewed)
		2.	Level II certification number issued by the Commission, signature and seal of the certified design professional (Signature, seal and Level II number must be on each sheet pertaining to ES&PC plan or the Plan will not be reviewed)
		3.	The name and phone number of the 24-hour local contact responsible for erosion, sedimentation and pollution controls
		4.	Provide the name, address and phone number of primary permittee
		5.	Note total and disturbed acreage of the project or phase under construction
		6.	Provide land lot and district numbers for site location. Describe critical areas and any additional measures that will be utilized for these areas.
		7.	Provide vicinity map showing site's relation to surrounding areas. Include designation of specific phase, if necessary
		8.	Graphic scale and north arrow.
		9.	Existing and proposed contour lines with contour lines drawn at an interval in accordance with the following

Map Scale	Ground Slope	Contour Intervals, ft.
1 inch = 100ft or larger scale	Flat 0 - 2% Rolling 2 - 8% Steep 8% +	0.5 or 1 1 or 2 2,5 or 10

		10.	Boundary line survey.*
		11.	Delineation and acreage of contributing drainage basins on the project site
		12.	Delineation of on-site wetlands and all state waters located on and within 200 feet of the project site
		13.	Delineation of the applicable 25-foot or 50-foot undisturbed buffers adjacent to state waters and any additional buffers required by the Local Issuing Authority. Clearly note and delineate all areas of impact
		14.	Delineate all sampling locations, perennial and intermittent streams and other water bodies into which storm water is discharged.*
		15.	Storm-drain pipe and weir velocities with appropriate outlet protection to accommodate discharges without erosion Identify/Delineate all storm water discharge points.
		16.	Soil series for the project site and their delineation.
		17.	Identify the project receiving waters and describe all adjacent areas including streams, lakes, residential areas, wetlands, etc. which may be affected.
		18.	Any construction activity which discharges storm water into an Impaired Stream Segment, or within 1 linear mile upstream of and within the same watershed as, any portion of an Biota Impaired Stream Segment must comply with Part III. C. of the Permit. Include the completed Appendix 1 listing all the BMPs that will be used for those areas of the site which discharge to the Impaired Stream Segment.*
		19.	If a TMDL Implementation Plan for sediment has been finalized for the Impaired Stream Segment (identified in item 18 above) at least six months prior to submittal of NOI, the ES&PC Plan must address any site-specific conditions or requirements included in the TMDL Implementation Plan.*
		20.	Provide hydrology study and maps of drainage basins for both the pre- and post-developed conditions.
		21.	Initial date of the Plan and the dates of any revisions made to the Plan including the entity who requested the revisions
		22.	The limits of disturbance for each phase of construction.
		23.	Limit of disturbance shall be no greater than 50 acres at any one time without prior written authorization from the EPD District Office. If EPD approves the request to disturb 50 acres or more at any one time, the plan must include at least 4 of the BMPs listed in Appendix 1 of this checklist.* (A copy of the written approval by EPD must be attached to the plan for the plan to be reviewed.)
		24.	Provide a minimum of 67 cubic yards of sediment storage per acre drained using a temporary sediment basin, retrofitted detention pond, and/or excavated inlet sediment traps for each common drainage location. Sediment storage volume must be in place prior to and during all land disturbance activities until final stabilization of the site has been achieved. A written rationale explaining the decision to use equivalent controls when a sediment basin is not attainable must be included in the plan for each common drainage location in which a sediment basin is not provided. Worksheets from the Manual must be included for structural BMPs and all calculations used by the design professional to obtain the required sediment storage when using equivalent controls.
		25.	Use of alternative BMPs whose performance has been documented to be equivalent to or superior to conventional BMPs

as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission). Please refer to the Alternative BMP Guidance Document found at www.gaswcc.org.

26. Best Management Practices to minimize off-site vehicle tracking of sediments and the generation of dust
27. BMPs for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of the vehicles. Washout of the drun at the construction site is prohibited.*
28. Provide BMPs for the remediation of all petroleum spills and leaks.*
29. Location of Best Management Practices that are consistent with and no less stringent than the Manual for Erosion and Sediment Control in Georgia. Use uniform coding symbols from the Manual, Chapter 6, with legend
30. Description of the nature of construction activity.
31. A description of appropriate controls and measures that will be implemented at the construction site including: (1) initia sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) fina BMPs. *
32. Description and chart or timeline of the intended sequence of major activities which disturb soils for the major portions of the site (i.e., initial perimeter and sediment storage BMPs, clearing and grubbing activities, excavation activities, utility activities, temporary and final stabilization).
33. Description of the practices that will be used to reduce the pollutants in storm water discharges.*
34. Description of the measures that will be installed during the construction process to control pollutants in storm water tha will occur after construction operations have been completed.*
35. Design professional's certification statement and signature that the site was visited prior to development of the ES&PC Plan as stated on page 14 of the permit.
36. Design professional's certification statement and signature that the permittee's ES&PC Plan provides for an appropriate and comprehensive system of BMPs and sampling to meet permit requirements as stated on page 14 of the permit.*
37. Certification statement and signature of the permittee or the duly authorized representative as stated in section V.G.2.d. of the state general permit.*
38. An estimate of the runoff coefficient or peak discharge flow of the site prior to and after construction activities are completed.
39. Indication that non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation without first acquiring the necessary variances and permits
40. Indication that the design professional who prepared the ES&PC Plan is to inspect the installation of the initial sediment storage requirements and perimeter control BMPs within 7 days after installation.*
41. Indication that amendments/revisions to the ES&PC Plan which have a significant effect on BMPs with a hydraulic component must be certified by the design professional.*
42. Indication that waste materials shall not be discharged to waters of the State, except as authorized by a Section 404 permit.*
43. Documentation that the ES&PC Plan is in compliance with waste disposal, sanitary sewer, or septic tank regulations during and after construction activities have been completed.*
44. Provide complete requirements of inspections and record keeping by the primary permittee.*
45. Provide complete requirements of sampling frequency and reporting of sampling results.*
46. Provide complete details for retention of records as per Part IV.F. of the permit.*
47. Description of analytical methods to be used to collect and analyze the samples from each location.*
48. Appendix B rationale for outfall sampling points where applicable.*
49. Clearly note statement in bold letters- **"The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities."**
50. Clearly note maintenance statement in bold letters - **"Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source.'**
51. Clearly note the statement in bold letters - **"Any disturbed area left exposed for a period greater than 14 days shall be stabilized with mulch or temporary seeding."**
52. Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet the guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
53. Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia

*If using this checklist for a project that is less than 1 acre and not part of a common develo but within 200 ft of a perennial stream the * checklist items would be N/A

Effective January 1, Current Year

EROSION, SEDIMENTATION & POLLUTION CONTROL PLAN CHECKLIST
INFRASTRUCTURE CONSTRUCTION PROJECTS

Updated Checklist

SWCD:_____

Project Name:_____ Address:_____

City/County:_____ Date on Plans:_____

Plan Page #	Included Y/N		
			TO BE SHOWN ON ES&PC PLAN
		1.	The applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Commission as of January 1 of the year in which the land-disturbing activity was permitted. (The completed Checklist must be submitted with the ES&PC Plan or the Plan will not be reviewed)
		2.	Level II certification number issued by the Commission, signature and seal of the certified design professional. (Signature, seal and Level II number must be on each sheet pertaining to ES&PC plan or the Plan will not be reviewed)
		3.	The name and phone number of the 24-hour local contact responsible for erosion, sedimentation and pollution controls.
		4.	Provide name, address and phone number of primary permittee.
		5.	Note total and disturbed acreage of the project or phase under construction.
		6.	Provide land lot and district numbers for site location. Describe critical areas and any additional measures that will be utilized for these areas.
		7.	Provide vicinity map showing site's relation to surrounding areas. Include designation of specific phase, if necessary.
		8.	Graphic scale and north arrow.
		9.	Existing and proposed contour lines with contour lines drawn at an interval in accordance with the following:

Existing Contours:	USGS 1":2000' Topographical Sheets
Proposed Contours:	1" : 400' Centerline Profile

		10.	Delineation and acreage of contributing drainage basins on the project site.
		11.	Delineation of on-site wetlands and all state waters located on and within 200 feet of the project site.
		12.	Delineation of the applicable 25-foot or 50-foot undisturbed buffers adjacent to state waters and any additional buffers required by the Local Issuing Authority. Clearly note and delineate all areas of impact.
		13.	Delineate all sampling locations, perennial and intermittent streams and other water bodies into which storm water is discharged.*
		14.	Storm-drain pipe and weir velocities with appropriate outlet protection to accommodate discharges without erosion. Identify/Delineate all storm water discharge points.
		15.	Soil series for the project site and their delineation.
		16.	Identify the project receiving waters and describe all adjacent areas including streams, lakes, residential areas, wetlands, etc. which may be affected.
		17.	Any construction activity which discharges storm water into an Impaired Stream Segment, or within 1 linear mile upstream of and within the same watershed as, any portion of an Biota Impaired Stream Segment must comply with Part III. C. of the Permit. Include the completed Appendix 1 listing all the BMPs that will be used for those areas of the site which discharge to the Impaired Stream Segment.*
		18.	If a TMDL Implementation Plan for sediment has been finalized for the Impaired Stream Segment (identified in item 18 above) at least six months prior to submittal of NOI, the ES&PC Plan must address any site-specific conditions or requirements included in the TMDL Implementation Plan.*
		19.	Delineate on-site drainage and off-site watersheds using USGS 1" : 2000' topographical sheets.
		20.	Initial date of the Plan and the dates of any revisions made to the Plan including the entity who requested the revisions.
		21.	The limits of disturbance for each phase of construction.
		22.	Provide a minimum of 67 cubic yards of sediment storage per acre drained using a temporary sediment basin, retrofitted detention pond, and/or excavated inlet sediment traps for each common drainage location. Sediment storage volume must be in place prior to and during all land disturbance activities until final stabilization of the site has been achieved. A written rationale explaining the decision to use equivalent controls when a sediment basin is not attainable must be included in the plan for each common drainage location in which a sediment basin is not provided. Worksheets from the Manual must be included for structural BMPs and all calculations used by the design professional to obtain the required sediment storage when using equivalent controls.
		23.	Use of alternative BMPs whose performance has been documented to be equivalent to or superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission). Please refer to the Alternative BMP Guidance Document found at www.gaswcc.org.
		24.	Best Management Practices to minimize off-site vehicle tracking of sediments and the generation of dust.
		25.	BMPs for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of the vehicles. Washout of the drum at the construction site is prohibited.*

26. Provide BMPs for the remediation of all petroleum spills and leaks.*
27. Location of Best Management Practices that are consistent with and no less stringent than the Manual for Erosion and Sediment Control in Georgia. Use uniform coding symbols from the Manual, Chapter 6, with legend.
28. Description of the nature of construction activity.
29. A description of appropriate controls and measures that will be implemented at the construction site including: (1) initial sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) final BMPs. *
30. Description and chart or timeline of the intended sequence of major activities which disturb soils for the major portions of the site (i.e., initial perimeter and sediment storage BMPs, clearing and grubbing activities, excavation activities, utility activities, temporary and final stabilization).
31. Description of the practices that will be used to reduce the pollutants in storm water discharges.*
32. Description of the measures that will be installed during the construction process to control pollutants in storm water that will occur after construction operations have been completed.*
33. Design professional's certification statement and signature that the site was visited prior to development of the ES&PC Plan as stated on page 15 of the permit.
34. Design professional's certification statement and signature that the permittee's ES&PC Plan provides for an appropriate and comprehensive system of BMPs and sampling to meet permit requirements as stated on page 14 of the permit.*
35. Certification statement and signature of the permittee or the duly authorized representative as stated in section V.G.2.d. of the state general permit.*
36. An estimate of the runoff coefficient or peak discharge flow of the site prior to and after construction activities are completed.
37. Indication that non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation without first acquiring the necessary variances and permits.
38. Indication that the design professional who prepared the ES&PC Plan is to inspect the installation of the initial sediment storage requirements and perimeter control BMPs within 7 days after installation.*
39. Indication that amendments/revisions to the ES&PC Plan which have a significant effect on BMPs with a hydraulic component must be certified by the design professional.*
40. Indication that waste materials shall not be discharged to waters of the State, except as authorized by a Section 404 permit.*
41. Documentation that the ES&PC Plan is in compliance with waste disposal, sanitary sewer, or septic tank regulations during and after construction activities have been completed.*
42. Provide complete requirements of inspections and record keeping by the primary permittee.*
43. Provide complete requirements of sampling frequency and reporting of sampling results.*
44. Provide complete details for retention of records as per Part IV.F. of the permit.*
45. Description of analytical methods to be used to collect and analyze the samples from each location.*
46. Appendix B rationale for outfall sampling points where applicable.*
47. Clearly note statement in bold letters- **"The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities."**
48. Clearly note maintenance statement in bold letters - **"Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."**
49. Clearly note the statement in bold letters - **"Any disturbed area left exposed for a period greater than 14 days shall be stabilized with mulch or temporary seeding."**
50. Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet the guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
51. Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.

Effective January 1, Current Year

*If using this checklist for a project that is less than 1 acre and not part of a common development but within 200 ft of a perennial stream the * checklist items would be N/A.

Updated Checklist

EROSION, SEDIMENTATION & POLLUTION CONTROL PLAN CHECKLIST
COMMON DEVELOPMENTS

SWCD:_____

Project Name:_____ Address:_____

City/County:_____ Date on Plans:_____

Plan Page #	Included Y/N		
			TO BE SHOWN ON ES&PC PLAN
		1.	The applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Commission as of January 1 of the year in which the land-disturbing activity was permitted. (The completed Checklist must be submitted with the ES&PC Plan or the Plan will not be reviewed)
		2.	Level II certification number issued by the Commission, signature and seal of the certified Design Professional. (Signature, seal and Level II number must be on each sheet pertaining to ES&PC plan or the Plan will not be reviewed)
		3.	The name and phone number of the 24-hour local contact responsible for erosion, sedimentation and pollution controls
		4.	Provide the name, address and phone number of primary permittee or tertiary permittee
		5.	Note total and disturbed acreage (the disturbed area shall be the total estimated disturbed area of the primary and secondary permittees or the tertiary permittee) of the project or phase under construction
		6.	Provide land lot and district numbers for site location. Describe critical areas and any additional measures that will be utilized for these areas.
		7.	Provide vicinity map showing site's relation to surrounding areas. Include designation of specific phase, if necessary.
		8.	Graphic scale and north arrow.
		9.	Existing and proposed contour lines with contour lines drawn at an interval in accordance with the following:

Map Scale	Ground Slope	Contour Intervals, ft.
1 inch = 100ft or larger scale	Flat 0 - 2% Rolling 2 - 8% Steep 8% +	0.5 or 1 1 or 2 2,5 or 10

		10.	Boundary line survey.
		11.	Delineation and acreage of contributing drainage basins on the project site.
		12.	Delineation of on-site wetlands and all state waters located on and within 200 feet of the project site.
		13.	Delineation of the applicable 25-foot or 50-foot undisturbed buffers adjacent to state waters and any additional buffers required by the Local Issuing Authority. Clearly note and delineate all areas of impact.
		14.	Delineate all sampling locations, perennial and intermittent streams and other water bodies into which storm water is discharged.
		15.	Storm-drain pipe and weir velocities with appropriate outlet protection to accommodate discharges without erosion Identify/Delineate all storm water discharge points.
		16.	Soil series for the project site and their delineation.
		17.	Identify the project receiving waters and describe all adjacent areas including streams, lakes, residential areas, wetlands, etc. which may be affected.
		18.	Any construction activity which discharges storm water into an Impaired Stream Segment, or within 1 linear mile upstream of and within the same watershed as, any portion of an Biota Impaired Stream Segment must comply with Part III. C. of the Permit. Include the completed Appendix 1 listing all the BMPs that will be used for those areas of the site which discharge to the Impaired Stream Segment.
		19.	If a TMDL Implementation Plan for sediment has been finalized for the Impaired Stream Segment (identified in item 18 above) at least six months prior to submittal of NOI, the ES&PC Plan must address any site-specific conditions or requirements included in the TMDL Implementation Plan.
		20.	Provide hydrology study and maps of drainage basins for both the pre- and post-developed conditions.
		21.	Initial date of the Plan and the dates of any revisions made to the Plan including the entity who requested the revisions.
		22.	The limits of disturbance for each phase of construction.
		23.	Limit of disturbance shall be no greater than 50 acres for each individual permittee (i.e. Primary, Secondary or Tertiary) at any one time and no more than 50 contiguous acres at one time without prior written authorization from the EPD District Office. If EPD approves the request to disturb 50 acres or more at any one time, the Plan must include at least 4 of the BMPs listed in Appendix 1 of this checklist. (A copy of the written approval by EPD must be attached to the plan for the plan to be reviewed.)
		24.	Provide a minimum of 67 cubic yards of sediment storage per acre drained using a temporary sediment basin, retrofitted detention pond, and/or excavated inlet sediment traps for each common drainage location. Sediment storage volume must be in place prior to and during all land disturbance activities until final stabilization of the site has been achieved. A written rationale explaining the decision to use equivalent controls when a sediment basin is not attainable must be included in the Plan for each common drainage location in which a sediment basin is not provided. Worksheets from the Manual must be included for structural BMPs and all calculations used by the design professional to obtain the required sediment storage when using equivalent controls.
		25.	Use of alternative BMPs whose performance has been documented to be equivalent to or superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission). Please refer to the Alternative BMP Guidance Document found at www.gaswcc.org.
		26.	Best Management Practices to minimize off-site vehicle tracking of sediments and the generation of dust.
		27.	BMPs for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of the vehicles. Washout of the drum

at the construction site is prohibited.

28. Provide BMPs for the remediation of all petroleum spills and leaks.
29. Plan addresses BMPs for all phases of common development including individual building lots and out-parcels, etc. regardless of who owns or operates the individual sites. Include a typical and any situational lots applicable.
30. Location of Best Management Practices that are consistent with and no less stringent than the Manual for Erosion and Sediment Control in Georgia. Use uniform coding symbols from the Manual, Chapter 6, with legend.
31. Description of the nature of construction activity.
32. A description of appropriate controls and measures that will be implemented at the construction site including: (1) initial sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) fina BMPs.
33. Description and chart or timeline of the intended sequence of major activities which disturb soils for the major portions of the site (i.e., initial perimeter and sediment storage BMPs, clearing and grubbing activities, excavation activities, utility activities, temporary and final stabilization).
34. Description of the practices that will be used to reduce the pollutants in storm water discharges.
35. Description of the measures that will be installed during the construction process to control pollutants in storm water that will occur after construction operations have been completed.
36. Design professional's certification statement and signature that the site was visited prior to development of the ES&PC Plan as stated on page 17 of the permit.
37. Design professional's certification statement and signature that the permittee's ES&PC Plan provides for an appropriate and comprehensive system of BMPs and sampling to meet permit requirements as stated on page 17 of the permit
38. Certification statement and signature of the permittee or the duly authorized representative as stated in section V.G.2.d. of the state general permit.
39. An estimate of the runoff coefficient or peak discharge flow of the site prior to and after construction activities are completed.
40. Indication that non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation without first acquiring the necessary variances and permits.
41. Indication that the design professional who prepared the ES&PC Plan is to inspect the installation of the initial sediment storage requirements and perimeter control BMPs within 7 days after installation.
42. Indication that amendments/revisions to the ES&PC Plan which have a significant effect on BMPs with a hydraulic component must be certified by the design professional.
43. Indication that waste materials shall not be discharged to waters of the State, except as authorized by a Section 404 permit.
44. Indication that the applicable portion of ES&PC Plan is to be provided to each secondary permittee prior to the secondary conducting any construction activity and that each secondary shall sign the Plan or portion of the Plan applicable to their site. List the names and addresses of all secondary permittees.
45. Documentation that the ES&PC Plan is in compliance with waste disposal, sanitary sewer, or septic tank regulations during and after construction activities have been completed.
46. Provide complete requirements of inspections and record keeping by the primary permittee, secondary permittees and tertiary permittees.
47. Provide complete requirements of sampling frequency and reporting of sampling results.
48. Provide complete details for retention of records as per Part IV.F. of the permit.
49. Description of analytical methods to be used to collect and analyze the samples from each location.
50. Appendix B rationale for outfall sampling points where applicable.
51. Clearly note statement in bold letters- **"The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to, or concurrent with, land disturbing activities."**
52. Clearly note maintenance statement in bold letters - **"Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."**
53. Clearly note the statement in bold letters - **"Any disturbed area left exposed for a period greater than 14 days shall be stabilized with mulch or temporary seeding."**
54. Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet the guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
55. Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georg

APPENDIX 1

THE ES&PC PLAN MUST INCLUDE AT LEAST FOUR (4) OF THE FOLLOWING BMPS FOR THOSE AREAS OF THE SITE WHICH DISCHARGE TO A IMPAIRED STREAM SEGMENT AND FOR SITES WHICH EPD HAS APPROVED IN WRITING A REQUEST TO DISTURB 5O ACRES OR MORE AT ANY ONE TIME.

Plan Page #	Included Y/N		
		a.	During construction activities, double the width of the 25 foot undisturbed vegetated buffer along all State waters requiring a buffer and the 50 foot undisturbed vegetated buffer along all State waters classified as "trout streams" requiring a buffer. During construction activities, EPD will not grant variances to any such buffers that are increased in width.
		b.	Increase all temporary sediment basins and retrofitted storm water management basins to provide sediment storage of at least 3600 cubic feet (134 cubic yards) per acre drained.
		c.	Use baffles in all temporary sediment basins and retrofitted storm water management basins to at least double the conventional flow path length to the outlet structure.
		d.	Place a large sign (minimum 4 feet x 8 feet) on the site visible from the roadway identifying the construction site, the permittee(s), and the contact person(s) and telephone number(s).
		e.	Use anionic polyacrylamide (PAM) and/or mulch to stabilize areas left disturbed for more than seven (7) calendar days in accordance with Part III. D.1. of the NPDES Permits.
		f.	Conduct turbidity and Total Suspended Solids (TSS) sampling after every rain event of 0.5 inch or greater within any 24 hour period, recognizing the exceptions specified in Part IV.D.6.d. of the NPDES Permits.
		g.	Comply with the applicable end-of-pipe turbidity effluent limit, without the "BMP defense" as provided for in O.C.G.A. 12-7-6 (a)(1).
		h.	Limit the total planned site disturbance to less than 50% impervious surfaces (excluding any State-mandated buffer areas from such calculations).
		i.	Limit the amount of disturbed area at any one time to no greater than 25 acres or 50% of the total planned site, whichever is less.
		j.	Use "Dirt II" techniques to model and manage storm water runoff (e.g., seep berms, sand filters, anionic Pam), available on the EPD website, www.gaepd.org.
		k.	Add appropriate organic soil amendments (e.g., compost) and conduct pre- and post-construction soil sampling to a depth of six (6) inches to document improved levels of soil carbon after final stabilization of the construction site.
		l.	Use mulch filter berms, in addition to a silt fence, on the site perimeter wherever storm water may be discharged.
		m.	Apply the appropriate Georgia Department of Transportation approved erosion control matting or blankets or bonded fiber matrix to all slopes steeper than 3:1.
		n.	Use appropriate erosion control matting or blankets instead of concrete in construction storm water ditches and storm drainages designed for a 25 year, 24 hour rainfall event.
		o.	Use anionic PAM under a passive dosing method (e.g., flocculant blocks) within construction storm water ditches and storm drainages that feed into temporary sediment basins and retrofitted management basins.
		p.	Install sod for a minimum 20 foot width, in lieu of seeding, along the site perimeter wherever storm water may be discharged.
		q.	Use a surface draining skimmer designed to drain temporary sediment basins and retrofitted storm water management basins over a minimum three (3) day period.
		r.	Certified personnel shall conduct inspections at least twice every seven (7) calendar days and within 24 hours of the end of the storm that is 0.5 inches rainfall or greater in accordance with Part IV.D.4.a.(2). (a) - (c), Part IV.D.4.b.(3). (a) - (c) or Part IV.D.4.c.(2). (a) - (c) of the NPDES Permit GAR 100003, as applicable or Part IV.D.4.a.(2) of the Permit GAR 100001. (*If working under NPDES Permit GAR 100002 see below*)
		r.1.	**Certified personnel shall conduct inspections at least once every seven calendar days and within 24 hours of the end of the storm that is 0.5 inches or greater in accordance with part IV.D.4.a.(2). (A) - (C) of this permit.**
		s.	Apply the appropriate compost blankets (minimum depth 1.5 inches) to protect soil surfaces until vegetation is established during the final stabilization phase of the construction activity.
		t.	Use alternative BMPs whose performance has been documented to be superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the State Soil and Water Conservation Commission). (If using this item please refer to the Alternative BMP guidance document found at www.gaswcc.georgia.gov)

Effective January 1,Current Year

SECTION II: VEGETATIVE MEASURES

Vegetative Measures

Erosion control should be addressed in the planning stages of all proposed land-disturbing activities. While erosion is difficult to control completely, methods to reduce it are practical, affordable, and cost effective. Erosion control techniques shall be used on all areas exposed for a prolonged period of time, including areas that will be paved or built upon in the future. Various types of vegetative practices are used for erosion control.

The time-line for the implementation of various vegetative practices is as follows:

Mulch, temporary vegetation, or permanent (perennial) vegetation shall be completed on all exposed areas within 14 days after disturbance.

Ds1 - Disturbed Area Stabilization (With Mulching Only) Mulching can be used as a singular erosion control method on areas at rough grade. Mulch can be an option for up to six months provided that the mulch is applied at the appropriate depth (depending on type of mulch used), anchored, and has a continuous 90% cover or greater of the soil surface. Maintenance shall be required to maintain appropriate depth, anchorage, and 90% cover. If an area will remain undisturbed for greater than six months, permanent (perennial) vegetation shall be used.

Ds2 - Disturbed Area Stabilization (With Temporary Seeding) Temporary vegetation may be employed instead of mulch if the area will remain undisturbed for less than six months.

Ds3 - Disturbed Area Stabilization (With Permanent Vegetation) Permanent (perennial) vegetation or sod shall be used immediately on areas at final grade. Permanent (perennial) vegetation shall be used on rough graded areas that will be undisturbed for more than six months.

Ds4 - Disturbed Area Stabilization (With Sodding) may be used in place of Ds3.

"Stabilization" of an area is accomplished when 70 percent of the surface area is covered in a uniform, vegetative cover (permanent or temporary) or anchored mulch of the appropriate thickness with 90% coverage. **"Final stabilization"** ~~means that all soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures, at least 70% of the soil surface is uniformly covered in permanent vegetation or equivalent permanent stabilization measures (such as the use of rip rap, gabions, permanent mulches or geotextiles) have been employed.~~ means that all soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures and areas located outside the waste disposal limits of a landfill cell that has been certified by EPD for waste disposal, 100% of the soil surface is uniformly-covered in permanent vegetation with a density of 70% or greater, or landscaped according to the Plan (uniformly covered with landscaping materials in planned landscaped areas), or equivalent permanent stabilization measures.

Permanent (perennial) vegetation shall consist of: planted trees, shrubs, perennial vines; a crop of perennial vegetation appropriate for the time of year and region; or a crop of annual vegetation and a seeding of target crop perennials appropriate for the region, such that within the growing season a 70% coverage by perennial vegetation shall be achieved.

For linear construction projects on land used for agricultural or silvicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or silvicultural use.

For the purposes of this publication, permanent vegetation is used synonymously with perennial vegetation. Perennial vegetation is plant material that lives continuously from year to year although it may have a dormant

season when the leaves and possibly the stems “die back” to the ground. No vegetative planting can technically be considered permanent. Annual vegetation is plant material that lives for only one growing season. This type of vegetation is typically used for temporary establishment due to its quick germination. Some perennial vegetation can be used for temporary stabilization.

Buffer Zone

Bf

DEFINITION

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

PURPOSE

To provide a buffer zone serving one or more of the following purposes:

- Reduce storm runoff velocities
- Act as screen for “visual pollution”
- Reduce construction noise
- Improve aesthetics on the disturbed land
- Filtering and infiltrating runoff
- Cooling rivers and streams by creating shade
- Provide food and cover for wildlife and aquatic organisms
- Flood protection
- Protect channel banks from scour and erosion.

CONDITIONS

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

General Buffers

A strip of undisturbed, original land surrounding the disturbed site. It can be useful not only to filter and infiltrate runoff, but also to act as a screen for “visual pollution” and reduce construction noise. General buffers may be enhanced to achieve desired goals.

Vegetated Stream Buffers

Buffers bordering streams are critical due to the invaluable protection of streams from sedimentation. Stream buffers are also useful in cooling rivers and providing food and cover for wildlife. Refer to the minimum requirements in Act 599 (O.C.G.A. 1-7-1, et. seq.) and Chapters 16 and 18 of the NRCS Engineering Field Handbook.

In most cases, the buffer zone will be incorporated into the permanent vegetative cover. Refer to specification Ds3 - Disturbed Area Stabilization (With Permanent Vegetation).

DESIGN SPECIFICATIONS

Important design factors such as slope, hydrology, width and structure shall be considered. While Georgia’s Environmental Protection Division enforces minimum stream buffer requirements, expanding the stream buffer width is always encouraged. If any land-disturbing activity, including exempt and non-exempt practices, occurs within the EPD mandated stream buffers, cut and fills within the buffer shall be stabilized with appropriate matting or blanket.

General Buffers

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

Vegetated Stream Buffers

The structure of vegetated stream buffers should be considered to determine if the buffer must be enhanced to achieve the neces-

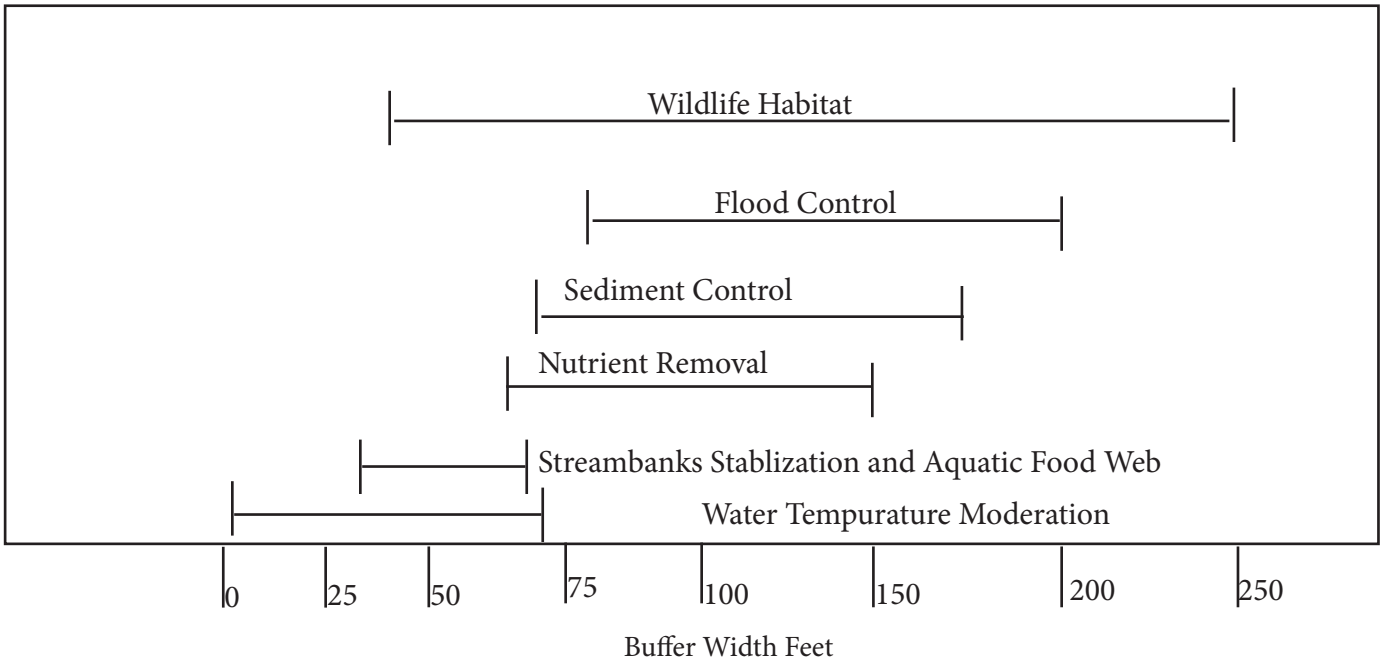


Figure 6-1.1 - Range of Minimum Width for Meeting Specific Buffer Objectives (Palone and Todd, draft)

sary goals. The size of the stream as well as the topography of the area must be considered to determine the appropriate width of the vegetated stream buffer. A vegetated stream buffer of 50 feet or greater can protect waters from excess sedimentation. The buffer should be increased 2 feet in width for every 1% slope (measured along a line perpendicular to the stream bank). Surface water pollution can be reduced with a 100 foot or wider vegetative buffer.

A general multipurpose riparian buffer consists of three zones.

1. Zone 1 The first 20 feet nearest the stream should consist of trees spaced 6-10 feet apart.

2. Zone 2 The next 10 feet should consist of managed forest.

3. Zone 3 The following 20 feet should be comprised of grasses.

This general multipurpose design contains trees and shrubs that help to stabilize stream banks and grasses which spread and reduce the flow from adjacent areas as well as increase settling and infiltration. See Tables 6-1.1 and 6-1.2 for suggested plant species.

If the ideal vegetated buffer width cannot be achieved; narrower buffers can still be used to obtain the goals concerning forest structure and riparian habitat. If this is the case, several design principals should be considered:

1. Sheet flow should be encouraged at the edge of the vegetated stream buffer.

2. The structure of the buffer should consist of under-story and canopy species.

3. The width should be proportional to the watershed area and slope.

4. Native and non-invasive plant species should be used.

5. Density must be considered to determine if the existing buffer must be enhanced to achieve the necessary goals. Vegetation must be dense enough to filter sediment and provide detrital nutrients for aquatic organism.

Streambank stabilization techniques may be required if steep slopes and hydrologic patterns deem it necessary. Refer to specification Sb - Streambank Stabilization (Using Permanent Vegetation). Vegetated stream buffers on steep slopes may need to be wider to effectively filter overland flow. Corridors subject to intense flooding may require additional stream bank stabilization measures.

PLANTING TECHNIQUES

Plantings for buffer re-establishment and enhancement can consist of bare root seedlings, container-grown seedlings, container-grown plants, and balled and burlapped plants. Refer to Tables 6-1.1 and 6-2, and Wildlife Plantings in Ds3 - Disturbed Area Stabilization (With Permanent Vegetation). Standard permanent erosion control grasses and legumes may be used in denuded areas for quick stabilization. Refer to specification Ds3 - Disturbed Area Stabilization (With Permanent Vegetation). Availability, cost, associated risk, equipment, planting procedures, and planting density must be considered when choosing planting types.

Soil preparation and maintenance are essential for the establishment of planted vegetation. Soil fertility, weed control, herbaceous cover, as well as additional associated products may be required.

OPERATIONS AND MAINTENANCE

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

Watering

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

Weed Control

Weeds can be removed by hand or with careful spraying.

Replanting

It is imperative that the structure of the vegetated stream buffer be maintained. If the buffer has been planted, it is suggested that the area be monitored to determine if plant material must be replaced. See Tables 6-1.1 and 6-1.2 for suggested plant species. Provisions for the protection of new plantings from destruction or damage from beavers shall be incorporated into the plan.

Fertilizer

If appropriate vegetation is chosen, it is unlikely that fertilizer will be necessary.

Local Contacts:

USDA Natural Resources Conservation Service

Georgia Forestry Commission

Table 6-1.1 - Unrooted Hardwood Cuttings

Species	Region	Tolerance To Flooding	Tolerance To Drought	Tolerance To Deposition	Tolerance To Shade
Acer negundo Boxelder	C,P,M	H	H	H	L
Baccharis halimifolia Groundsel bush	C,P (lower)	M	M	H	L
Cornus amomum Silky dogwood	P,M	L	M	L	M
Cornus sericia Ssp. slolonifera Red osier dogwood	P,M	L	M	H	M
Crataegus sp. Hawthon	C,P,M	M	H	L	L
Populus deltoids Eastern cottonwood	C,P,M	M	M	H	L
Salix sp. interior Sandbar willow	C,P,M	H	L	H	L
Salix nigra Black willow	C,P,M	H	H	H	L
Salix purpurea Streamco willow	C,P,M	H	M	H	L
Salix x colleti Bankers willow	P,M	H	M	H	L
Sambucus canadensis American elderberry	P,M	H	M	M	M
Viburnum denlatum Arrowwood viburnum	C,P,M	M	M	M	M
Viburnum lentago Nannyberry viburnum	C,P,M	M	M	L	M

Adapted from the USDA/NRCS Engineering Field Handbook, Chapter 18

Legend:

Tolerance to Flooding, Drought, Deposition, and Shade
H = High
M = Medium
L = Low

Region
C = Coastal
P = Piedmont
M =Mountain

Rooting of all species will be improved if nearby vegetation is pruned to increase sunlight penetration.

Whenever possible, harvest hardwood cuttings as close to the repair site as possible. Many of the above grow naturally along streams, in adjacent wetlands, along sewer and power line easements, and where streams enter lakes and along lake shores. Willows generally grow profusely in stormwater detention ponds in urban areas.

ALWAYS OBTAIN PERMISSION FROM THE PROPERTY OWNER BEFORE HARVESTING PLANTS!

Table 6-1.2 - Native Plant Guide

NATIVE PLANT GUIDE FOR STREAMBANK PLANTING ROOTED STOCK

Species	Region	Stream Zone	Wildlife Value	Notes
Acer rubrum Red Maple	M,P,C	Tree	High seed and browse.	Rapid growth.
Alnus serrulata Smooth alder	M,P,C	Shrub	Moderate, Cover	Rapid growth. Stablizes streambank. Sun.
Amorpha fruticosa False indigo	M,P,C	Shrub	Moderate	Sun.
Aronia arbutifolia Red chokeberry	M,P,C	Shrub	Moderate cover and food.	Rhizomatous Colonial Shrub.
Asimina triloba Pawpaw	M,P,C	Tree	Important food for fox and possum.	
Betula nigra River Burch	M,P,C	Tree	Good for cavity nester.	Full sun.
Carpinus caroliniana American hornbeam	M,P,C	Tree	Low	Partial shade.
Carya cordiformis Bitternut hickory	P,C	Tree	Moderate, food	Wet bottoms.
Catalpa bignonioides Catalpa tree	P,C	Tree	Unknown	
Celtis laevigata Sugarberry	P,C	Tree	High food cover	Partial shade.
Celtis occidentalis Hackberry	P,C	Tree	High	Partial shade.
Cephalantus Occidentalis Buttonbush	M,P,C	Shrub	Moderate, ducks and shorebirds are users. Nectar for hummingbirds.	Sun.
Chionanthus virginicus Fringe tree	P,C	Tree	Moderate	Tolerant of shade.
Clethra alnifolia Sweet pepperbush	P,C	Shrub	Moderate	Partial shade. Good landscape value
Cornus amomum Silky dogwood	M,P	Shrub	High, songbirds, Mammals	Shade tolerant. Good bank stabilizer.
Cornus stricta Swamp dogwood	M,P	Shrub	High	Good bank stabilizer in shade.
Cornus florida Flowering dogwood	M,P,C	Tree	High, birds, food	Shade tolerant.
Cyrilla racemiflora Titi	C	Tree	Low	Light shade.
Diospyros Virginia Persimmon	M,P,C	Tree	Extremely high Mammals	Not shade tolerant.
Fraxinus caroliniana Carolina ash	C	Tree	Moderate	Rapid growing. Streambank grower. Sun to partial shade.
Fraxinus pennsylvanica Green ash	M,P,C	Tree	Low	Rapid grower. Full sun.
Gleditsia aquatica Water locust	P,C	Tree	Low	Sun.
Gleditsia triacanthos Honey locust	P,C	Tree	Low	Full sun, thorns.

Table 6-1.2 - Native Plant Guide - continued

Species	Region	Stream Zone	Wildlife Value	Notes
Hibiscus aculeatus Hibiscus Comfort root	C	Shrub	Unknown	Use on open level floodplain areas and Depression in C.
Hibiscus militaris Hibiscus Halberd-leaved Marshmallow	C	Shrub	Unknown	Use on open level floodplain areas and Depression in C.
Hibiscus lasiocarpus Hibiscus	C	Shrub	Unknown	Use on open level floodplain areas and
Hibiscus moscheutos Hibiscus	C	Shrub	Unknown	Use on open level floodplain areas and
Ilex coriacea Sweet Gallberry	C	Shrub	Unknown	
Ilex decidua Possumhaw	P,C	Shrub	High, food, nest sites.	Sun or shade.
Ilex glabra Bitter gallberry or Inkberry	C	Shrub	High	Stoloniferous. Sun to some shade.
Ilex opaca American holly	M,P,C	Tree	High, food, cover nests.	Prefers shade.
Ilex verticilata Winterberry	M,P	Shrub	High, cover and fruits for birds. Holds berries in winter.	Full sun to some shade seasonally flooded areas.
Ilex vomitoria Yaupon	C	Shrub	High, songbirds	Small tree, very adaptable, suckers.
Juglans nigra Black Walnut	M,P	Tree	Good	Temporarily flooded wetlands along
Juniperus virginiana Eastern red cedar	M,P,C	Tree	High, food	Tolerant to some shad in youth.
Leucothoe axillaris Leucothoe	C	Shrub	Low	Partial shade.
Lindera benzoin Common spicebush	M	Shrub	High, songbirds	Shade, acidic soils. Good Understory
Liriondendron tulipefera Tulip poplar	M,P	Tree	Low	Tolerant to partial shade.
Liquidambar styraciflua Sweetgum	M,P,C	Tree	Low	Partial shade.
Lyonia lucida Lyonia or Fetterbush	C	Shrub	Low	Sun.
Magnolia Virginia Sweetbay	P,C	Tree	Very low	Shade tolerant.
Myrica cerifera Southern wax myrtle	C	Shrub	Moderate	Light shade.
Nyssa ogeche Ogeechee lime	C	Tree	High, fruit, cavity nesters.	Wetland tree
Nyssa sylvatica Blackgum or sourgum	M,P,C	Tree	Moderate, seeds	Sun to partial shade.
Nyssa aquatica Swamp tupelo	C	Tree	High	Prefers shade.

Table 6-1.2 - Native Plant Guide - continued

Species	Region	Stream Zone	Wildlife Value	Notes
Ostrya Virginiana Hophornbeam	M,P,C	Tree	Moderate	Tolerant of all sunlight conditions.
Persea borbonia Red bay	C	Tree	Good food, for quail and bluebirds.	Understory tree.
Pinus taeda Loblolly pine	P,C	Tree	Moderate	Poor sites.
Platanus occidentalis Sycamore	M,P,C	Tree	Low. Cavity Nesters	Transplants well. Rapid growth in full sun.
Populus deltoides Eastern cottonwood	M,P,C	Tree	High	Invasive roots. Rapid growth.
Quercus alba White oak	M,P,C	Tree	High, food	Prefers moist well drained soils.
Quercus laurifolia Swamp laurel oak	C	Tree	High	
Quercus lyrata Overcup oak	P,C	Tree	High	Sloughs & bottoms.
Quercus michauxii Swamp chestnut oak	M,P,C	Tree	High	Wetter sites than white oak.
Quercus nigra Water oak	M,P,C	Tree	High	
Quercus pagoda Cherrybark oak	M,P	Tree	High	
Quercus phellos Willow oak	M,P,C	Tree	High, mast	Full to partial sun.
Quercus shumardii Shumard oak	P,C	Tree	High	
Salix nigra Black willow	M,P,C	Shrub & Tree	Nesting	Rapid growth, full sun.
Rhododendron atlanticum Coast azelea	P,C	Shrub	Very low	Very fragrant suckers.
Rhododendron viscosum Swamp azelea	C	Shrub	Low	
Styrax american	C	Shrub	Unknown	
Taxodium distichum Bald cypress	C	Tree	Good perching site	Full sun.
Tsuga canadensis Eastern hemlock	M	Tree	Moderate	Tolerates all light conditions.
Viburnum nudum Swamp haw	M,P,C	Shrub	High	Shade tolerant

Legend

Region:

M = Mountains

P = Piedmont

C = Coastal Plain

Table 6-1.2 - Native Plant Guide - continued

Plant List Sources:

Brown, Claude L. & Kirkman, Katherine L. 1990. Trees of Georgia and Adjacent States.

Foote, Leonard E. & Jones, Samuel B., Jr. 1989. Native Shrubs and Woody Vines of the Southeast.

Georgia Cooperative Extension Service. Native Plants for Georgia Gardens.

Hightshoe, Gary L. 1988. Native Trees, Shrubs and Vines for Urban & Rural America.

USDA Natural Resources Conservation Service. 1973. Seacoast Plants of the Carolinas.

USDA Natural Resources Conservation Service, Engineering Field Handbook, Chapter 18, Soil Bioengineering for Upland Slope Protection and Erosion Reduction.

Coastal Dune Stabilization (With Vegetation)

Cs

DEFINITION

Planting vegetation on dunes that are denuded, artificially constructed, or renourished.

PURPOSE

- To stabilize soil on dunes allowing them to become more resistant to wind and waves.

- To allow development of dunes in areas where they have been damaged or destroyed.

CONDITIONS

On bare or sparsely vegetated dunes or areas where dune development is desired.

PLANNING CONSIDERATIONS

Coastal beaches are subject to regulation from a variety of Federal, State, and local agencies. Permits must be requested and granted by all appropriate jurisdictions before work is performed.

Coastal areas are affected by many dynamic systems. Detailed studies are often required to determine the possible effects that may result from dune modifications. Environmental assessments are generally required including public review and comment.

Protection of dunes from human and vehicular traffic is essential if vegetation is to succeed. Crosswalks or crossover structures should be planned to provide beach access.

Plant species that are native to coastal areas should be used whenever possible.

An irrigation system will be required during the first growing season in order to obtain good survival.

Common Commercially Available Plants

Marshhay cordgrass (Spartina patens) “Flageo” variety (or native collections) is a perennial grass that occurs on dunes throughout the South Atlantic and Gulf region and in Puerto Rico. It is the dominant plant on dunes composed of broken shale and coquina rock along the northern Florida coast. The grass is especially tolerant of salt.

Stems are slender and grow two to three feet tall. Leaves are rolled inward and resemble rushes. Seed heads are composed of two to several compressed spikes attached at about 90 degrees to the culm. Plants spread by means of a network of slender rhizomes.

Plantings of vegetative material in early spring are most successful. Bare root or potted planting stock is recommended for large plantings. Stems rooted at the base can be planted at a depth of four to five inches deep. Plants that have developed rhizomes are preferred for planting stock.

Bitter panicum (Panicum amarum) is a perennial grass found on dunes throughout the South Atlantic and Gulf regions. It is most common in South Florida and Texas.

Plants grow to an average height of three to four feet tall. Leaves are smooth and bluish green in color. Seed heads are narrow, compressed, and generally are sparsely seeded. Plants spread from a very aggressive, scattered system of rhizomes, but stands are rather open.

Bitter panicum produces few viable seed but is easier to transplant than sea oats. They can be propagated from a stem with part of the rhizome attached or from rhizomes that are eight to twelve inches long. Plant rhizomes about four inches deep in early spring.

Plants may be propagated by removing all of the stem from robust plants and placing them in the dune at an angle of about 45 degrees. Several nodes should be buried. Spacing should be no more than six feet apart.

Coastal Panicgrass (Panicum amarum v. amaralum) is a somewhat dense, upright perennial bunchgrass found on coastal dunes throughout the South Atlantic and Gulf area. It is the dominant plant at many locations in West Florida, Alabama, and Texas.

The stems are coarse, straight, stiff, and up to four feet tall. Partially compressed seed heads produce moderate amounts of viable seed each fall. The crowns enlarge slowly from short, almost vertical tillers.

Plant seed one to three inches deep in the spring and mulch the area. Seedling survival depends on moisture after germination. Clumps of coastal panicgrass can be dug, divided and planted during rainy seasons or when irrigation is available.

Planting Requirements for Native Plants			
Species	**Stock**	**Date**	**Depth**
Marshhay Cordgrass (Spartina patens)	Plants	Spring	4”-5”
Bitter Panicum (Panicum amarum)	Rhizomes	Spring	About 4”
Coastal Panigrass (Panicum ararum vamaralum)	Seeds or plants	Spring	1”-3”

Sand Fence Use In Building Dunes

Sand fence may be used to build sand dunes when sand is available. Costs are usually higher but dune development is faster when compared to vegetation alone and generally less expensive than building dunes with machinery.

Figure 6-2.1 - Sand Fence and Native Plants

To form a barrier dune, construct sand fences a minimum of 100 feet from the mean high tide line. Two or more parallel fences spaced from 30 to 40 feet apart are needed. Locate fences as near as possible to a 90 degree angle with the prevailing winds, but as near parallel to the water line as possible.

Where winds are generally parallel with the water line, a single line of fence may be constructed at least 140 feet from the mean high tide. Construct short sections of fence (approximately 30 feet long) parallel to the prevailing wind and approximately perpendicular to the original fence. Place these fences opposite the water side and space these fences about 40 feet apart.

As sand collects over the fence, additional fence can be constructed over the original fence until the desired height is obtained.

Old dunes may be widened by constructing sand fence about 15 feet to the seaward side of the base of the old dune.

Vegetation must be established following development of dunes, or allowed to develop from existing stands as dunes develop.

SPECIFICATIONS

Sand Fence Specifications

Use standard commercial 4-foot high snow fence that consists of wooden slats wired together with spaces between the slats. Distance between slats is approximately equal to the slat width, or generally 1 1/4 inches. Slats will be made from grade A or better spruce. Slats will be woven between five two-wire cables of copper-bearing, galvanized wire. Slats will be dipped in a red oxide, weather resistant stain. The fence must be sound, free of decay, broken wire or missing or broken slats.

Fence will be supported by black locust, red cedar, or white cedar posts. Other wood of equal life or strength may be used. Posts will be a minimum of 7 feet with a minimum diameter of three inches. Posts will be spaced no farther than 10 feet apart.

Four wire ties will be used to fasten fence to posts. Weave fence between posts so that every other post will be attached on the ocean side of posts. Tie wires will be no smaller than 12-gauge galvanized wire.

Posts will be set in holes at least three feet deep.

Three or four rows of fence should be used if sufficient land area and sand are available.

MAINTENANCE

Maintaining Dunes

A strong, uniform dune line must be maintained to provide maximum protection from wind and water. Blowouts, wash pits, or other natural or man-made damage must be repaired quickly to prevent weakening of the entire system. Blow-outs in a dune system can be repaired by placing sand fence between existing dunes. One or more fences may be required. It is essential to tie the ends of the fence into the existing dune to keep the wind from slipping around the ends. Maintain fences, and erect additional fences if needed, until the eroding area is replenished to the desired height and permanently stabilized.

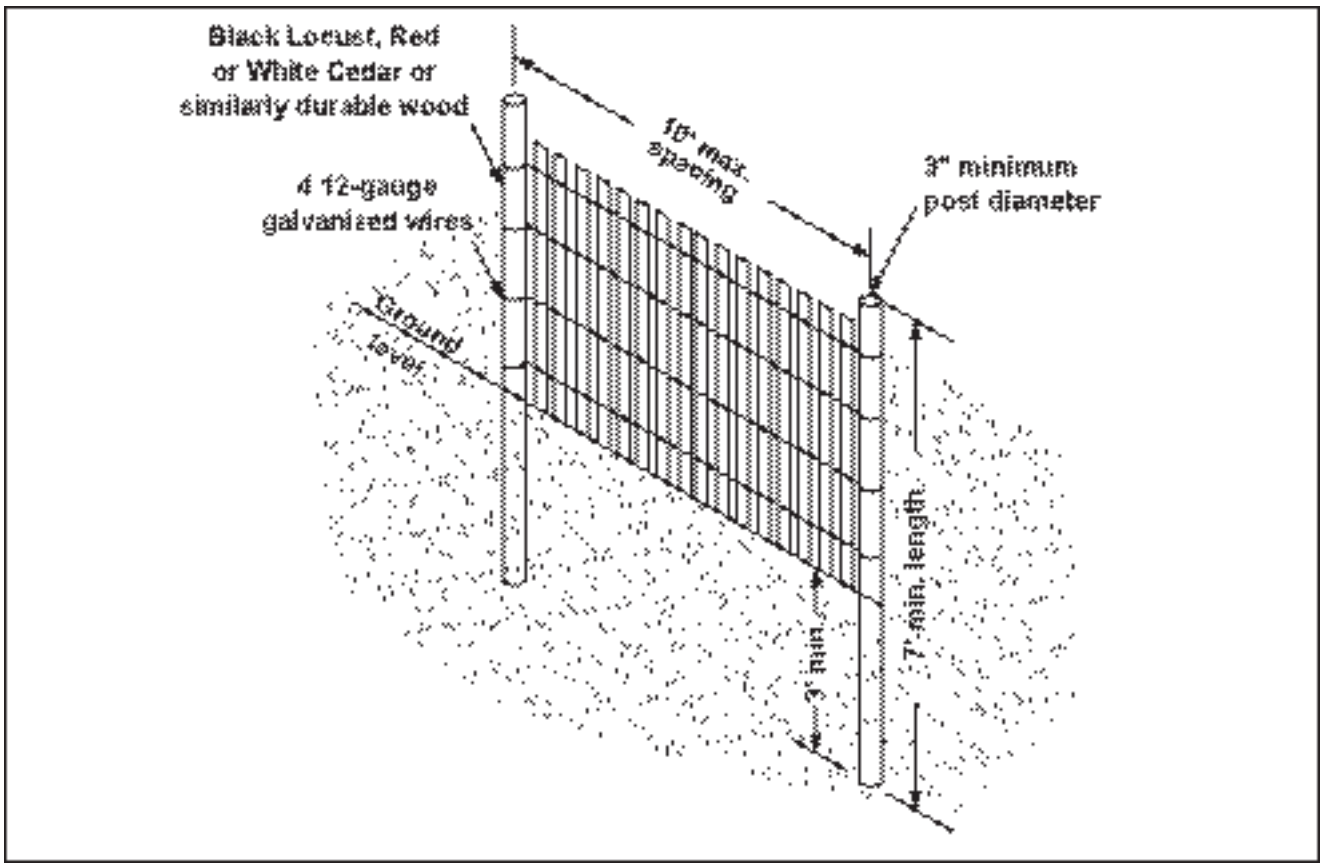
Foot and vehicular traffic must be controlled or prohibited on dunes to maintain vegetation and prevent excessive sand movement. Elevated walks, semi-permanent paved paths, and portable roll-up walkways are satisfactory. Walkways should be curved to reduce wind movement. Both inland and secondary dunes must be protected from traffic.

Vegetative Maintenance

Plantings are maintained with applications of fertilizer to keep desired density of plants. Annual application of about 50 pounds of nitrogen per acre should be applied. Where vegetation has been destroyed, replanting should be considered.

Figure 6-2.2 - Sand Fence Installation Requirements

Detail to be redrawn



Disturbed Area Stabilization (With Mulching Only) Ds1

DEFINITION

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

PURPOSE

- To reduce runoff and erosion
- To conserve moisture
- To prevent surface compaction or crusting
- To control undesirable vegetation
- To modify soil temperature
- To increase biological activity in the soil

REQUIREMENT FOR REGULATORY COMPLIANCE

Mulch or temporary grassing shall be applied to all exposed areas within 14 days of disturbance. Mulch can be used as a singular erosion control device for up to six months, but it shall be applied at the appropriate depth, depending on the material used, anchored, and have a continuous 90% cover or greater of the soil surface. Maintenance shall be required to maintain appropriate depth and 90% cover. Temporary vegetation may be employed instead of mulch if the area will remain undisturbed for less than six months. If any area will remain undisturbed for greater than six months, permanent vegetative techniques shall be employed. Refer to Ds2 -Disturbed Area Stabilization (With Temporary Seeding), Ds3 - Disturbed Area Stabilization (With Permanent Seeding), and Ds4 - Disturbed Area Stabilization (With Sodding).

SPECIFICATIONS

MULCHING WITHOUT SEEDING

This standard applies to grades or cleared areas where seedings may not have a suitable growing season to produce an erosion retardant cover, but can be stabilized with a mulch cover.

Site Preparation

1. Grade to permit the use of equipment for applying and anchoring mulch.
2. Install needed erosion control measures as required such as dikes, diversions, berms, terraces and sediment barriers.
3. Loosen compact soil to a minimum depth of 3 inches.

Mulching Materials

Select one of the following materials and apply at the depth indicated:

1. Dry straw or hay shall be applied at a depth of 2 to 4 inches providing complete soil coverage. One advantage of this material is easy application.
2. Wood waste (chips, sawdust or bark) shall be applied at a depth of 2 to 3 inches. Organic material from the clearing stage of development should remain on site, be chipped, and applied as mulch. This method of mulching can greatly reduce erosion control costs.

~~3. Cutback asphalt (slow curing) shall be~~

~~applied at 1200 gallons per acre (or 1/4 gallon per sq. yd.).~~

4. Polyethylene film shall be secured over banks or stockpiled soil material for temporary protection. This material can be salvaged and re-used.

Applying Mulch

When mulch is used without seeding, mulch shall be applied to provide full coverage of the exposed area.

1. Dry straw or hay mulch and wood chips shall be applied uniformly by hand or by mechanical equipment.

2. If the area will eventually be covered with perennial vegetation, 20-30 pounds of nitrogen per acre in addition to the normal amount shall be applied to offset the uptake of nitrogen caused by the decomposition of the organic mulches.

3. ~~Cutback asphalt shall be applied uniformly. Care should be taken in areas of pedestrian traffic due to problems of 'tracking in" or damage to shoes, clothing, etc.~~

4. Apply polyethylene film on exposed areas.

Anchoring Mulch

1. Straw or hay mulch can be pressed into the soil with a disk harrow with the disk set straight or with a special "packer disk." Disks may be smooth or serrated and should be 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disk should be dull enough not to cut the mulch but to press it into the soil leaving much of it in an erect position. Straw or hay mulch shall be anchored immediately after application.

   Straw or hay mulch spread with special blower-type equipment may be anchored ~~with emulsified asphalt (Grade AE-5 or SS-1). The asphalt emulsion shall be sprayed onto the mulch as it is ejected from the machine. Use 100 gallons of emulsified asphalt and 100 gallons of water per ton of mulch.~~ Tackifers and binders can be substituted for emulsified asphalt. Please refer to specification ~~Tb~~ Tac- Tackifers and Binders. Plastic mesh or netting with mesh no larger than one inch by one inch shall be installed according to manufacturer's specifications.

2. Netting of the appropriate size shall be used to anchor wood waste. Openings of the netting shall not be larger than the average size of the wood waste chips.

3. Polyethylene film shall be anchor trenched at the top as well as incrementally as necessary.

Disturbed Area Stabilization (With Temporary Seeding)

Ds2

DEFINITION

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

PURPOSE

- To reduce runoff and sediment damage of down stream resources
- To protect the soil surface from erosion
- To improve wildlife habitat
- To improve aesthetics
- To improve tilth, infiltration and aeration as well as organic matter for permanent plantings.

REQUIREMENT FOR REGULATORY COMPLIANCE

Mulch or temporary grassing shall be applied to all exposed areas within 14 days of disturbance. Temporary grassing, instead of mulch, can be applied to rough graded areas that will be exposed for less than six months. If an area is expected to be undisturbed for longer than six months, permanent perennial vegetation shall be used. If optimum planting conditions for temporary grassing is lacking, mulch can be used as a singular erosion control device for up to six months but it shall be applied at the appropriate depth, anchored, and have a continuous 90% cover or greater of the soil surface. Refer to specification Ds1-Disturbed Area Stabilization (With Temporary Seeding).

CONDITIONS

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

SPECIFICATIONS

Grading and Shaping

Excessive water run-off shall be reduced by properly designed and installed erosion control practices such as closed drains, ditches, dikes, diversions, sediment barriers and others.

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

Seedbed Preparation

When a hydraulic seeder is used, seedbed preparation is not required. When using conventional or hand-seeding, seedbed preparation is not required if the soil material is loose and not sealed by rainfall.

When soil has been sealed by rainfall or consists of smooth cut slopes, the soil shall be pitted, trenched or otherwise scarified to provide a place for seed to lodge and germinate.

Lime and Fertilizer

Agricultural lime is required unless soil tests indicate otherwise. Apply agricultural lime at a rate of one ton per acre. Graded areas require lime application. Soils can be tested to determine if fertilizer is needed. On reasonably fertile soils or soil material, fertilizer is not required. For soils with very low fertility, 500 to 700 pounds of 10-10-10 fertilizer or the equivalent per acre (12-16 lbs./1,000 sq. ft.) shall be applied. Fertilizer should be applied before land preparation and incorporated with a disk, ripper or chisel.

Seeding

Select a grass or grass-legume mixture suitable to the area and season of the year. Seed shall be applied uniformly by hand, cyclone seeder, drill, culti-packer-seeder, or hydraulic seeder (slurry including seed and fertilizer). Drill or cultipacker seeders should normally place seed one-quarter to one-half inch deep. Appropriate depth of planting is ten times the seed diameter. Soil should be “raked” lightly to cover seed with soil if seeded by hand.

Mulching

Temporary vegetation can, in most cases, be established without the use of mulch. Mulch without seeding should be considered for short term protection. Refer to Ds1 - Disturbed Area Stabilization (With Mulching Only).

Irrigation

During times of drought, water shall be applied at a rate not causing runoff and erosion. The soil shall be thoroughly wetted to a depth that will insure germination of the seed. Subsequent applications should be made when needed.

Table 6-4.1 - Temporary Cover or Companion Cover Crops

PLANT, PLANTING RATE, AND PLANTING DATE FOR TEMPORARY COVER OR COMPANION CROPS [1]

Species	Broadcast Rates		Resource Area[3]	Planting Dates by Resource Area												
				Dark gray indicates optimum dates, Light gray indicates permissible but marginal dates												
	Rate Per Acre[2]	*Pure Live Seed (PLS) Per 1000 sqft*		J	F	M	P	M	J	J	A	S	O	N	D	
BARLEY *Hordeum vulagre*																
alone	3 bu. (144 lbs)	3.3 lbs	M-L													14,000 seed p
in mixture	1/2 bu. (24lbs)	0.6 lb	P													productive so
			C													
LESPEDEZA, ANNUAL *Lespedeza striata*																
alone	40 lbs	0.9 lb	M-L													200,000 seed pe
in mixture	10 lbs	0.2 lb	P													years. Use inoc
			C													
LOVEGRASS, WEEPING *Eragrostis curvula*																
alone	4 lbs	0.1 lb	M-L													1,500,000 seed
in mixture	2 lbs	0.05 lb	P													Mix with *Seric*
			C													
MILLET, BROWNTOP *Panicum fasciculatum*																
alone	40 lbs	0.9 lb	M-L													
in mixture	10 lbs	0.2 lb	P													137,000 seed pe provide excessi
			C													high rate.

MILLET, PEARL *Pennesetum glaucum*																
alone	50 lbs	1.1 lbs	M-L P C													88,000 seed per p 5 feet in height. N
OATS *Avena sativa*																
alone	4 bu. (128 lbs)	2.9 lbs	M-L													
in mixture	1 bu. (32 lbs)	0.7 lb	P C													13,000 seed per p a winter hardy as
RYE *Secale cereale*																
alone	3 bu. (168 lbs)	3.9 lbs	M-L													
in mixture	1/2 bu. (28 lbs)	0.6 lb	P C													18,000 seed per p and winter hardy
RYEGRASS, ANNUAL *Lolium temulentum*																
alone	40 lbs	0.9 lb	M-L P C													227,000 seed per tive and is <u>not</u> to
SUDANGRASS *Sorghum sudanese*																
alone	60 lbs	1.4 lbs	M-L P C													55,000 seed per p recommended fo
TRITICALE *X-Triticosecale*																
alone	3 bu. (144 lbs)	3.3 lbs	C													Use on lower par
in mixture	1/2 bu. (24 lbs)	0.6 lb														Atlantic Coastal

WHEAT *Triticum aestivum*																
alone	3 bu. (180 lbs)	4.1 lbs	M-L													
in mixture	1/2 bu. (30 lbs)	0.7 lb	P C													15,000 seed per p

[1]Temporary cover crops are very competitive and will crowd out perennials if s

[2]Reduce seeding rates by 50% when drilled.

[3]M-L represents the Mountain; Blue Ridge; and Ridges and Valleys MLRAs

P represents the Southern Piedmont MLRA

C represents Southern Coastal Plan; Sand Hills; Black Lands; and Atlantic Coa

(see Figure 6-4.1, p. 6-40)

Updated Map

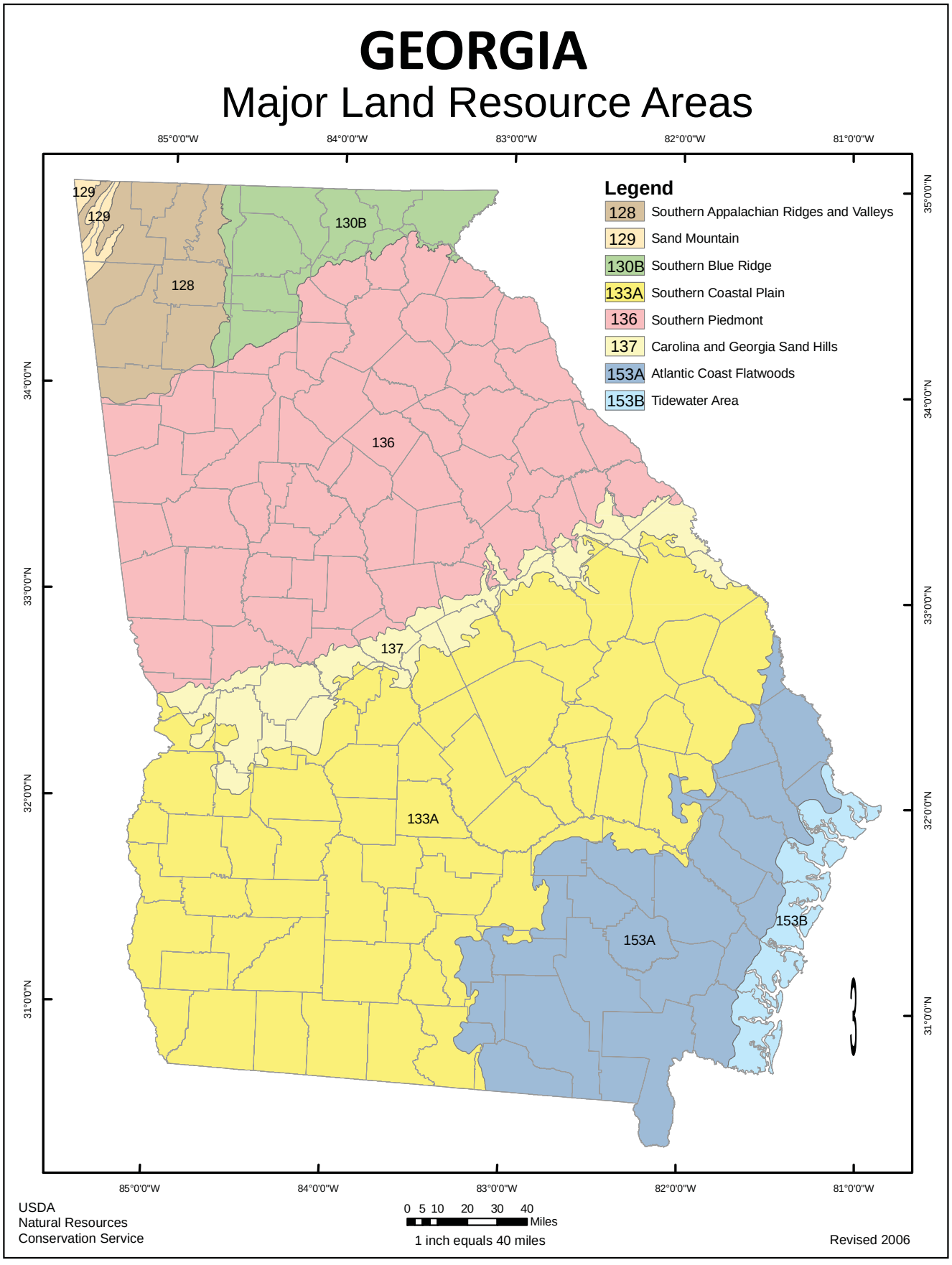


Figure 6-4.1

Disturbed Area Stabilization (With Permanent Vegetation)

Ds3

DEFINITION

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

PURPOSE

- To protect the soil surface from erosion
- To reduce damage from sediment and runoff to down-stream areas
- To improve wildlife habitat and visual re sources
- To improve aesthetics

REQUIREMENT FOR REGULATORY COMPLIANCE

This practice shall be applied immediately to rough graded areas that will be undisturbed for longer than six months. This practice or sodding shall be applied immediately to all areas at final grade. **Final Stabilization** means t~~hat all soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures, at least 70% of the soil surface is uniformly covered in permanent vegetation or equivalent permanent stabilization measures (such as the use of rip rap, gabions, permanent mulches or geotextiles) have been employed~~. means that all soil disturbing activities at the site have been completed, and that for unpaved areas and areas not covered by permanent structures and areas located outside the waste disposal limits of a landfill cell that has been certified by EPD for waste disposal, 100% of the soil surface is uniformlycovered in permanent vegetation with a density of 70% or greater, or landscaped according to the Plan (uniformly covered with landscaping materials in planned landscaped areas), or equivalent permanent stabilization measures .Permanent vegetation shall consist of: planted trees, shrubs, perennial vines; a crop of perennial vegetation appropriate for the region, such that within the growing season a 70% coverage by perennial vegetation shall be achieved. Final stabilization applies to each phase of construction. For linear construction projects on land used for agricultural or silvicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or silvicultural use. Until this standard is satisfied and permanent control measures and facilities are operational, interim stabilization measures and temporary erosion and sedimentation control measures shall not be removed.

CONDITIONS

Permanent perennial vegetation is used to provide a protective cover for exposed areas including cuts, fills, dams, and other denuded areas.

PLANNING CONSIDERATIONS

1. Use conventional planting methods where possible.
2. When mixed plantings are done during marginal planting periods, companion crops shall be used.
3. No-till planting is effective when planting is done following a summer or winter annual cover crop. Sericea lespedeza planted no-till into stands of rye is an excellent procedure.

4. Block sod provides immediate cover. It is especially effective in controlling erosion adjacent to concrete flumes and other structures. Refer to Specification **Ds4-Disturbed Area Stabilization (With Sodding)**.

5. Irrigation should be used when the soil is dry or when summer plantings are done.

6. Low maintenance plants, as well as natives, should be used to ensure long-lasting erosion control.

7. Mowing should not be performed during the quail nesting season (May to September).

8. Wildlife plantings should be included in critical area plantings.

Wildlife Plantings

Commercially available plants beneficial to wildlife species include the following:

Mast Bearing Trees

Beech, Black Cherry, Blackgum, Chestnut, Chinkapin, Hackberry, Hickory, Honey Locust, Native Oak, Persimmon, Sawtooth Oak and Sweetgum.

All trees that produce nuts or fruits are favored by many game species. Hickory provides nuts used mainly by squirrels and bear.

Shrubs and Small Trees

Bayberry, Bicolor Lespedeza, Crabapple, Dogwood, Huckleberry or Native Blueberry, Mountain Laurel, Native Holly, Red Cedar, Red Mulberry, Sumac, Wax Myrtle, Wild Plum and Blackberry.

Plant in patches without tall trees to develop stable shrub communities. All produce fruits used by many kinds of wildlife, except for lespedeza which produces seeds used by quail and songbirds.

Grasses, Legumes, Vines and Temporary Cover

Bahiagrass, Bermudagrass, Grass-Legume mixtures, Partridge Pea, Annual Lespedeza, Orchardgrass (for mountains), Browntop Millet (for temporary cover), and Native grapes.

Provides herbaceous cover in clearings for a game bird brood-rearing habitat. Appropriate legumes such as vetches, clovers, and lespedezas may be mixed with grass, but they may die out after a few years.

CONSTRUCTION SPECIFICATIONS

Grading and Shaping

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

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

Concentrations of water that will cause excessive soil erosion shall be diverted to a safe outlet. Diversions and other treatment practices shall conform with the appropriate standards and specifications.

Lime and Fertilizer Rates and Analysis

Agricultural lime is required at the rate of one to two tons per acre unless soil tests indicate otherwise. Graded areas require lime application. If lime is applied within six months of planting permanent perennial vegetation, additional lime is not required. Agricultural lime shall be within the specifications of the Georgia Department of Agriculture.

Lime spread by conventional equipment shall be “ground limestone.” Ground limestone is calcitic or dolomitic limestone ground so that

90 percent of the material will pass through a 10-mesh sieve, not less than 50 percent will pass through a 50-mesh sieve and not less than 25 percent will pass through a 100-mesh sieve.

Agricultural lime spread by hydraulic seeding equipment shall be “finely ground limestone.” Finely ground limestone is calcitic or dolomitic limestone ground so that 98 percent of the material will pass through a 20-mesh sieve and not less than 70 percent will pass through a 100-mesh sieve.

It is desirable to use dolomitic limestone in the Sand Hills, Southern Coastal Plain and Atlantic Coast Flatwoods MLRAs. (See Figure 6-4.1)

Agricultural lime is generally not required where only trees are planted.

Initial fertilization, nitrogen, topdressing, and maintenance fertilizer requirements for each species or combination of species are listed in Table 6-5.1.

Lime and Fertilizer Application

When *hydraulic seeding* equipment is used, the initial fertilizer shall be mixed with seed, innoculant (if needed), and wood cellulose or wood pulp fiber mulch and applied in a slurry. The innoculant, if needed, shall be mixed with the seed prior to being placed into the hydraulic seeder. The slurry mixture will be agitated during application to keep the ingredients thoroughly mixed. The mixture will be spread uniformly over the area within one hour after being placed in the hydroseeder.

Finely ground limestone will be mixed with water and applied immediately after mulching is completed or in combination with the top dressing.

When *conventional planting* is to be done, lime and fertilizer shall be applied uniformly in one of the following ways:

1. Apply before land preparation so that it will be mixed with the soil during seedbed preparation.

2. Mix with the soil used to fill the holes, distribute in furrows.

3. Broadcast after steep surfaces are scarified, pitted or trenched.

4. A fertilizer pellet shall be placed at root depth in the closing hole beside each pine tree seedling.

Plant Selection

Refer to Tables 6-4.1, 6-5.2, 6-5.3 and 6-5.4 for approved species. Species not listed shall be approved by the State Resource Conservationist of the Natural Resources Conservation Service before they are used.

Plants shall be selected on the basis of species characteristics, site and soil conditions, planned use and maintenance of the area; time of year of planting, method of planting; and the needs and desires of the land user.

Some perennial species are easily established and can be planted alone. Examples of these are Common Bermuda, Tall Fescue, and Weeping Lovegrass.

Other perennials, such as Bahia Grass and Sericea Lespedeza, are slow to become established and should be planted with another perennial species. The additional species will provide quick cover and ample soil protection until the target perennial species become established. For example, Common seeding combinations are 1) Weeping Lovegrass with Sericea Lespedeza (scarified) and 2) Tall Fescue with Sericea Lespedeza (unscarified).

Plant selection may also include annual companion crops. Annual companion crops should be used only when the perennial species are not planted during their optimum planting period. A common mixture is Brown Top Millet with Common Bermuda in mid-summer.

Care should be taken in selecting companion crop species and seeding rates because annual crops will compete with perennial species for water, nutrients, and growing space. A high seeding rate of the companion crop may prevent the establishment of perennial species.

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

Seed Quality

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

(PLS = % germination x % purity)

EXAMPLE:

Common bermuda seed
70% germination, 80% purity

PLS = 70% germination x 80% purity

PLS = 56%

The percent of PLS helps you determine the amount of seed you need. If the seeding rate is 10 pounds PLS and the bulk seed is 56 % PLS, the bulk seeding rate is:

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

You would need to plant 17.9 lbs/acre to provide 10 lbs/acre of pure live seed.

Seedbed Preparation

Seedbed preparation may not be required where hydraulic seeding and fertilizing equipment is to be used. When conventional seeding is to be used, seedbed preparation will be done as follows:

Broadcast plantings

1. Tillage at a minimum, shall adequately loosen the soil to a depth of 4 to 6 inches; alleviate compaction; incorporate lime and fertilizer; smooth and firm the soil; allow for the proper placement of seed, sprigs, or plants; and allow for the anchoring of straw or hay mulch if a disk is to be used.

2. Tillage may be done with any suitable equipment.

3. Tillage should be done on the contour where feasible.

4. On slopes too steep for the safe operation of tillage equipment, the soil surface shall be pitted or trenched across the slope with appropriate hand tools to provide two places 6 to 8 inches apart in which seed may lodge and germinate. Hydraulic seeding may also be used.

Individual Plants

1. Where individual plants are to be set, the soil shall be prepared by excavating holes, opening furrows, or dibble planting.

2. For nursery stock plants, holes shall be large enough to accommodate roots without crowding.

3. Where pine seedlings are to be planted, subsoil under the row 36 inches deep on the contour four to six months prior to planting. Subsoiling should be done when the soil is dry, preferably in August or September.

Innoculants

All legume seed shall be inoculated with

appropriate nitrogen-fixing bacteria. The innoculant shall be a pure culture prepared specifically for the seed species and used within the dates on the container.

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

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

Planting

Hydraulic Seeding

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

Conventional Seeding

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

No-Till Seeding

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

Individual Plants

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

Nursery stock plants shall be planted at the same depth or slightly deeper than they grew at the nursery. The tips of vines and sprigs must be at or slightly above the ground surface.

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

Mulching

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

1. *Dry straw* or *dry hay* of good quality and free of weed seeds can be used. Dry straw shall be applied at the rate of 2 tons per acre. Dry hay shall be applied at a rate of 2 1/2 tons per acre.

2. *Wood cellulose mulch* or *wood pulp fiber* shall be used with hydraulic seeding. It shall be applied at the rate of 500 pounds per acre. Dry straw or dry hay shall be applied (at the rate indicated above) after hydraulic seeding.

3. One thousand pounds of *wood cellulose* or *wood pulp fiber*, which includes a tackifier, shall be used with hydraulic seeding on slopes 3/4:1 or steeper.

4. *Sericea lespedeza* hay containing mature seed shall be applied at a rate of three tons per acre.

5. *Pine straw* or *pine bark* shall be applied at a thickness of 3 inches for bedding

purposes. Other suitable materials in sufficient quantity may be used where ornamentals or other ground covers are planted. This is not appropriate for seeded areas.

6. When using temporary erosion control blankets or block sod, mulch is not required.

7. *Bituminous treated roving* may be applied on planted areas on slopes, in ditches or dry waterways to prevent erosion. Bituminous treated roving shall be applied within 24 hours after an area has been planted. Application rates and materials must meet Georgia Department of Transportation specifications.

Wood cellulose and wood pulp fibers shall not contain germination or growth inhibiting factors. They shall be evenly dispersed when agitated in water. The fibers shall contain a dye to allow visual metering and aid in uniform application during seeding.

Applying Mulch

Straw or hay mulch will be spread uniformly within 24 hours after seeding and/or planting. The mulch may be spread by blower-type spreading equipment, other spreading equipment or by hand. Mulch shall be applied to cover 75% of the soil surface.

Wood cellulose or wood fiber mulch shall be applied uniformly with hydraulic seeding equipment.

Anchoring Mulch

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

1. ~~*Emulsified asphalt* can be (a) sprayed uniformly onto the mulch as it is ejected from the blower machine or (b) sprayed on the mulch immediately following mulch application when straw or hay is spread by methods other than special blower equipment.~~

~~The combination of asphalt emulsion and water shall consist of a homogeneous mixture satisfactory for spraying. The mixture shall consist of 100 gallons of grade SS-1h or CSS-1h emulsified asphalt and 100 gallons of water per ton of mulch.~~

~~Care shall be taken at all times to protect state waters, the public, adjacent property, pavements, curbs, sidewalks, and all other structures from asphalt discoloration.~~

2. *Hay and straw* mulch shall be pressed into the soil immediately after the mulch is spread. A special "packer disk"' or disk harrow with the disks set straight may be used. The disks may be smooth or serrated and should be 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disks shall be dull enough to press the mulch into the ground without cutting it, leaving much of it in an erect position. Mulch shall not be plowed into the soil.

3. *Synthetic tackifiers or binders* approved by GDOT shall be applied in conjunction with or immediately after the mulch is spread. Synthetic tackifiers shall be mixed and applied according to manufacturer's specifications. Refer to ~~**Tb - Tackifiers and Binders**~~ **Tackifiers-Tac**

4. *Rye or wheat* can be included with Fall and Winter plantings to stabilize the mulch. They shall be applied at a rate of one-quarter to one-half bushel per acre.

5. *Plastic mesh or netting* with mesh no larger than one inch by one inch may be needed to anchor straw or hay mulch on unstable soils and concentrated flow areas. These materials shall be installed and anchored according to manufacturer's specifications.

Bedding Material

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

Material	Depth
Grain straw	4” to 6”
Grass Hay	4” to 6”
Pine needles	3” to 5”
Wood waste	4” to 6”

Irrigation

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

Topdressing

Topdressing will be applied on all temporary and permanent (perennial) species planted alone or in mixtures with other species. Recommended rates of application are listed in Table 6-5.1.

Second Year and Maintenance Fertilization

Second year fertilizer rates and maintenance fertilizer rates are listed in Table 6-5.1.

Lime Maintenance Application

Apply one ton of agricultural lime every 4 to 6 years or as indicated by soil tests. Soil tests can be conducted to determine more accurate requirements if desired.

Use and Management

Mow Sericea lespedeza only after frost to ensure that the seeds are mature. Mow between November and March.

Bermudagrass, Bahiagrass and Tall Fescue may be mowed as desired. Maintain at least 6 inches of top growth under any use and management. Moderate use of top growth is beneficial after establishment.

Exclude traffic until the plants are well established. Because of the quail nesting season, mowing should not take place between May and September.

Table 6-5.1. Fertilizer Requirements

TYPE OF SPECIES	YEAR	ANALYSIS OR EQUIVALENT N-P-K	RATE	N TOP DRESSING RATE
1. Cool season grasses	First Second Maintenance	6-12-12 6-12-12 10-10-10	1500 lbs./ac. 1000 lbs./ac. 400 lbs./ac.	50-100 lbs./ac. 1/2/ __ 30
2. Cool season grasses and legumes	First Second Maintenance	6-12-12 0-10-10 0-10-10	1500 lbs./ac. 1000 lbs./ac. 400 lbs./ac.	0-50 lbs./ac. 1/ __ __
3. Ground covers	First Second Maintenance	10-10-10 10-10-10 10-10-10	1300 lbs./ac. 3/ 1300 lbs./ac. 3/ 1100 lbs./ac.	__ __ __
4. Pine seedlings	First	20-10-5	one 21-gram pellet per seedling placed in the closing hole	__
5. Shrub Lespedeza	First Maintenance	0-10-10 0-10-10	700 lbs./ac. 700 lbs./ac. 4/	__
6. Temporary cover crops seeded alone	First	10-10-10	500 lbs./ac.	30 lbs./ac. 5/
7. Warm season grasses	First Second Maintenance	6-12-12 6-12-12 10-10-10	1500 lbs./ac. 800 lbs./ac. 400 lbs./ac.	50-100 lbs./ac. 2/6/ 50-100 lbs./ac. 2/ 30 lbs./ac.
8. Warm season grasses and legumes	First Second Maintenance	6-12-12 0-10-10 0-10-10	1500 lbs./ac. 1000 lbs./ac. 400 lbs./ac.	50 lbs./ac./6/

1/ Apply in spring following seeding.
2/ Apply in split applications when high rates are used.
3/ Apply in 3 split applications.
4/ Apply when plants are pruned.
5/ Apply to grass species only.
6/ Apply when plants grow to a height of 2 to 4 inches.

Table 6-5.3.

Durable Shrubs and Ground Covers for Permanent Cover

Ground covers include a wide range of low-growing plants planted together in considerable numbers to cover large areas of the landscape. Ground covers grow slower than grasses. Weeds are likely to compete, especially the first year. Maintenance is needed to insure survival. These ground covers will not be used unless proper maintenance is planned. Maintain mulch at three-inch thickness until plants provide adequate cover.

Fall planting is encouraged because the need for constant watering is reduced and plants have time to establish new roots before hot weather.

Common Name	Scientific Name	Mature Height	Plant Spacing	Comments
Albelia	Abelia grandiflora	3-4 ft.	5 ft.	Also a prostrate form 2 feet high. Sun, semi-shade. Semi-evergreen.
Carolina Yellow Jessamine	Gelsemium sempervirens	low	3 ft.	Vine. Yellow, trumpet-like flowers. Hardy, one of best vines. Evergreen. Native to Georgia.
Carpet Blue	Ajuga reptans	2-4 in.	3 ft.	Needs good drainage, partial shade. Blue or white flowers. Evergreen.
Bearberry Cotoneaster	Cotoneaster dammeri	2-4 ft.	5 ft.	White flowers, red fruit. Sun. Evergreen.
Ground Cover Cotoneaster	Cotoneaster salicifoluis ‘Repens’	1-2 ft.	5 ft.	White flowers, red fruit. Sun. Evergreen.
Rock Cotoneaster	Cotoneaster horizontalis	1-2 ft.	5 ft.	Semi-evergreen. Sun.
Virginia Creeper	Parthenocissue quinquefolia	low	3 ft.	Red in fall. Vine. Deciduous. Native to Georgia.
Daylily	Hemerocallis spp.	2-3 ft.	2 ft.	Many flower colors. Full sun. Very hardy.
English Ivy	Hedera helix	low	3 ft.	Shade only. Climbs.
Compacta Holly	Ilex crenata ‘Compacta’	3-4 ft.	5 ft.	Sun, semi-shade.
Chinese Holly	Ilex cornuta ‘Rotunda’	3-4 ft.	5 ft.	Very durable. Sun, semi-shade.
Dwarf Burford Holly	Ilex burfordii ‘Nana’	5-8 ft.	8 ft.	
Dwarf Yaupon Holly	Ilex vomitoria ‘Nana’	3-4 ft.	5 ft.	Very durable, sun, semi-shade.

Table 6-5.3. Durable Shrubs and Ground Covers for Permanent Cover

Common Name	Scientific Name	Mature Height	Plant Spacing	Comments
Repandens Holly	Ilex crenata 'Repandens'	2-3 ft.	5 ft.	Sun, semi-shade.
Andorra Juniper	Juniperus horizontalis 'Plumosa'	2-3 ft.	5 ft.	Excellent for slopes. Sun.
Andorra Compacta Juniper	Juniperus horizontalis 'Plumosa compacta'	1-2 ft.	5 ft.	More compact than andora.
Blue Chip Juniper	Juniperus horizontalis 'Blue Chip'	8-10 in.	4 ft.	
Blue Rug Juniper	Juniperus horizontalis 'Wiltonii'	4-6 in.	3 ft.	Very low. Sun.
Parsons Juniper	Juniperus davurica 'Expansa' (Squamata Parsoni)	18-24 in.	5 ft.	One of the best, good winter cover.
Pfitzer Juniper	Juniperus chinensis 'Pfitzerana'	6-8 ft.	6 ft.	Needs room.
Prince of Wales Juniper	Juniperus horizontalis 'Prince of Wales'	8-10 in.	4 ft.	Feathery appearance.
Sargent Juniper	Juniperus chinensis 'Sargentii'	1-2 ft.	5 ft.	Full sun. Needs good drainage. Good winter color.
Shore Juniper	Juniperus conferta	2-3 ft.	5 ft.	Emerald Sea or Blue Pacific cultivars are good.
Liriope	Liriope muscari	8-10 in.	3 ft.	

Table 6-5.3. Durable Shrubs and Ground Covers for Permanent Cover

Common Name	Scientific Name	Mature Height	Plant Spacing	Comments
Creeping Liriope	Liriope spicata	10-12 in.	1 ft.	Spreads by runners.
Big Leaf Periwinkle	Vinca major	12-15 in.	4 ft.	Lilac flowers in spring. Semi-shade.
Common Periwinkle	Vinca minor	5-6 in.	4 ft.	Lavender-blue flowers in spring. Semi-shade
Cherokee Rose	Rosa laevigata	2 ft.	5 ft.	Rampant grower. Not for restricted spaces. State flower.
Memoria Rose	Rosa weuchuriana	2 ft.	5 ft.	Rampant grower.
St. Johnswort	Hypericum calycenum	8-12 in.	3 ft.	Semi-shade.
Anthony Waterer Spirea	Spirea bumalda	3-4 ft.	5 ft.	Sun.
Thunberg Spirea	Spirea thinbergii	3-4 ft.	5 ft.	Sun.

Table 6-5.4.

Trees for Erosion Control

SITE	SOIL MATERIAL	COMMON SOILS	PLANTING TREE SPECIES[1]	SPACING	PLANTING DATES[3]
Borrow areas, graded areas, and spoil material	Sandy	Lakeland, Troup	Loblolly pine (Pinus taeda) Longleaf pine (Pinus palustris)	[2]	M-L,P 12/1-3/15 C 12/1-3/1
	Loamy	Orangeburg, Tifton	Loblolly pine Slash pine Loblolly pine	[2]	M-L,P 12/1-3/15 C 12/1-3/1
	Clay	Cecil, Facevillle	Slash pine Virginia pine (Pinus virginiana)	[2]	M-L,P 12/1-3/15 C 12/1-3/1
Streambanks			Willows[4] (Salix speciecs)	2 ft x 2 ft	ALL

[1] Other trees and shrubs listed on Table 6-25.3 may be interplanted with the pines for improved wildlife benefits.

[2]

Type of Planting	Tree Spacing	No. of Trees Per Acre
Trees alone	4 ft. x 4 ft.	2722
Trees in combination with grasses and/or other plants	6 ft. x 6 ft.	1210

[3] M-L represents the Mountains; Blue Ridge; and Ridges and Vallevs MLRAs

P represents the Southern Piedmont MLRA

C represents the Southern Coastal Plain; Sand Hills; Black Lands; and Atlantic Coast Flatwoods ML RAs (See Figure 6-4.1).

[4] Fertilization of companion crop is ample for this species.

DISTURBED AREA STABILIZATION (WITH SODDING)

Ds4

DEFINITION

A permanent vegetative cover using sods on highly erodible or critically eroded lands.

PURPOSE

- Establish immediate ground cover.
- Reduce runoff and erosion.
- Improve aesthetics and land value.
- Reduce dust and sediments.
- Stabilize waterways, critical areas.
- Filter sediments, nutrients and bugs.
- Reduce downstream complaints.
- Reduce likelihood of legal action.
- Reduce likelihood of work stoppage due to legal action.
- Increase “good neighbor” benefits.

CONDITIONS

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

PLANNING CONSIDERATIONS

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

1. Immediate erosion control, green surface, and quick use.
2. Reduced failure as compared to seed as well as the lack of weeds.
3. Can be established nearly year-round.

Sodding is preferable to seed in waterways and swales because of the immediate protection of the channel after application. Sodding must be staked in concentrated flow areas (See Figure 6-6.1).

Consider using sod framed around drop inlets to reduce sediments and maintaining the grade.

CONSTRUCTION SPECIFICATIONS INSTALLATION

Soil Preparation

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

Topsoil properly applied will help guarantee a stand. Don’t use topsoil recently treated with herbicides or soil sterilants.

Mix fertilizer into soil surface. Fertilize based on soil tests or Table 6-6.1.

Table 6-6.1. Fertilizer Requirements for Soil Surface Application

Fertilizer Type	Fertilizer Rate (lbs/acre)	Fertilizer Rate (lbs/sq ft)	Season
10-10-10	1000	.025	Fall

Agricultural lime should be applied based on soil tests or at a rate of 1 to 2 tons per acre.

Installation

Lay sod with tight joints and in straight lines. Don't overlap joints. Stagger joints and do not stretch sod (See Figure 6-6.2)

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

Irrigate sod and soil to a depth of 4" immediately after installation.

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

MATERIALS

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

1. Sod should be machine cut and contain 3/4" (+ or -1/4") of soil, not including shoots or thatch.

2. Sod should be cut to the desired size within + or -5%. Torn or uneven pads should be rejected.

3. Sod should be cut and installed within 36 hours of digging.

4. Avoid planting when subject to frost heave or hot weather if irrigation is not available.

5. The sod type should be shown on the plans or installed according to Table 6-6.2. See Figure 6-4.1 for your Resource Area.

Table 6-6.2 Sod Planting Requirements

Grass	Varieties	Resource Area	Growing Season
Bermudagrass	Common Tifway Tifgreen Tiflawn	M-L,P,C P,C P,C P,C	warm weather
Bahiagrass	Pensacola	P,C	warm weather
Centipede	–	P,C	warm weather
St. Augustine	Common Bitterblue Raleigh	C	warm weather
Zoysia	Emerald Myer	P,C	warm weather
Tall Fescue	Kentucky	M-L,P	cool weather

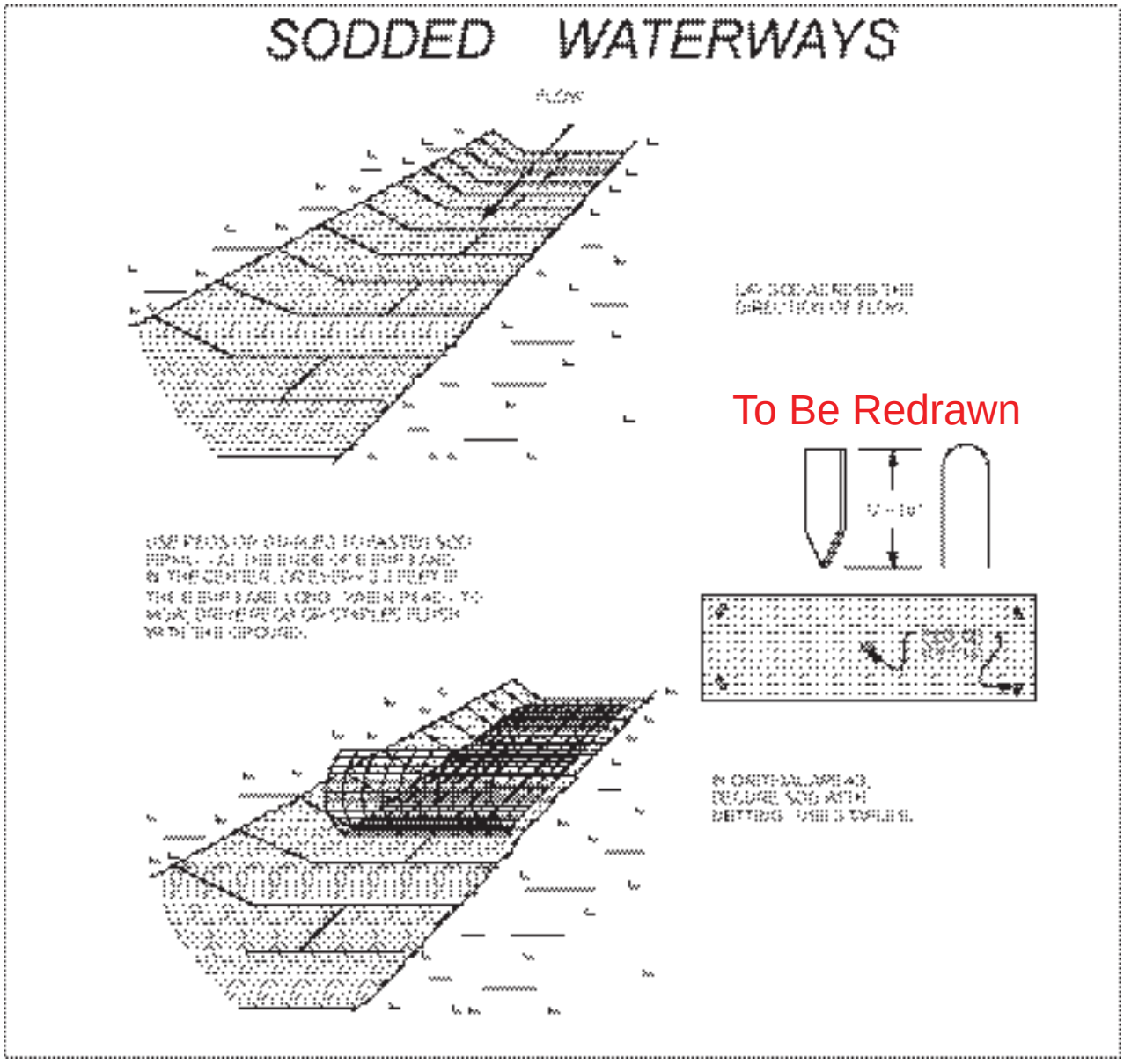
MAINTENANCE

Re-sod areas where an adequate stand of sod is not obtained. New sod should be mowed sparingly. Grass height should not be cut less than 2"-3" or as specified (See Figure 6-6.2).

Apply one ton of agricultural lime as indicated by soil test or every 4-6 years. Fertilize grasses in accordance with soil tests or Table 6-6.3.

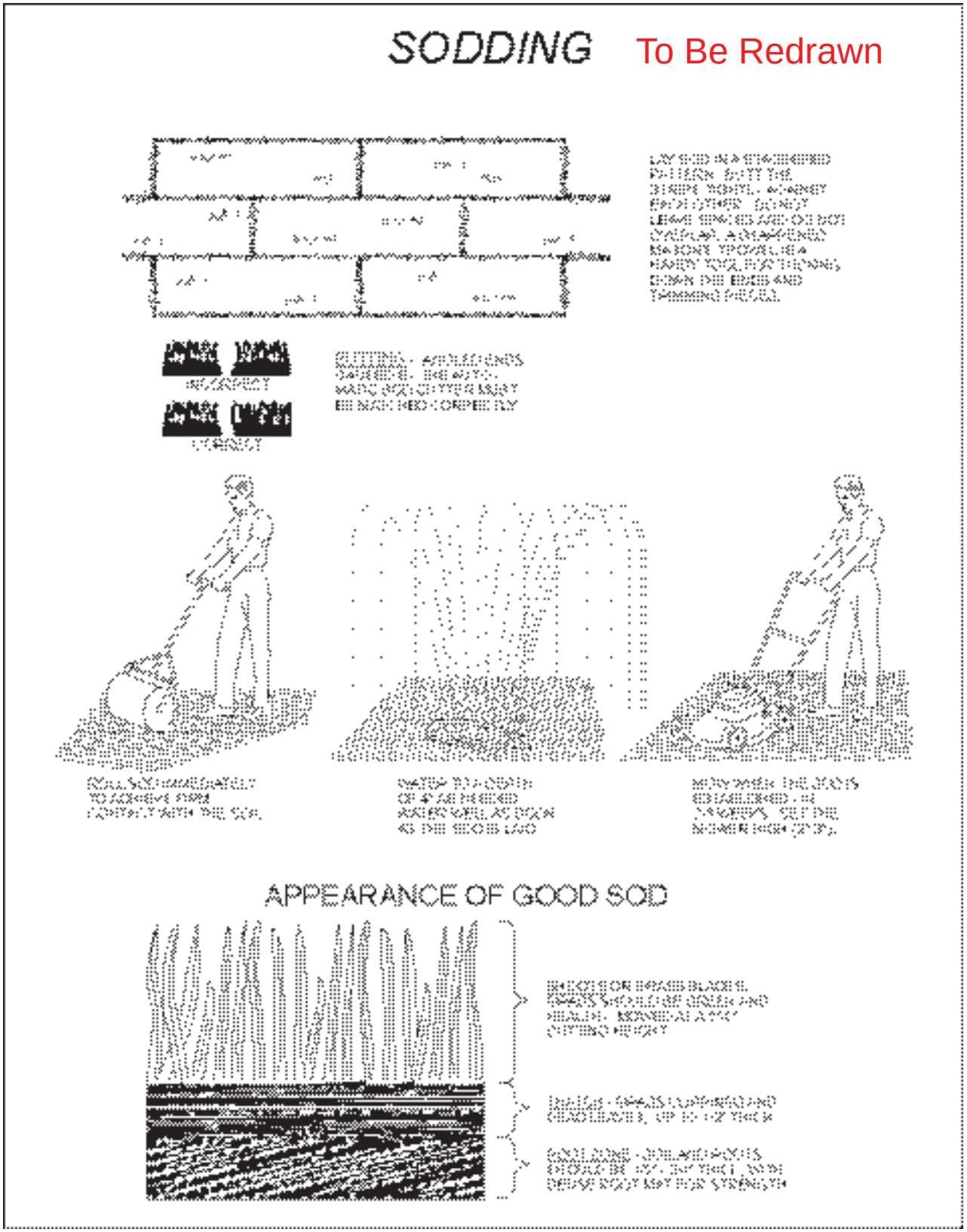
Table 6-6.3
Fertilizer Requirements for Sod

Types of Species	Planting Year	Fertilizer (N-P-K)	Rate (lbs./acre)	Nitrogen Top Dressing Rate (lbs./acre)
cool season grasses	first second maintenance	6-12-12 6-12-12 10-10-10	1500 1000 400	50-100 - 30
warm season grasses	first second maintenance	6-12-12 6-12-12 10-10-10	1500 800 400	50-100 50-100 30



Source: Va. DSWC

Figure 6-6.1



Source: Va. DSWC

Figure 6-6.2

Dust Control on Disturbed Areas

Du

DEFINITION

Controlling surface and air movement of dust on construction sites, roads, and demolition sites.

PURPOSE

- To prevent surface and air movement of dust from exposed soil surfaces.

- To reduce the presence of airborne substances which may be harmful or injurious to human health, welfare, or safety, or to animals or plant life.

CONDITIONS

This practice is applicable to areas subject to surface and air movement of dust where on and off-site damage may occur without treatment.

METHOD AND MATERIALS

A. TEMPORARY METHODS

Mulches. See standard **Ds1 - Disturbed Area Stabilization (With Mulching Only)**. Synthetic resins may be used instead of asphalt to bind mulch material. Refer to standard ~~**Tb-Tackifiers and Binders**~~ **Tac - Tackifiers**. Resins such as Curasol or Terratack should be used according to manufacturer's recommendations.

Vegetative Cover. See standard **Ds2 - Disturbed Area Stabilization (With Temporary Seeding)**.

Spray-on Adhesives. These are used on mineral soils (not effective on muck soils). Keep traffic off these areas. Refer to standard ~~**Tb-Tackifiers and Binders**~~ **Tac - Tackifiers**.

Tillage. This practice is designed to roughen and bring clods to the surface. It is an emergency measure which should be used before wind erosion starts. Begin plowing on windward side of site. Chisel-type plows spaced about 12 inches apart, spring-toothed harrows, and similar plows are examples of equipment which may produce the desired effect.

Irrigation. This is generally done as an emergency treatment. Site is sprinkled with water until the surface is wet. Repeat as needed.

Barriers. Solid board fences, snowfences, burlap fences, crate walls, bales of hay and similar material can be used to control air currents and soil blowing. Barriers placed at right angles to prevailing currents at intervals of about 15 times their height are effective in controlling wind erosion.

Calcium Chloride. Apply at rate that will keep surface moist. May need retreatment.

B. PERMANENT METHODS

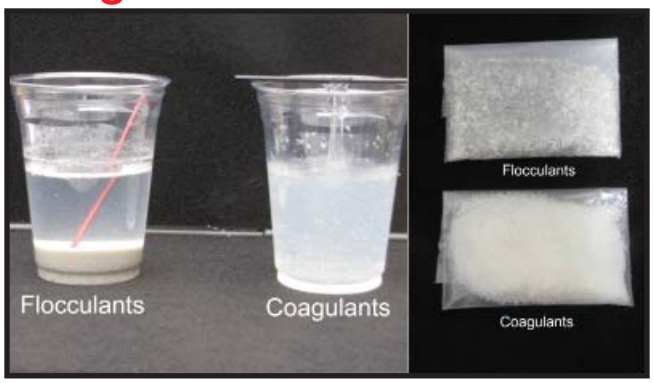
Permanent Vegetation. See standard **Ds3 -Disturbed Area Stabilization (With Permanent Vegetation)**. Existing trees and large shrubs may afford valuable protection if left in place.

Topsoiling. This entails covering the surface with less erosive soil material. See standard **Tp - Topsoiling**.

Stone. Cover surface with crushed stone or coarse gravel. See standard **Cr-Construction Road Stabilization**.

Flocculants Coagulants

Fl-Co



Definition

Flocculants and Coagulants are formulated to assist in the solids/liquid separation of suspended particles in solution. Such particles are characteristically very small and the suspended stability of such particles (colloidal complex) is due to both their small size and to the electrical charge between particles. Conditioning a solution to promote the removal of suspended particles requires chemical coagulation and/or flocculation.

A coagulant is required to help give body to the water. Coagulants neutralize the repulsive electrical charges (typically negative) surrounding particles allowing them to "stick together" creating clumps or flocs that form a small to mid-size particles (sometimes called a pin-floc). Once the pin-floc has formed, a second chemical called a flocculent is required to make even larger particles. Flocculants facilitate the agglomeration or aggregation of the coagulated particles to form larger floccules and acts as a net where it gathers up the smaller coagulated particles making a larger particle. This larger particle will slowly drop to the bottom of the container (vessel), forming a sludge.

Coagulation and Flocculation occur in successive order. Firstly the forces stabilizing suspended particles are neutralized allowing particles to meet (coagulate) and secondly, to form larger, heavier flocs (flocculants).

Purpose

To settle suspended sediment, heavy metals and hydrocarbons (TSS) in runoff water from construction sites for water clarification.

Conditions

Water clarification and the removal of turbidity will usually require the addition of flocculants, polymers, polyacrylamides (PAM), chitosan and other chemicals that cause soil particles to bind together, become heavy and settle to the bottom of a sediment trap, sediment basin or become entrapped in other BMPs.

This practice is not intended for application to surface waters of the state. It is intended for application within construction storm water ditches and storm drainages which feed into pre-constructed ponds or basins or other BMPs.

Federal and Local Laws

Flocculant/Coagulant applications shall comply with all federal, local laws, rules or regulations governing Flocculants/Coagulants. The operator is responsible for securing applicable required permits if needed. This standard does not contain the text of the federal or local laws governing Flocculants/Coagulants.

Planning Considerations

Since settling of flocculated soil particles requires very slow moving (still) water, chemical additives should never be introduced into an outfall BMP where water leaves the property or enters state waters. In all cases where chemical additives are used to reduce turbidity it is essential to include a sediment basin or sediment trap unless using a "pump and treat" treatment system.

Criteria

Application rates shall conform to manufacturer's guidelines for application. Only anionic forms of Flocculants/Coagulants shall be used.

Following are examples of Flocculants/ Coagulants applications within construction storm water ditches or drainageways which feed into sediment basins or other BMPs:

- Flocculant/Coagulant Bags or Socs that are installed directly in a ditch, pipe or culvert.
- Flocculant/Coagulant treated ditch checks (ie fiber rolls, wattles, or com post logs inoculated or used in conj junction with flocculants/coagulants).
- Granulated Flocculant/Coagulant treated rock ditch checks.
- Ditch checks with attached Flocculant/Coagulant Bags or Socs.
- Addition of granular Flocculants/Coagulants directly into a ditch.
- Erosion control blankets and turf reinforcement mats that have been inoculated with a Flocculant/Coagulant.
- "Pump and Treat" systems that use mechanical mixing with a chemical treatment of a Flocculant/Coagulant.

Operation and Maintenance

Application rates shall conform to manufacturer's guidelines for application. Maintenance shall consist of reapplying Flocculants/Coagulants via one of means above when turbidity levels are no longer met or the Flocculant/Coagulant is used up.

Bricks, blocks, socks,logs and bags shall be maintained when sediment sediment accumulates on the products.

Erosion Control Matting and Blankets

DEFINITION

A protective covering (blanket) or soil stabilization mat used to establish permanent vegetation on steep slopes, channels, or shorelines.

PURPOSE

- To provide a microclimate which protects young vegetation and promotes its establishment.

- To reinforce the turf to resist forces of erosion during storm events.

- To reinforce channnels.

CONDITIONS

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

On streambanks or tidal shorelines where moving water is present, matting can prevent new plantings from being washed away.

PLANNING CONSIDERATIONS

Care must be taken to choose the type of blanket or matting which is most appropriate for the specific needs of a project. Two general types of blankets and mats are discussed within this specification. Due to the abundance of erosion control matting and blanket products available, all of the advantages, disadvantages, and specifications of all manufactured products will not be discussed in this manual. Manufacturer's instructions and recommendations, as well as a site visit by designer and plan reviewer is highly recommended to determine a product's appropriateness.

Temporary Erosion Control Blankets

This includes temporary "combination" blankets (rolled erosion control blankets-RECB) consisting of a plastic netting which covers and is intertwined with a natural organic or manmade mulch; ~~or~~, a jute mesh which is typically homogeneous in design and can act alone as a soil stabilization blanket; or, a hydraulically applied bonded fiber matrix which upon drying shall adhere to the soil in the form of a continuous 100% coverage of biodegradable blanket.

Temporary blankets as a minimum shall be used to stabilize concentrated flow areas with a velocity less than 5 ft/sec and slopes 2.5:1 or steeper with a height of 10 feet or greater. Because temporary blankets will deteriorate in a short period of time, they provide no enduring reduction in erosion protection.

Benefits of using erosion control blankets include the following:

1. Protection of the seed and soil from raindrop impact and subsequent displacement.
2. Thermal consistency and moisture retention for seedbed area.
3. Stronger and faster germination of grasses and legumes.
4. Planing off excess stormwater runoff.
5. Prevention of sloughing of topsoil added to steeper slopes.

Permanent Erosion Control Matting

Consists of a permanent non-degradable, three-dimensional plastic structure which can be filled with soil prior to planting. These mats are also known as permanent soil reinforcing mats (turf reinforcement matting). Roots penetrate and become entangled in the matrix, forming a continuous anchorage for surface growth and promoting enhanced energy dissipation. Matting shall be used when a vegetative lining is desired in stormwater conveyance channels where the velocity is between five and ten feet per second.

Benefits of using erosion control matting include the

following:

1. All benefits gained from using erosion control blankets.
2. Causes soil to drop out of stormwater and fill matrix with fine soils which become the growth medium for the development of roots.
3. Acts with the vegetative root system to form an erosion resistant cover which resists hydraulic lift and shear forces when embedded in the soil within stormwater channels.

Materials

All blanket and matting materials shall be on the Georgia Department of Transportation Qualified Products List (QPL # 62 for blankets, QPL # 49 for matting).

All blankets shall be nontoxic to vegetation and to the germination of seed and shall not be injurious to the unprotected skin of humans. At a minimum, the plastic netting shall be intertwined with the mulching material/fiber to maximize strength and provide for ease of handling.

Temporary Blankets

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

a. Straw blankets are combination blankets that consist of weed-free straw from agricultural crops formed into a blanket. Blankets with a top side of photodegradable plastic mesh with a maximum mesh size of 5/16 x 5/16 inch and sewn to the straw with biodegradable thread is appropriate for slopes. The blanket shall have a minimum thickness of 3/8 inch and minimum dry weight of 0.5 pounds per square yard.

b. Excelsior blankets are combination blankets that consist of curled wood excelsior (80% of fibers are six inches or longer) formed into a blanket. The blanket shall have clear markings indicating the top side of the blanket and be smolder resistant. Blankets shall have photodegradable plastic mesh having a maximum mesh size of 1 1/2x3 inches. The blanket shall have a minimum thickness of 1/4 of an inch and a minimum dry weight of 0.8 pounds per square yard. Slopes require excelsior matting with the top side of the blanket covered in the plastic mesh, and for waterways, both sides of the blanket require plastic mesh.

c. Coconut fiber blankets are combination blankets that consist of 100% coconut fiber formed into a blanket. The minimum thickness of the blanket shall be 1/4 of an inch with a minimum dry weight of 0.5 pounds per square yard. Blankets shall have photodegradable plastic mesh, with a maximum mesh size of 5/8 x 5/8 inch and sewn to the fiber with a breakdown resistant synthetic yarn. Plastic mesh is required on both sides of the blanket if used in waterways. A maximum of two inches is allowable for the stitch pattern and row spacing.

d. Wood fiber blankets are combination blankets that consist of reprocessed wood fibers that do not possess or contain any growth or germination inhibiting factors. The blanket shall have a photodegradable plastic mesh, with a maximum mesh size of 5/8 x 3/4 inch, securely bonded to the top of the mat. The blanket shall have a minimum dry weight of 0.35 pounds per square yard. A maximum of two inches is allowable for the stitch pattern and row spacing. This practice shall be applied only to slopes.

e. Jute Mesh can be applied to slopes. Jute mesh with a 48 inch width shall show between 76 and 80 warpings and a one yard length shall show between 39 to 43 weftings. The woven mesh shall be at least 45 inches wide. Yarn shall have a unit weight of at least 0.9 pounds per square yard, but not more than 1.5 pounds per square yard.

f. Bonded Fiber Matrix shall not be applied on saturated soils. Installation shall be applied as per manufacturer's specifications.

Permanent Matting

Permanent matting shall consist of a lofty web of mechanically or melt bonded polymer nettings, monofilaments or fibers which are entangled to form a strong and dimensionally stable matrix. Polymer welding, thermal or polymer fusion, or the placement of fibers between two high strength, biaxially oriented nets bound securely together by parallel lock stitching with polyolefin, nylon or polyester threads are all appropriate bonding methods. Mats shall maintain their shape before, during, and after installation, under dry or water saturated conditions. Mats must be stabilized against ultraviolet degradation and shall be inert to chemicals normally encountered in a natural soil environment.

The mat shall conform to the following physical properties:

Property	Minimum Value
Thickness	0.5 inch
Weight	0.6 PSY
Roll Width	38 inches
Tensile Strength	
Length (50% elongation)	15 lbs./in.

Length (ultimate)	20 lbs./in.
Width (50% elongation)	5 lbs./in.
Width (ultimate)	10 lbs./in.
(ASTM D 1682-6" strip)	
Ultraviolet Stability	80%
(1000hrs. in an Atlas ARC Weatherometer, ASTM G 23, Type D in accordance with ASTM D 822)	

Site Preparation

After the site has been shaped and graded to the approved design, prepare a friable seedbed relatively free from clods and rocks more than one inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. Surface must be smooth to ensure proper contact of blankets or matting to the soil surface. If necessary, redirect any runoff from the ditch or slope during installation.

Staples

The following are considered appropriate stapling and staking materials.

Temporary Blankets

This includes straw, excelsior, coconut fiber, and wood fiber blankets. Staples shall be used to anchor temporary blankets. U-shaped wire (11 gauge or greater) staples with legs at least 6 inches in length and a crown of one inch or appropriate biodegradable staples can be used. Staples shall be of sufficient thickness for soil penetration without undue distortion.

Permanent Matting

Sound wood stakes, 1x3 inches stock sawn in a triangular shape, shall be used. Depending on the compaction of the soil, select stakes with a length from 12 to 18 inches. U-shaped staples shall be 11 gauge steel or greater, with legs at a minimum of 8 inches length with a 2 inch crown.

Planting

Lime, fertilizer, and seed shall be applied in accordance with seeding or other type of planting plan completed prior to installation of temporary combination blankets or jute mesh. For permanent mats, the area must be brought to final grade, plowed, limed, and fertilized. After the permanent mat has been installed and backfilled, the entire area shall be grassed. Refer to specification Ds3 - Disturbed Area Stabilization (With Permanent Vegetation).

Installation

See Figure 6-7.1 for typical installation guidelines. Follow manufacturer's recommendations for laying and stapling.

Maintenance

All erosion control blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after repairing damage to the slope or ditch. Continue to monitor these areas until they become permanently stabilized.

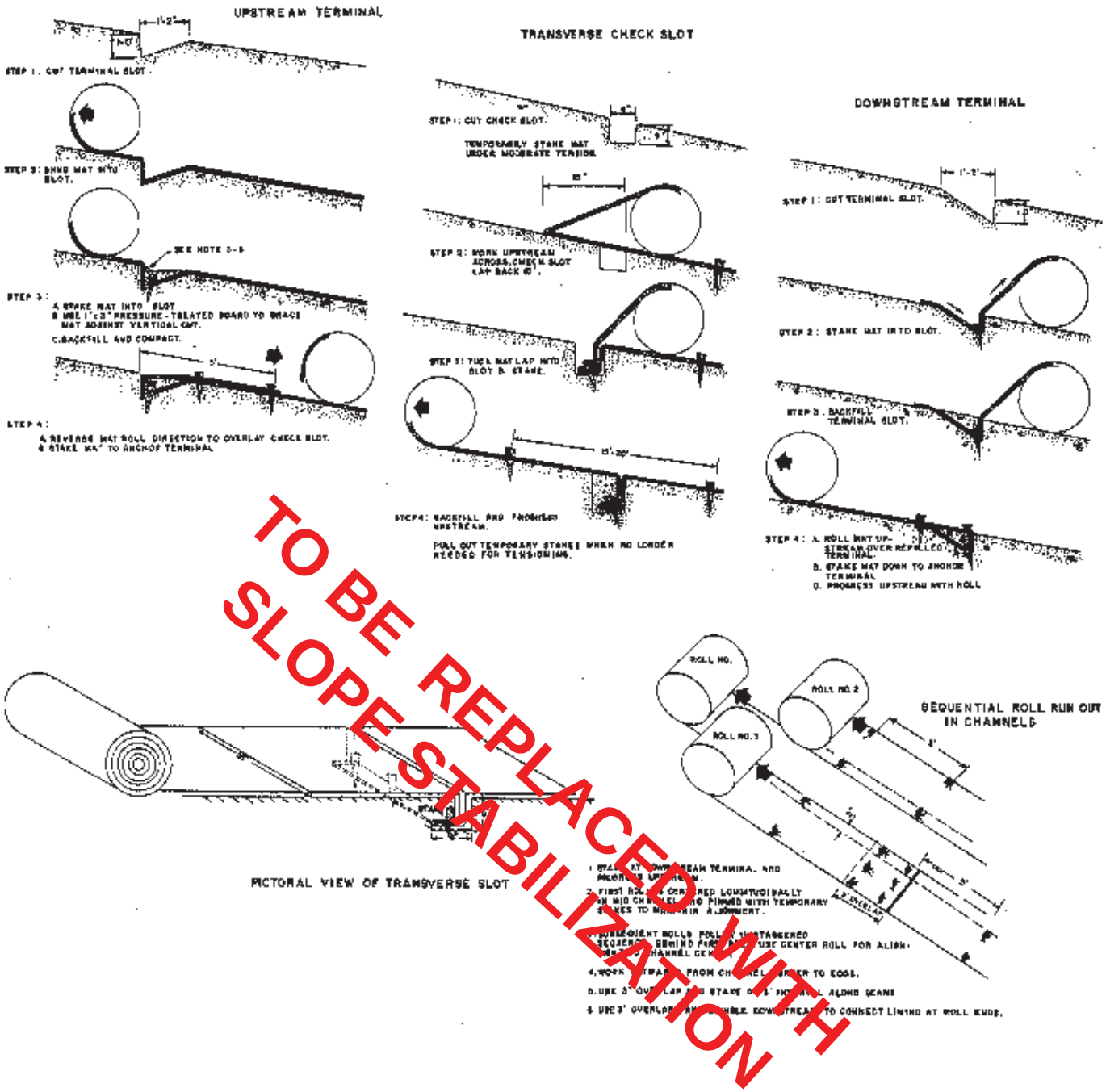


Figure 6-7.1 - Typical Installation Guidelines for Matting and Blankets

Polyacrylamide (PAM) Pm

DEFINITION

The land application of product containing anionic polyacrylamide (PAM) as temporary soil binding agents to reduce soil erosion.

PURPOSE

To reduce erosion from wind and water on construction sites and agricultural lands. Other benefits may include improved water quality, infiltration, soil fertility, and visibility.

CONDITIONS

This temporary practice is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. Such areas may include agricultural lands, where plant residues are inadequate to protect the soil surface, and construction sites where land-disturbing activities prevent the establishment or maintenance of a vegetative cover.

This temporary practice is not intended for application to surface waters of the state. It is intended for application within construction storm water ditches and storm drainages which feed into preconstructed sediment ponds or basins.

Federal, State and Local Laws

Anionic PAM application shall comply with all federal, state, and local laws rules or regulations governing anionic PAM. The operator is responsible for securing required permits. **This standard does not contain the text of the federal, state, or local laws governing anionic PAM.**

PLANNING CONSIDERATIONS

Anionic PAM is available in emulsions, powders, and gel bars or logs. It is required that other Best Management Practices be used in combination with anionic PAM.

Figure 6-8.1. Hydroseeded Slope with and without Polyacrylamide Application

The use of seed and mulch for additional erosion protection beyond the life of the anionic PAM is recommended. Repeat application if disturbance occurs to target area.

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

1. Use setbacks when applying anionic PAM near natural waterbodies.
2. Consider that decreased performance can occur due to ultra-violet light and time after mixing when applying anionic PAM.
3. In flow concentration channels, the effectiveness of anionic PAM for stabilization decreases.
4. Mulch to protect seed if seed is applied with anionic PAM.
5. Never add water to PAM, add PAM slowly to water. If water is added to PAM, “globs” can form which can clog dispensers. This signifies incomplete dissolving of the PAM and therefore increases the risk of under-application.
6. NOT *ALL* POLYMERS ARE PAM.

CRITERIA

Application rates shall conform to manufacturer’s guidelines for application.

1. Only the anionic form of PAM shall be used. Cationic PAM is toxic and shall NOT be used.

2. PAM and PAM mixtures shall be environmentally benign, harmless to fish, wildlife, and plants. PAM and PAM mixtures shall be non-combustible.

3. Anionic PAM, in pure form, shall have less than or equal to 0.05% acrylamide monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency.

4. To maintain less than or equal to 0.05% of acrylamide monomer, **the maximum application rate of PAM, in pure form, shall not exceed 200 pounds/acre/year**. Do not over apply PAM. Excessive application of PAM can lower infiltration rate or suspend solids in water, rather than promoting settling.

5. Users of anionic PAM shall obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations.

6. Additives such as fertilizers, solubility promoters or inhibitors, etc. to PAM shall be non-toxic.

7. The manufacturer or supplier shall provide written application methods for PAM and PAM mixtures. The application method shall insure uniform coverage to the target and avoid drift to non-target areas including waters of the state. The manufacturer or supplier shall also provide written instructions to insure proper safety, storage, and mixing of the product.

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

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

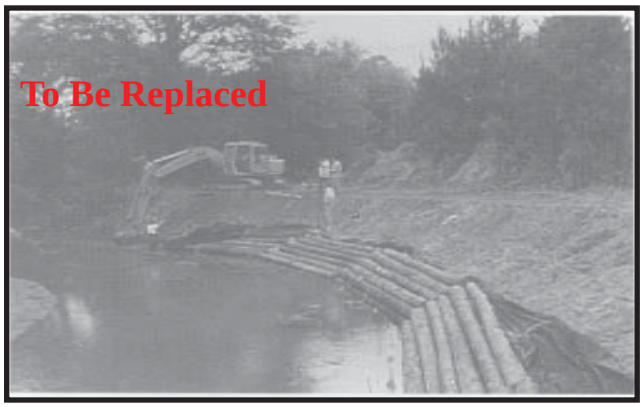
OPERATION AND MAINTENANCE

Maintenance will consist of reapplying anionic PAM to disturbed areas including high use traffic areas which interfere in the performance of this practice.

STREAMBANK STABILIZATION

Sb

(USING PERMANENT VEGETATION)



DEFINITION

The use of readily available native plant materials to maintain and enhance streambanks, or to prevent, or restore and repair small streambank erosion problems.

PURPOSE

- Lessen the impact of rain directly on the soil.
- Trap sediment from adjacent land.
- Form a root mat to stabilize and reinforce the soil on the streambank.
- Provide wildlife habitat.
- Enhance the appearance of the stream.
- Lower summertime water temperatures for a healthy aquatic population.

NOTE: Careful thought, planning and execution is required to assure that the streambank stabilization project is done efficiently and correctly. Please refer to ~~S~~GSWCC's STREAMBANK AND SHORELINE STABILIZATION. ~~Guidelines for Streambank Restoration~~ and ~~Chapters 16 and 18 of the NRCS~~ Engineering ~~Field Handbook for more detailed information.~~

~~SELECTED MEASURES~~

Preferred Practices:(show illustrations for Live

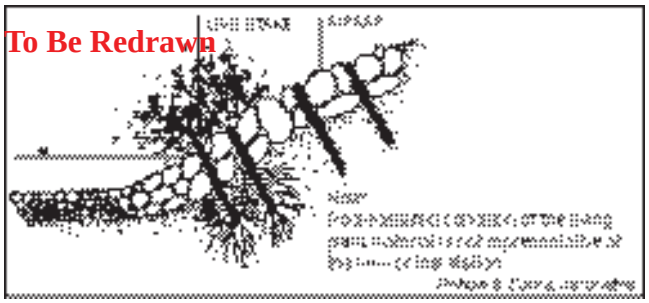
Staking, Live Fascines, Branchpacking, Vegetated Geogrid, Brushmattress, Coconut Fiber Roll, Dormant Post Plantings.)

Acceptable Practices:(show illustrations for Joint Planting, Live Cribwall, Vegetated

~~Figure 6-9.1 - Illustration of a Live Stake~~

Gabion Baskets, Tree Revetments, & Log, Rootwad and Boulder Revetments.)

Discouraged Practices:(show illustrations for Rock Riprap, Rock Gabions, Bulkheads and Seawalls.)



~~Figure 6-9.2 - Illustration of Joint Planting~~

~~Revegetation includes seeding and sodding of grasses, seeding in combination with erosion control fabrics, and the planting of woody vegetation (shrubs and trees). Refer to **Ds3 - Disturbed Area Stabilization (With Permanent Vegetation)**, **Ds4 - Disturbed Area Stabilization (With Sodding)**, and **Bf - Buffer Zone**.~~

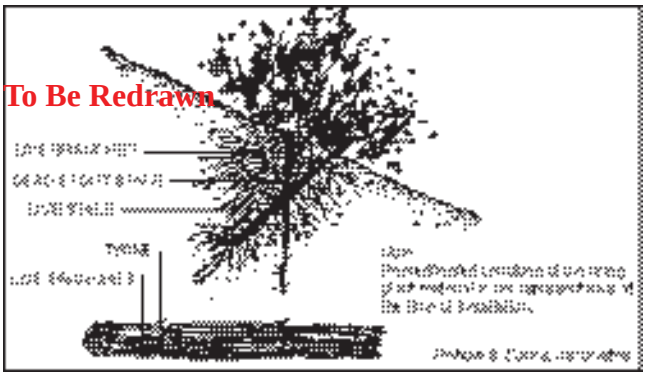


Figure 6-9.3 - Illustration of a Live Fascine

Use jute mesh and other geotextiles to aid in soil stabilization and revegetation. Refer to **Mb - Matting and Blankets**.

Live Stake

Fresh, live woody plant cuttings are tamped into the ground as stakes, intended to root and grow into mature shrubs that will stabilize soils and restore the riparian zone habitats. Live stakes provide no immediate streambank stabilization. Willow species work best.

Joint Planting

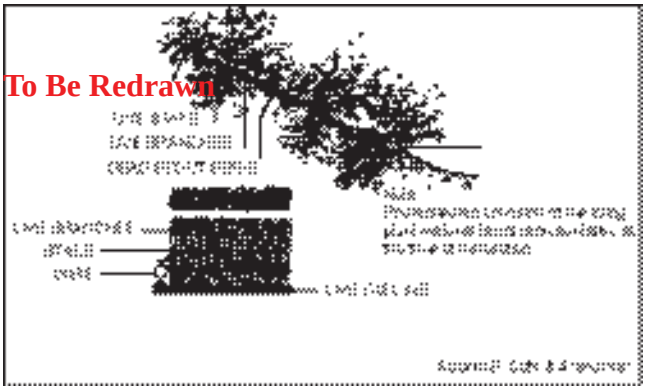


Figure 6-9.4 - Illustration of a Brushmattress

Install live willow stakes between rock previously placed along the streambank. Rock needs to be loosely dumped or hand placed and no thicker than 2 feet. Joint plantings enable a bank previously installed with conventional rip-rap to become naturalized.

Live Fascine

Live fascines are sausage-like bundles of live cut branches placed into trenches along the streambank. They provide immediate protection from erosion when properly used and installed. Willow species work best.

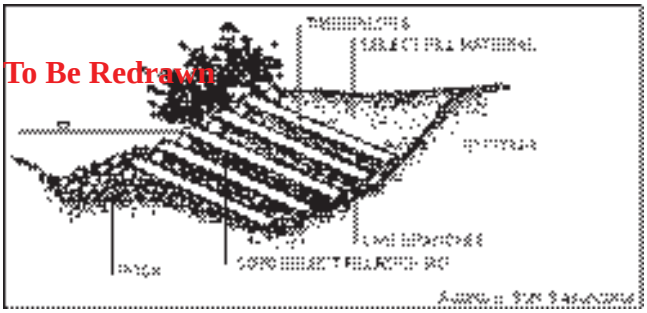


Figure 6-9.5 - Illustration of a Live Cribwall

Live fascines create very little site disturbance as compared to other systems and works especially well when combined with surface covers such as jute mesh or coir fabrics.

Brushmattress

A combination of living units that forms an immediate protective surface cover over the streambank. Living units used include live stakes, live fascines, and a mattress branch cover (long, flexible branches placed against

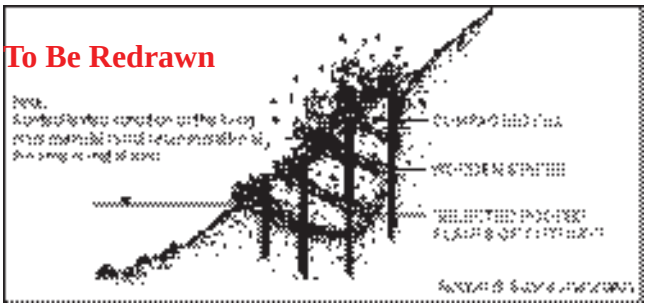


Figure 6-9.6 - Illustration of Branchpacking

the bank surface).

Brushmattreses require a great deal of live material, and is complicated as well as expensive to evaluate, design, and install.

Brushmattesses capture sediment during flood conditions, produces habitat rapidly and quickly develops a healthy riparian zone.

Live Cribwall

A rectangular framework of logs or timbers, rock, and woody cuttings. This requires a great deal of assessment and understanding of stream behavior.

Cribwalls can be complicated and expensive if a supply of wood and some volunteer help is not available.

Benefits include developing a natural streambank or upland slope appearance after it has begun to grow and provides excellent habitat for a variety of fish, birds, and animals. It is very useful where space is limited on small, narrow stream corridors.

Branchpacking

Process of alternating layers of live branches and soil, incorporated into a hole, gully, or slumped-out area in a slope or streambank. There is a moderate to complex level of difficulty for construction.

Branchpacking produces an immediate filter barrier, reducing scouring conditions, repairing gully erosion, and providing habitat cover and bank reinforcement.

This is one of the most effective and inexpensive methods for repairing holes in earthen embankments along small stream sites.

MAINTENANCE

Check banks after every high-water event, fixing gaps in the vegetative cover at once with structural materials or new plants, and mulching if necessary. Fresh cuttings from other plants may be used for repairs.

When fertilizer is applied on the surface, it is best to apply about one-half at planting, one-fourth when new growth is about two inches tall, and one-fourth about sixweeks later.REFERENCES Guidelines for Streambank Restoration. Georgia Soil and Water Conservation Commission

LOCAL CONTACTS

USDA Natural Resources Conservation Service

Georgia Soil and Water Conservation Commission

Table 6-9.1 Streambank Erosion Protection Measures Relative Costs and Complexity		
Measure	**Relative Cost**	**Relative Complexity**
Live Stake	Low	Simple
Joint Planting	Low*	Simple*
Live Fascine	Moderate	Moderate
Bushmatress	Moderate	Moderate to Complex
Live Cribwall	High	Complex
Branchpacking	Moderate	Moderate to Complex
Conventional Vegetation	Low to Moderate	Simple to Moderate
Converntional bank amoring (rip rap)	Moderate to High	Moderate to Complex

*Assumes rock is in place

Slope Stabilization Products Ss

DEFINITION
A protective covering used to prevent erosion and establish temporary or permanent vegetation on steep slopes , shore lines, or channels.

PURPOSE
To provide a cover layer that stabilizes the soil and acts as a rain drop impact dissipater while providing a microclimate which protects young vegetation and promotes its establishment. If using to reinforce channels

CONDITIONS
Slope stabilization products can be applied to flat areas or extreme slopes where the erosion hazard is high and slope protection is needed during the vegetation reestablishment phase.

Performance Evaluation
For a product or practice to be approved as a slope stabilization product, that product or practice must have a documented C- factor of 0.087, as specified by GSWCC. For complete test procedures and approved products list please visit www.gaswcc.org.

PLANNING CONSIDERATIONS
Care must be taken to choose the type of slope stabilization product which is most appropriate for the specific needs of a project. Two general types of slope stabilization products are discussed within this specification

Rolled Erosion Control Products (RECP)
A natural fiber blanket with single or double photodegradable or biodegradable nets.

Hydraulic Erosion Control Products (HECP)
HECP shall utilize straw, cotton, wood or other natural based fibers held together by a soil binding agent which works to stabilize soil particles. Paper mulch should not be used for erosion control.

CRITERIA

Rolled Erosion Control Products (RECPs) and Hydraulic Erosion Control Products (HECPs):

- Installation and stapling of RECPs and application rates for the HECPs shall conform to manufacturer's guidelines for application

- Products shall have a maximum C-factor ASTM 6459 – NTPEP) for the following slope grade:

Slope (H:V)	C-Factor (max.)
3:1	0.087

Materials – HECP
Hydraulic Erosion Control products shall be prepackaged from the manufacturer. Field mixing of performance enhancing additives will not be allowed. Fiberous components should be all natural and biodegradable.

Products shall be determined to be non-toxic in accordance with EPA-821-R-02-012.

Materials – RECP
Blankets shall be nontoxic to vegetation,

seed, or wildlife. Products shall be determined to be non-toxic in accordance with EPA-821-R-02-012. At minimum, the plastic or biodegradable netting shall be stitched to the fibrous matrix to maximize strength and provide for ease of handling.

RECPs are categorized as follows:

a. Short-Term
(functional longevity 12 mo.)

i.Photodegradable

Straw blankets with a top and bottom side photodegradable net. The maximum size of the mesh shall be openings of ½" X ½". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should be 0.35" and minimum density should be 0.5 lbs per square yard.

ii.Biodegradable

Straw blanket with a top and bottom side biodegradable jute net. The top side net shall consist of machine direction strands that are twisted together and then interwoven with cross direction strands (leno weave). The bottom net may be leno weave or otherwise to meet requirements. The approximate size of the mesh shall be openings of 0.5" X 1.0". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should be 0.25" and minimum density should be 0.5 lbs per square yard.

b. Extended-Term
(functional longevity 24 mo.)

i.Photodegradable

Blankets that consist of 70% straw and 30% coconut with a top and bottom side photodegradable net. The top net should have ultraviolet additives to delay breakdown. The maximum size of the mesh shall be openings of 0.65" X 0.65". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should be 0.35" and minimum density should be 0.6 lbs per square yard.

ii.Biodegradable

Blankets that consist of 70% straw and 30% coconut with a top and bottom side biodegradable jute net. The top side net shall consist of machine direction strands that are twisted together and then interwoven with cross direction strands (leno weave). The bottom net may be leno weave or otherwise to meet requirements. The approximate size of the mesh shall be openings of 0.5" X 1.0". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should be 0.25" and minimum density should be 0.65 lbs per square yard.

c. Long-Term
(functional longevity 36 mo.)

i. Photodegradable
Blankets that consist of 100% coconut with a top and bottom side photodegradable net. Each net should have ultraviolet additives to delay breakdown. The maximum size of the mesh shall be openings of 0.65" X 0.65". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should be 0.3" and minimum density should be 0.5 lbs per square yard.

iii. Biodegradable
Blankets that consist of 100% coconut with a top and bottom side biodegradable jute net. The top side net shall consist of machine direction strands that are twisted together and then interwoven with cross direction strands (leno weave). The bottom net may be leno weave or otherwise to meet requirements. The approximate size of the mesh shall be openings of 0.5" X 1.0". The blanket should be sewn together on 1.5" centers with degradable thread. Minimum thickness should

be 0.25” and minimum density should be 0.5 lbs per square yard.

NOTES

It is the intention of this section to allow interchangeable use of RECPs and HECPs for erosion protection on slopes. The project engineer should select the type of erosion control product that best fits the need of the particular site.

Site Preparation

After the site has been shaped and graded to the approved design, prepare a friable seedbed relatively free from clods and rocks more than one inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. Surface must be smooth to ensure proper contact of blankets or matting to the soil surface. If necessary, redirect any runoff from the ditch or slope during installation. Maintenance

Maintenance

All erosion control blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after repairing damage to the slope or ditch. Continue to monitor these areas until they become permanently stabilized.

Tackifiers and Binders

DEFINITION

Substances used to anchor straw or hay mulch by causing the organic material to bind together.

PURPOSE

To prevent the movement of mulching material from the desired location. Increases performance of the mulching material, so that it can:

- Increase infiltration.
- Reduce wind and water erosion.
- Conserve moisture, prevent surface compaction or crusting.
- Control undesirable vegetation.
- Modify soil temperature.
- Increase biological activity in the soil.

CONDITIONS

All organic mulching materials shall be anchored by tackifiers/binders or matting/netting. Tackifiers and binders are used to anchor wood cellulose, wood pulp fiber, and other mulch materials applied with hydro-seeding equipment. All tackifiers and binders shall be on the Georgia Department of Transportation Qualified Products List (QPL#33) for Tackifiers.

~~**APPROVED TACKIFIERS AND BINDERS**~~

~~Product or Trade Name~~	~~Recommended Application Rate~~
~~A500 HYDRO-STIK~~	~~40 lb./ac.~~
~~Agro Tack MP~~	~~PMR~~
~~CONWED CON-TAC~~	~~40 lb./ac.~~
~~EcoTak-OP/EcoTAk-SATII~~	~~PMR~~
~~Emulsified Asphalt~~	~~100 gal. of SS-1h or CSS-1h and 100 gal. of water per ton of mulch~~
~~Hercules Soilloc-E~~	~~PMR~~
~~HYDRO-BOND~~	~~35 lb./ac.~~
~~RMB-plus~~	~~80-120 lb./ac.~~
~~TACPAC GT~~	~~PMR~~
~~TERRA-MULCH~~	~~TACKING AGENT III~~ ~~PMR~~

TO BE REPLACED WITH Tac

TACKIFIERS

Tac

Definition

Tackifiers are used as a tie-down for soil, compost, seed, straw, hay or mulch. Tackifiers hydrate in water and readily blend with other slurry materials to form a homogenous slurry.

Purpose

To reduce soil erosion from wind and water on construction sites. Other benefits include soil infiltration, soil fertility, enhanced seed germination, increased soil cohesion, enhanced soil stabilization, reduced stormwater runoff turbidity, reduces loss of top soil.

Conditions

This practice is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetation cover is absent or inadequate. Such areas include construction areas, where plant residues are inadequate to protect the soil surface and where land disturbing activities prevent the establishment or maintenance of a vegetative cover.

Criteria

Type I Tackifiers: Synthetic Polymers

Tac-1

- Application rates shall conform to manufacturer's guidelines for application.
- Only anionic forms of PAM shall be used. Anionic PAMs must have less than or equal to 0.05% acrylamide monomer by weight, as established by the Food and Drug Administration and the Environmental Protection Agency.
- Not harmful to plants, animals and aquatic life.
- Contain no growth or germination inhibiting materials.
- Shall not reduce infiltration rates.

Type II Tackifiers: Organic Polymers

Such as guar gum, polysaccharides, and starches

Tac-2

- Application rates shall conform to manufacturer's guidelines for application.
- Derived from natural plant sources.
- Not harmful to plants, animals and aquatic life.
- Contain no growth or germination inhibiting materials.
- Shall not reduce infiltration rates.

Type III Tackifiers: Synthetic/Organic Blends

Tac-3

- Application rates shall conform to manufacturer's guidelines for application.
- Only anionic forms of PAM shall be used in the blend having less than or equal to 0.05% acrylamide monomer by weight.
- Organic material must be derived from natural plant sources.
- Not harmful to plants, animals and aquatic life.
- Contain no growth or germination inhibiting materials.
- Shall not reduce infiltration rates.

Type IV Tackifiers: Organic Tackifiers with Synthetic Fibers

Tac-4

- Application rates shall conform to manufacturer's guidelines for application.
- Only anionic forms of PAM shall be used in the blend having less than or equal to 0.05% acrylamide monomer by weight.
- Organic material must be derived from natural plant sources
- Not harmful to plants, animals and aquatic life.
- Contain no growth or germination inhibiting materials.
- Shall not reduce infiltration rates.
- Synthetic fibers shall be of nylon or polyester blends.

Type V Tackifiers:Synthetic/Organic Blends

Tac-5

- Application rates shall conform to manufacturer's guidelines for application.
- Only anionic forms of PAM shall be used in the blend having less than or equal to 0.05% acrylamide monomer by weight.
- Organic material must be derived from natural plant sources.
- Not harmful to plants, animals and aquatic life.
- Contain no growth or germination inhibiting materials.
- Shall not reduce infiltration rate.
- Synthetic fibers shall be of nylon or polyester blends.

Maintenance

Tackified areas should be checked after every rain event. Periodic inspections and required maintenance must be provided per manufacturers recommendations.

SECTION III: STRUCTURAL PRACTICES

The E&S ACT, O.C.G.A. § 12-7-6 (a)(4), and the state general permits (NPDES) Part IV. require an ES&PC Plan to be properly designed, installed and maintianed using BMPs which are consistent with, and no less stringent than practices contained in this manual.

The following structural BMPs in this Manual require worksheets or specifications to be shown on, and/or with the ES&PC Plan: Channel Stabilization (Ch), Diversion (Di), Temporary Downdrain Structure (Dn1), Rock Filter Dam (Rd), Retofitting (Rt), Inlet Sediment Trap (Sd2) when excavated to provide sediment storage, Temporary Sediment Basin (Sd3), Temporary Stream Crossing (Sr), Storm Drain Outlet Protection (St), and Vegetated Waterway or Stormwater Conveyznce Channel (WT).

Most of the structural BMPs provide the maintenance requirements, and a detail showing proper installation procedures and specifications. When the design professonal has chosen to use alternative BMPs that are not included in the manual, a detail and maintenance requirements must be provided by the manufacturer or the design professional, and shown on the ES&PC Plan.

O.C.G.A. § 12-7-8 (a)(1) requires a local issuing authority (LIA) to enact an ordinance which meets or exceeds the standards, requirements, and provisions of the Act and the NPDES permits. However, the ordinance which the LIA enacts may not exceed the NPDES permit requirements for monitoring, reporting, inspections, design standards, turbidity standards, education and training, and project size thresholds with regard to education and training. Inspections are an important part of insuring that structural BMPs are properly maintained. Following are the inspection and retention of records requirements of the current NPDES permits:

PRIMARY PERMITTEE:

1). Each day when any type of construction activity has taken place at a primary permittee's site, certified personnel provided by the primary permittee shall inspect: (a) all areas at the primary permittee's site where petroleum products are stored, used, or handled for spills and leaks from vehicles and equipment; (b) all locations at the primary permittee's site where vehicles enter or exit the site for evidence of off-site sediment tracking; and (c) measure rainfall once each 24 hour period at the site. These inspections must be conducted until a Notice of Termination is submitted.

(2)Certified personnel (provided by the primary permittee) shall inspect the following at least once every seven (7) calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater (unless such storm ends after 5:00 PM on any Friday or on any non-working Saturday, non-working Sunday or any non-(working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first): (a) disturbed areas of the primary permittee's construction site that have not undergone final stabization (b) areas used by the primary permittee for storage of materials that are exposed to precipitation that have not undergone final stabilization; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the **primary permittee's site shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). For areas of a site that have undergone final stabilization, the permittee must comply with Part IV.D.4.a.(3). These inspections must be conducted until a Notice of Termination is submitted.**

(3). Certified personnel (provided by the primary permittee) shall inspect at least once

per month during the term of this permit (i.e., until a Notice of Termination is received by EPD) the areas of the site that have undergone final stabilization. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and the receiving water(s). Erosion and sediment control measures identified in the Plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s).

(4). Based on the results of each inspection, the site description and the pollution prevention and control measures identified in the Erosion, Sedimentation and Pollution Control Plan, the Plan shall be revised as appropriate not later than seven (7) calendar days following each inspection. Implementation of such changes shall be made as soon as practical but in no case later than seven (7) calendar days following each inspection. The primary permittee must amend the Plan in accordance with Part IV.D.4.b.(5). when a secondary permittee notifies the primary permittee of any Plan deficiencies.

(5). A report of each inspection that includes the name(s) of personnel making each inspection, the date(s) of each inspection, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan, and actions taken in accordance with Part IV.D.4.a.(4). of the permit shall be made and retained at the site or be readily available at a designated alternate location until the entire site or that portion of a construction project that has been phased has undergone final stabilization and a Notice of Termination is submitted to EPD. Such reports shall identify any incidents of non-compliance. Where the report does not identify any incidents of non-compliance, the report shall contain a certification that the construction site is in compliance with the Erosion, Sedimentation and Pollution Control Plan and this permit. The report shall be signed in accordance with Part V.G. of this permit.

SECONDARY PERMITTEE:

(1). Each day when any type of construction activity has taken place at a secondary permittee's site, certified personnel provided by the secondary permittee shall inspect: (a) all areas used by the secondary permittee where petroleum products are stored, used, or handled for spills and leaks from vehicles and equipment; and (b) all locations at the secondary permittee site where that permittee's vehicles enter or exit the site for evidence of off-site sediment tracking. These inspections must be conducted until a Notice of Termination is submitted. This paragraph is not applicable to utility companies and utility contractors if they are secondary permittees.

(2). Certified personnel (provided by the utility companies and utility contractors if they are secondary permittees) shall inspect the following each day any type of construction activity has taken place at the construction site: (a) areas of the construction site disturbed by the utility companies and utility contractors that have not undergone final stabilization; (b) areas used by the utility companies and utility contractors for storage of materials that are exposed to precipitation that have not undergone final stabilization; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the utility companies and utility contractors' construction activities shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). This paragraph is not applicable to utility companies and utility contractors when they are secondary permittees performing service line installations or when conducting repairs on existing line installations. The certification requirements of this paragraph shall be applicable 90 days after the effective date of this permit.

(3). Certified personnel (provided by the secondary permittee) shall inspect the following

at least once every seven calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater (unless such storm ends after 5:00 PM on any Friday or on any non-working Saturday, non-working Sunday or any non-working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first): (a) disturbed areas of the secondary permittee's construction site that have not undergone final stabilization; (b) areas used by the secondary permittee for storage of materials that are exposed to precipitation that have not undergone final stabilization; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the secondary permittee's site shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). For areas of a site that have undergone final stabilization, the permittee must comply with Part IV.D.4.b.(4). These inspections must be conducted until a Notice of Termination is submitted. This paragraph is not applicable to utility companies and utility contractors if they are secondary permittees.

(4). Certified personnel (provided by the secondary permittee) shall inspect at least once per month during the term of this permit (i.e., until a Notice of Termination is received by EPD) the areas of their sites that have undergone final stabilization. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and the receiving water(s). Erosion and sediment control measures identified in the Plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). This paragraph is not applicable to utility companies and utility contractors if they are secondary permittees

(5). Based on the results of each inspection, the secondary permittee must notify the primary permittee within 24-hours of any suspected BMP design deficiencies. The primary permittee must evaluate

whether these deficiencies exist within 48-hours of such notice, and if these deficiencies are found to exist must amend the Plan in accordance with Part IV.C. of this permit to address those deficient BMPs within seven (7) days of being notified by the secondary permittee. When the Plan is amended, the primary permittee must notify and provide a copy of the amendment to all affected secondary permittee(s) within this seven (7) day period. The secondary permittees must implement any new Plan requirements affecting their site(s) within 48-hours of notification by the primary permittee.

(6). A report of each inspection that includes the name(s) of personnel making each inspection, the date(s) of each inspection, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan, and actions taken in accordance with Part IV.D.4.b.(5). of the permit shall be made and retained at the site or be readily available at a designated alternate location until the entire site has undergone final stabilization and a Notice of Termination is submitted to EPD. Such reports shall identify any incidents of non-compliance. Where the report does not identify any incidents of non-compliance, the report shall contain a certification that the construction site is in compliance with the Erosion, Sedimentation and Pollution Control Plan and this permit. The report shall be signed in accordance with Part V.G. of this permit. This paragraph is not applicable to utility companies and utility contractors if they are secondary permittees performing only service line installations or when conducting repairs on existing line installations.

TERTIARY:

(1). Each day when any type of construction activity has taken place at a tertiary permittee's site, certified personnel provided by the tertiary permittee shall inspect: (a) all areas used by the tertiary permittee where petroleum products are stored, used, or handled for spills and leaks from vehicles and equipment; and (b) all locations at the tertiary permittee site where that permittee's vehicles enter or exit the site for evidence of off-site sediment tracking. These inspections must be conducted until a Notice of Termination is submitted. This paragraph is not applicable to utility companies and utility contractors performing only service line installations or when conducting repairs on existing line installations.

(2). Certified personnel (provided by the tertiary permittee) shall inspect at least the following once every seven calendar days and within 24 hours of the end of a storm that is 0.5 inches rainfall or greater (unless such storm ends after 5:00 PM on any Friday or on any non-working Saturday, non-working Sunday or any non-working Federal holiday in which case the inspection shall be completed by the end of the next business day and/or working day, whichever occurs first): (a) disturbed areas of the tertiary permittee's construction site that have not undergone final stabilization; (b) areas used by the tertiary permittee for storage of materials that are exposed to precipitation that have not undergone final stabilization; and (c) structural control measures. Erosion and sediment control measures identified in the Plan applicable to the tertiary permittee's site shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s).

For areas of a site that have undergone final stabilization, the permittee must comply with Part IV.D.4.c.(3). These inspections must be conducted until a Notice of Termination is submitted. This paragraph is not applicable to utility companies and utility contractors performing only service line installations or when conducting repairs on existing line installations.

(3). Certified personnel (provided by the tertiary permittee) shall inspect at least once per month during the term of this permit (i.e., until a Notice of Termination is received by EPD) the areas of their sites that have undergone final stabilization. These areas shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and the receiving water(s). Erosion and sediment control measures identified in the Plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). This paragraph is not applicable to utility companies and utility contractors performing only service line installations or when conducting repairs on existing line installations.

(4). Based on the results of each inspection, the site description and the pollution prevention and control measures identified in the Erosion, Sedimentation and Pollution Control Plan, the Plan shall be revised as appropriate not later than seven (7) calendar days following each inspection. Implementation of such changes shall be made as soon as practical but in no case later than seven (7) calendar days following the inspection.

(5). A report of each inspection that includes the name(s) of personnel making each inspection, the date(s) of each inspection, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan, and actions taken in accordance shall be made and retained at the site or be readily available at a designated alternate location until the entire site has undergone final stabilization and a Notice of Termination is submitted to EPD. Such reports shall identify any incidents of non-compliance. Where the report does not identify any incidents of

non-compliance, the report shall contain a certification that the construction site is in compliance with the Erosion, Sedimentation and Pollution Control Plan and this permit. The report shall be signed in accordance with Part V.G. of this permit. This paragraph is not applicable to utility companies and utility contractors performing only service line installations or when conducting repairs on existing line installations11.5

RETENTION OF RECORDS:

1. The primary permittee shall retain the following records at the construction site or the records shall be readily available at a designated alternate location from commencement of construction until such time as a NOT is submitted in accordance with Part VI:
   a. A copy of all Notices of Intent submitted to EPD;
   b. A copy of the Erosion, Sedimentation and Pollution Control Plan required by this permit;
   c. The design professional's report of the results of the inspection conducted in accordance with Part IV.A.5. of this permit;
   d. A copy of all monitoring information, results, and reports required by this permit;
   e. A copy of all inspection reports generated in accordance with Part IV.D.4.a. of this permit;
   f. A copy of all violation summaries and violation summary reports generated in accordance with Part III.D.2. of this permit; and
   g. Daily rainfall information collected in accordance with Part IV.D.4.a.(1)(c) of this permit.

2. Each secondary permittee shall retain the following records at the construction site or the records shall be readily available at a designated alternate location from commencement of construction until such time as a NOT is submitted in accordance with Part VI:
   a. A copy of all Notices of Intent submitted to EPD;
   b. A copy of the Erosion, Sedimentation and Pollution Control Plan required by this permit or the applicable portion of the Erosion, Sedimentation and Pollution Control Plan for their activities at the construction site required by this permit;
   c. A copy of all inspection reports generated in accordance with Part IV.D.4.b. of this permit;and
   d. A copy of all violation summaries and violation summary reports generated in accordance with Part III.D.2. of this permit.

3. Each tertiary permittee shall retain the following records at the construction site or the records shall be readily available at a designated alternate location from commencement of construction until such time as a NOT is submitted in accordance with Part VI:
   a. A copy of all Notices of Intent submitted to EPD; and
   b. A copy of the Erosion, Sedimentation and Pollution Control Plan required by this permit;
   c. The design professional's report of the results of the inspection conducted in accordance with Part IV.A.5. of this permit;
   d. A copy of all monitoring information, results, and reports required by this permit;
   e. A copy of all inspection reports generated in accordance with Part IV.D.4.c. of this permit; and
   f. A copy of all violation summaries and violation summary reports generated in accordance with Part III.D.2. of this permit.
   g. Daily rainfall information collected in accordance with Part IV.D.4.c.(1)(c) of this permit.

4. Copies of all Notices of Intent, Notices of Termination,reports, plans, monitoring reports, monitoring information, including all

calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, Erosion, Sedimentation and Pollution Control Plans, records of all data used to complete the Notice of Intent to be covered by this permit and all other records required by this permit shall be retained by the permittee who either produced or used it for a period of at least three years from the date that the NOT is submitted in accordance with Part VI of this permit. These records must be maintained at the permittee's primary place of business once the construction activity has ceased at the permitted site. This period may be extended by request of the EPD at any time upon written notification to the permittee.

Check Dam

Cd

SEE REVISED PRACTICE Below

DEFINITION

Small temporary barrier, grade control structure, or dam constructed across a swale, drainage ditch, or area of concentrated flow.

PURPOSE

To minimize the erosion rate by reducing the velocity of storm water in areas of concentrated flow.

CONDITIONS

This practice is applicable for use in small open channels and is **not to be used in a live stream**. Specific applications include:

1. Temporary or permanent swales or ditches in need of protection during establishment of grass linings.

2. Temporary or permanent swales or ditches which, due to their short length of service or other reasons, cannot receive a permanent non-erodible lining for an extended period of time.

3. Other locations where small localized erosion and resulting sedimentation problems exist.

DESIGN CRITERIA

Formal design is not required. The following standards shall be used:

Drainage Area

For stone check dams, the drainage area shall not exceed two acres. For haybales, the drainage area shall not exceed one acre.

Height

The center of the check dam must be at least 9 inches lower than outer edges. Dam height should be 2 feet maximum measured to center of check dam. (See Figure 6-10.2)

Side Slopes

Side slopes shall be 2:1 or flatter.

Spacing

Two or more stone check dams in series shall be used ~~for~~ when drainage area is greater than one acre. Maximum spacing between dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. (See Figure 6-10.1)

Geotextiles

A geotextile should be used as a separator between the graded stone and the soil base and abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be selected/specified in accordance with AASHTO M288-96 Section 4.3, *Separation Requirements*, Table 3. Geotextiles shall be "set" into the subgrade soils. The geotextile shall be placed immediately adjacent to the subgrade without any voids and extend five feet beyond the downstream toe of the dam to prevent scour.

CONSTRUCTION SPECIFICATIONS

The following types of check dams are used for this standard:

Stone Check Dams

Cd-S

Stone check dams should be constructed of graded size 2-10 inch stone. (See Figure 6-10.2) Mechanical or hand placement shall be required to insure complete coverage of entire width of ditch or swale and that center of dam is lower than edges.

Haybale Check Dams

Cd-Hb

Staked and embedded hay-bales may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. They ~~should~~ shall not be used where the drainage area exceeds one acre. Haybales should be embedded a minimum of 4 inches. (See Figure 6-10.3)

MAINTENANCE

Periodic inspection and required maintenance must be provided. Sediment shall be removed when it reaches a depth of one-half the original dam height or before. If the area is to be mowed, check dams shall be removed once final stabilization has occurred. Otherwise, check dams may remain in place permanently. After removal, the area beneath the dam shall be seeded and mulched immediately.

Check Dam

Cd

Definition

A temporary grade control structure, or dam constructed across a swale, drainage ditch, or area of concentrated flow.

Purpose

To minimize the erosion rate by reducing the velocity of the storm water in areas of concentrated flow.

Conditions

This practice is applicable for use in small open channels and is not to be used in a live stream. Specific applications include:

1. Temporary or permanent swales or ditches in need of protection during establishment of grass linings.
2. Temporary or permanent swales or ditches which, due to their short length of service or other reasons, cannot receive a permanent non-erodible lining for an extended period of time.
3. Other locations where small localized erosion and resulting sedimentation exist.

Design Criteria

Check dams should be designed using 2.0cfs. For any flows exceeding 2.0 cfs check dams may be used in conjunction with other BMP's in the channel.

Spacing

Two or more check dams in a series shall be used for drainage areas greater than one(1) acre. Maximum spacing between dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. (See Figure6-10.1)

Geotextiles

A geotextile should be used as a separator between the graded stone and the soil base and abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be selected/specified in accordance with AASHTO M288-96 Section7.3, Separation Requirements, Table 3. Geotextiles shall be "set" into the subgrade soils. The geotextile shall be placed immediately adjacent to the subgrade without any voids and extend five feet beyond the downstream toe of the dam to prevent scour.

Performance Evaluation

For a product or practice to be approved for use in a check dam application, that product or practice must have a documented performance efficiency in channels with a flow rate of 2.0 cfs, as specified by GSWCC. For complete test procedures and approved products list please visit www.gaswcc.org.

Construction Specifications

Stone Check Dams

Stone check dams should be constructed of graded size 2-10 inch stone (See Figure6-10.2). Mechanical or hand placement shall be required to insure compete coverage of the entire width of the ditch or swale and that the center of the dam is lower than the edges. The center of the check dam must be at least 9 inches lower than the outer edges. Dam height should be 24inches maximum measured to the center of the check dam. (See Figure6-10.2)

Straw-bale Check Dams

Staked and embedded straw-bales may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. Straw-bales should be installed per Figure 6-10.3.

Compost Filter Sock

The filter sock should be staked in the center. If the compost filter sock is to be left as a permanent filter or part of the natural landscape, it may be seeded at time of installation for establishment of permanent vegetation.

Compost filter media used for compost filter sock filler material shall be weed free and derived from a well-decomposed source of organic matter.

The compost shall be produced using an aerobic composting process meeting CFR 503 regulations including time and temperature data. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted.

Test methods for the items below should follow US Composting Council Test Methods for the Examination of Composting and Compost guidelines for laboratory procedures:

A. PH – 5.0-8.0 in accordance with TMECC 04.11-A, "Electrometric pH Determinations for Compost".

B. Particle size – 99% passing a 2 inch (50 mm) sieve and a maximum of 40% passing a 3/8 inch (-9.5 mm) sieve, in accordance with TMECC 02.02-B, "Sample Sieving for Aggregate Size Classification". (Note- In the field, product commonly is between ½ and 2 inch (12.5 and 50 mm) particle size).

C. Moisture content of less than 60% in accordance with standardized test methods for moisture determination.

D. Material shall be relatively free (<1% by dry weight) of inert or foreign man made materials.

E. Sock containment system for compost filter media shall be a photodegrad able or biodegradable knitted mesh material with 1/8 to 3/8 inch (3.2 to 9.5 mm) openings.

Maintenance

Periodic inspection and required maintenance must be provided. Sediment shall be removed when it reaches a depth of one-half the original dam height or before. If the area is to be mowed, check dams shall be removed once final stabilization has occurred. Otherwise check dams may remain in place permanently. After removal, the area beneath the dam shall be seeded and mulched immediately.

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

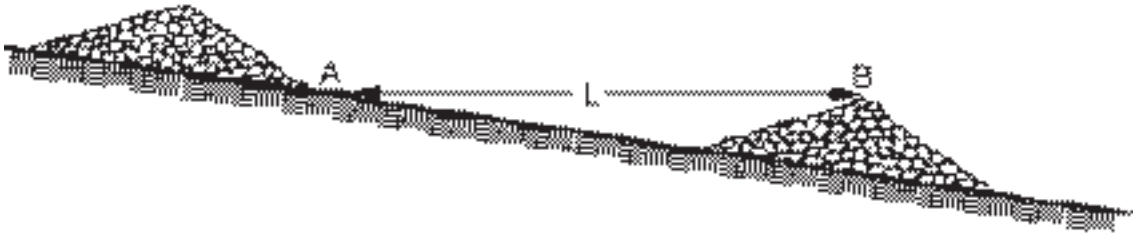
1.CFS in the channel/ditch that the check dam is being used in:_____

2. Above 2.0 CFS: Yes_____ No_____

3. If Yes list BMP being used in conjunction with check dams:_____

To Be Redrawn

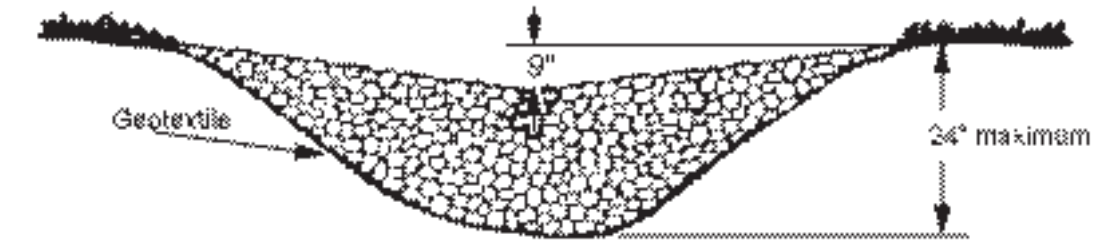
L = The distance such that points A and B are of equal elevation



SPACING BETWEEN CHECK DAMS

Figure 6-10.1

STONE CHECK DAM



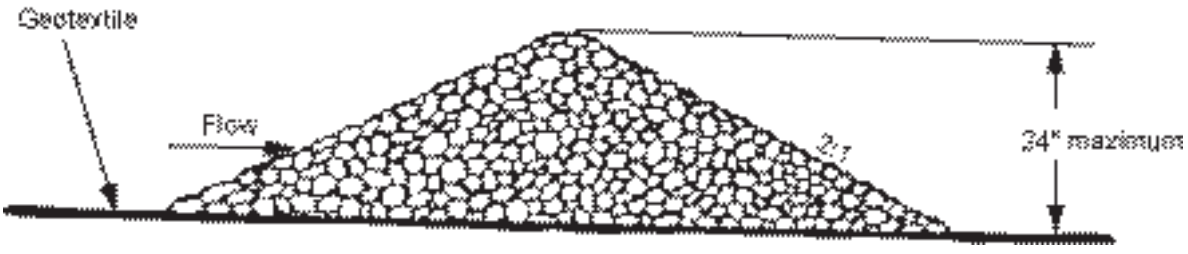
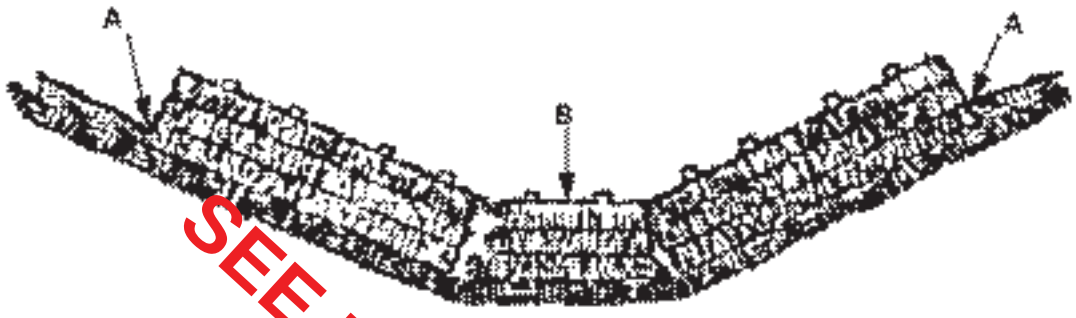
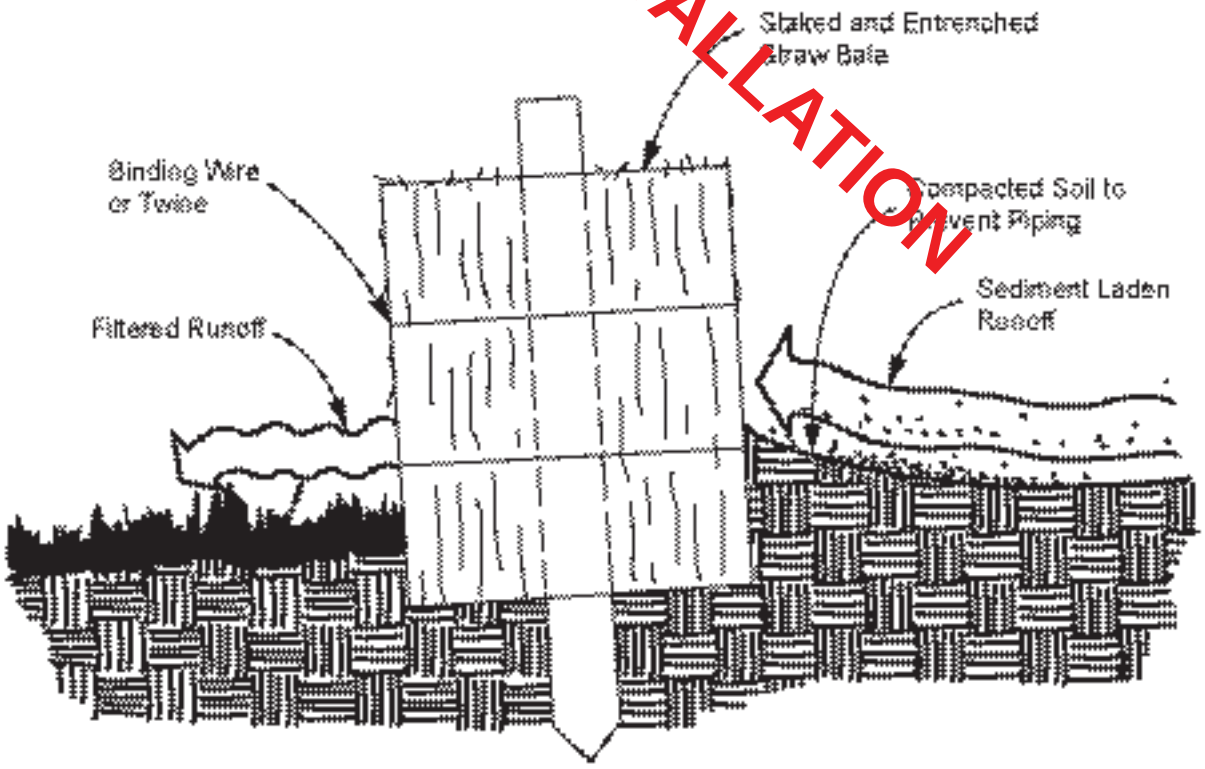


Figure 6-10.2



Point A should be higher than point B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

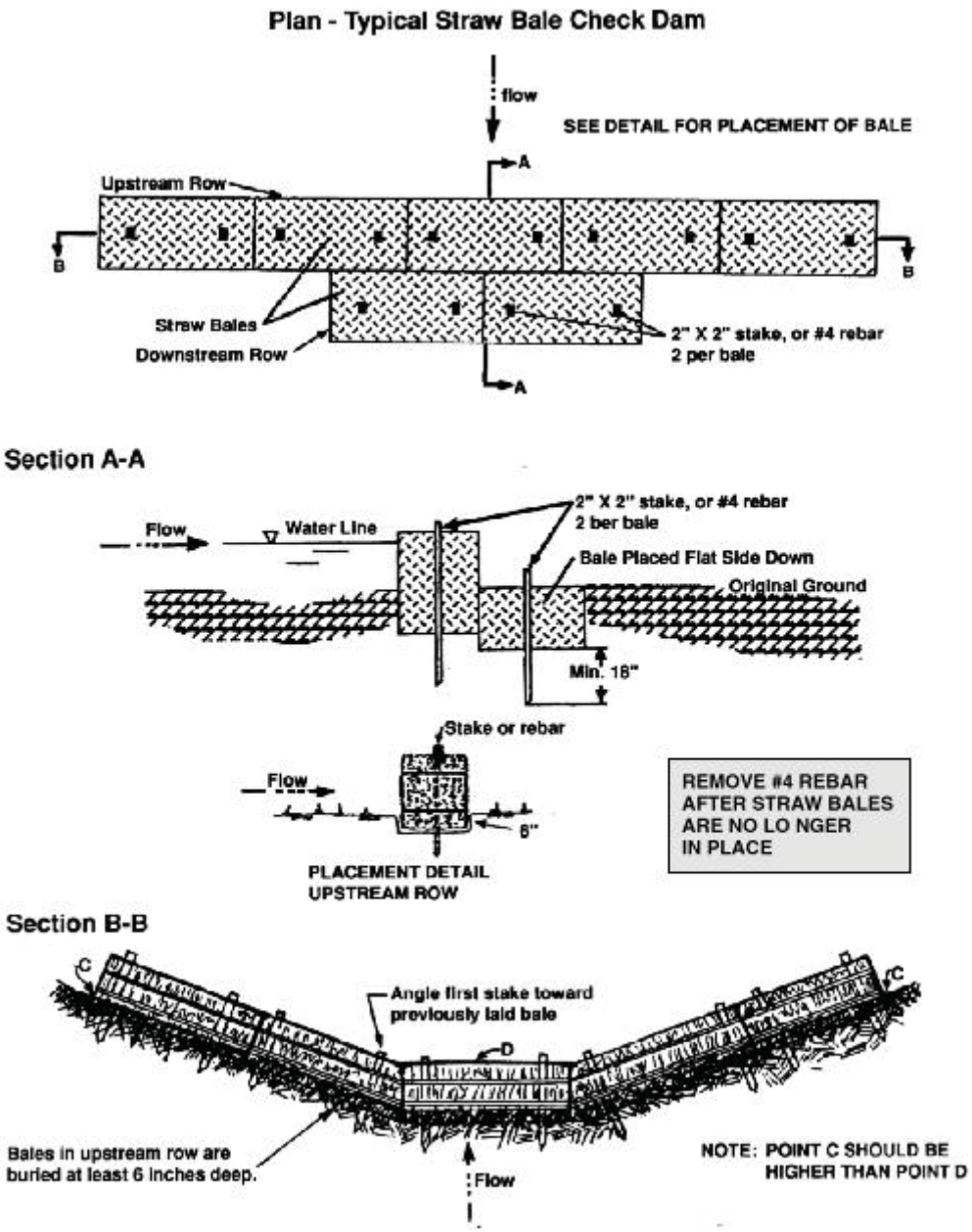


Note: Embed hay bales a minimum of 4 inches.

CROSS-SECTION OF A PROPERLY INSTALLED STRAW BALE

Figure 6-10.3

Figure 6-10.3



Installation

Bales should be bound with wire or nylon string. Twine bound bales are less durable. The bales should be placed in rows with bale ends tightly abutting the adjacent bales.

Downstream Row (refer to illustration): Dig a trench across the small channel, wide enough and deep enough to so that the top of the row of bales placed on their long, wide side is level with the ground. The tops of bales across the center of the channel should all be level and set at the same elevation. Place the bales in position and stake them according to the instructions below.

Upstream Row: Dig another trench across the small channel, upstream and immediately adjacent to the first row of bales. The trench should be wide enough to accommodate a row of bales set vertically on their long edge. The trench should be deep enough so that at least 6 inches of each bale is below ground starting with the bale in the channel bottom. The trench should be as level as possible so that the tops of the bales across the center of the channel are level and water can flow evenly across them. Continue this trench up the side slopes of the small channel to a point where the unburied bottom line of the highest bale (point “C”, illustration) is higher than the top of the bales that are in the center of the channel (point “D”, illustration).

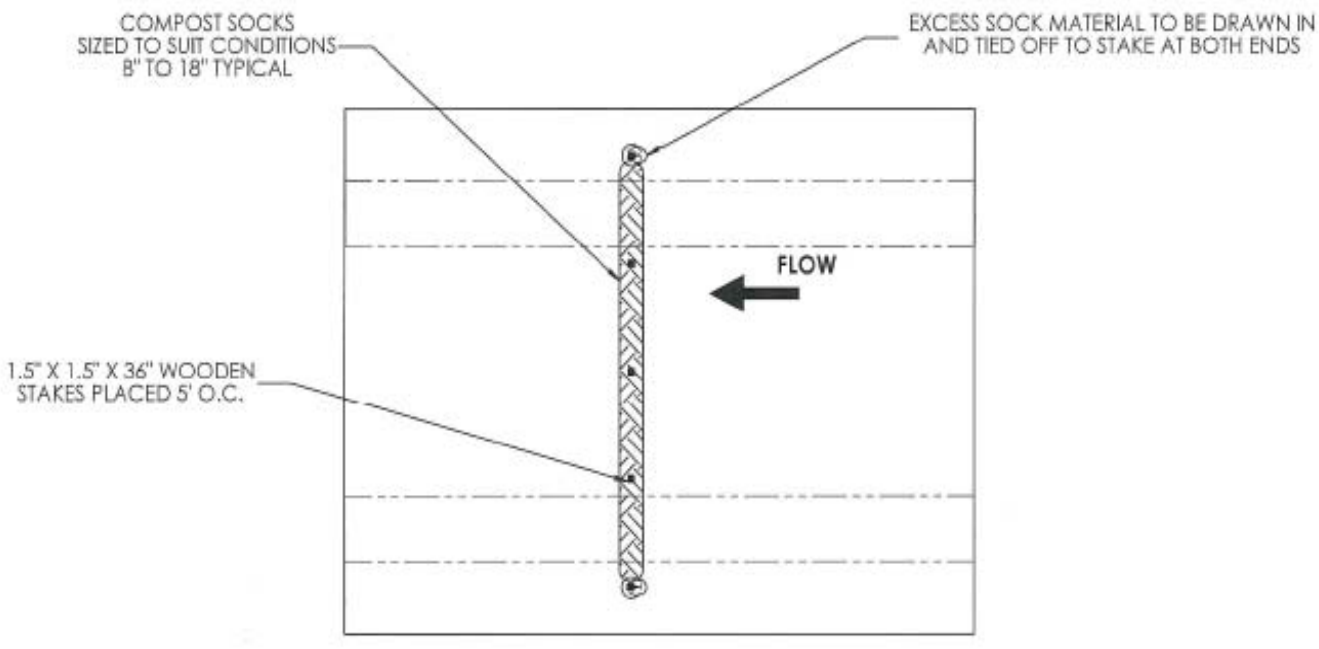
Anchorage: Drive 2 x 2 stakes or #4 rebar through the bales and into the ground 1 1/2 to 2 feet for anchorage. The first stake in each bale should be driven toward a previously laid bale to force the bales together (see illustration).

Maintanence: Inspect the bale check dam and provide necessary maintenance following each storm period. Remove the bales and stakes once permanent drainage and stabilization is reestablished. Used straw can be used as mulch in other areas.

Reference: http://www.co.nrcs.usda.gov/technical/eng/BALECHECKDAMfactsheet2.pdf

New Detail

Compost Socks for Check Dams



Notes:

1. All material to meet specifications.
2. Place one stake at the center of the ditch/channel. Also place stakes at the bed/ bank junction and at the end of the device not spaced more than 4 feet apart.
3. Sediment should be removed from behind check dam once the accumulated height has reached 1/2 the height of the check dam.
4. Check dams can be direct seeded at the time of installation
5. Minimum staking depth for sand, silt and clay shall be 18”.

Channel Stabilization Ch

DEFINITION

Improving, constructing or stabilizing an open channel for water conveyance.

PURPOSE

Open channels are constructed or stabilized to be non-erosive, with no sediment deposition and to provide adequate capacity for flood water, drainage, other water management practices, or any combination thereof.

CONDITIONS

This standard applies to the improvement, construction or stabilization of open channels and existing ditches with drainage areas less than one square mile. This standard applies only to channels conveying intermittent flow, not to channels conveying a continuous, live stream.

An adequate outlet for the modified channel length must be available for discharge by gravity flow. Construction or other improvements of the channel should not adversely affect the environmental integrity of the area and must not cause significant erosion upstream or flooding and/or sediment deposition downstream.

DESIGN CRITERIA

Planning

The alignment and design of channels shall give careful consideration to the preservation of valuable fish and wildlife habitat and trees of significant value for wildlife food or shelter or for aesthetic purposes.

Where channel construction will adversely affect significant fish or wildlife habitat, mitigation measures should be included in the plan. Mitigation measures may include pools, riffles, flats, cascades or other similar provisions.

As many trees as possible are to be left inside channel rights-of-way considering the requirements of construction, operation, and maintenance.

Unusually large or attractive trees shall be preserved.

Realignment

The realignment of channels shall be kept to an absolute minimum and should be permitted only to correct an adverse environmental condition.

Channel Capacity

The capacity for open channels shall be determined by procedures applicable to the purposes to be served.

Hydraulic Requirements

Manning's formula shall be used to determine velocities in channels. The "n" values for use in this formula shall be estimated using currently accepted guides along with knowledge and experience regarding the conditions. Acceptable guides can be found in hydrology textbooks.

Channel Cross-Section

The required channel cross-section and grade are determined by the design capacity, the materials in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to

provide adequate outlets for subsurface drains and tributary channels.

Channel Stability

All channel construction, improvement and modification shall be in accordance with a design expected to result in a stable channel which can be maintained.

Characteristics of a Stable Channel

1. Aggradation or degradation does not interfere with the function of the channel or affect adjacent areas.
2. The channel banks do not erode to the extent that the channel cross-section is changed appreciably.
3. Excessive sediment bars do not develop.
4. Excessive erosion does not occur around culverts, bridges or elsewhere.
5. Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.
6. The determination of channel stability considers "bankfull" flow. Bankfull flow is defined as flow in the channel which creates a water surface that is at or near normal ground elevation for a significant length of a channel reach. Excessive channel depth created by cutting through high ground should not be considered in determinations of bankfull flow.

CHANNEL LININGS AND STRUCTURAL MEASURES

Where channel velocities exceed safe velocities for vegetated lining due to increased grade or a change in channel cross-section, or where durability of vegetative lining is adversely affected by seasonal changes, channel linings of rock, concrete or other durable material may be needed. Grade stabilization structures may also be needed.

Velocities in channels when flowing at the bankfull discharge or the 25 year frequency discharge, whichever is the lesser, shall be used in determining the appropriate lining for stabilization of the channels.

The following categories for flow velocities shall apply when selecting the channel lining:

~~Channels may be stabilized by using one or more of the following methods:~~

Category 1 (0-5 cfs) Ch-1

~~Vegetated Lining~~

A vegetated lining may be used to stabilize channels with a velocity of 0 – 5 cfs ~~shall be designed to resist erosion when the channel is flowing at the bankfull discharge or 25-year frequency discharge, whichever is the lesser.~~ Temporary erosion control blankets or sod shall be used on all channels and concentrated flow areas to aid in the establishment of the vegetated lining. ~~If a vegetated lining is desired in a channel with velocities between 5-10 ft/sec, permanent soil reinforcement matting shall be used.~~ Refer to specifications Ds3 - Disturbed Area Stabilization (With Permanent Vegetation), Ds4 - Disturbed Area Stabilization (With Sodding), and ~~Mb - Matting and Blankets~~. SS – Slope Stabilization Products. Hydraulic Erosion Control Products (HECPs) are not intended to be applied in channels, swales or other areas where concentrated flows are anticipated, unless installed in conjunction with Rolled Erosion Control Products (RECPs).

Category 2 (5 – 10 cfs) Ch-2

Vegetated Lining

If a vegetated lining is used in channels with velocities between 5 -10 ft/sec, Turf Reinforcement Matting (TRM) shall be used. TRM is permanent geosynthetic erosion control matting that is used in channels to stabilize the soil while permanent vegetation is rooting, and to provide additional long-term protection.

Velocities in channels when flowing at the bankfull discharge or the 25 year frequency

discharge, whichever is the lesser, shall be used in determining the appropriate TRM for stabilization of the channels

Rock Riprap Lining

Rock riprap shall be designed to resist displacement when the channel is flowing at the bankfull discharge or 25-year frequency discharge, whichever is the lesser. Rock riprap lining should be used when channel velocities are between 5 and 10 ft/sec.

Dumped and machine placed riprap should not be installed on slopes steeper than 1-1/2 horizontal to 1 vertical. Rock shall be dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Rock shall be installed according to standards specified in Riprap, Appendix C.

A filter blanket layer consisting of an appropriately designed graded filter sand and/or gravel or geotextile material shall be placed between the riprap and base material. The gradation of the filter blanket material shall be designed to create a graded filter between the base material and the riprap. A geotextile can be used as a substitution for a layer of sand in a graded filter or as the filter blanket. Criteria for selecting an appropriate geotextile and guidance for recommended drop heights and stone weights are found in AASH-TO M288-96 Section 7.5, Permanent Erosion Control Specifications.

Category 3 (<10 cfs) Ch-3

Concrete Lining

If a channel has velocities high enough to require a concrete lining (when channel velocities exceed 10 ft/sec), methods should be utilized to reduce the velocity of the runoff and reduce erosion at the outlet - a common problem created by the smooth, concrete lining. Refer to specification St - Storm Drain Outlet Protection for information regarding energy dissipators.

If a concrete lining is chosen, it shall be designed according to currently accepted guides for structural and hydraulic adequacy. It must be designed to carry the required discharge and to withstand the loading imposed by site conditions.

A separation geotextile should be placed under concrete linings to prevent undermining in the event of stress cracks due to settlement of the base material. The separation geotextile will keep the base material soils in place and minimize the likelihood of a system failure.

Grade Stabilization Structures

Grade stabilization structures are used to reduce or prevent excessive erosion by reduction of velocities in the watercourse or by providing structures that can withstand and reduce the higher velocities. They may be constructed of concrete, rock, masonry, steel, aluminum, or treated wood.

These structures are constructed where the capability of earth and vegetative measures is exceeded in the safe handling of water at permissible velocities, where excessive grades or overall conditions are encountered or where water is to be lowered structurally from one elevation to another. These structures should generally be planned and installed along with or as a part of other erosion control practices.

The structures shall be designed hydraulically to adequately carry the channel discharge and structurally to withstand loadings imposed by the site conditions. The structure shall meet requirements of Gr - Grade Stabilization Structure.

~~CONSTRUCTION SPECIFICATIONS~~

1. ~~Where needed, all trees, brush, stumps and other objectionable materials shall be removed so they will not interfere with the construction or proper functioning of the channel.~~

2. ~~Where possible, trees will be left standing, and stumps will not be removed.~~

3. Excavation shall be at the locations and grades shown on the drawings. The lining shall not compromise the capacity of the channel, e.g. the emergency spillway shall be over-excavated so that the lining will be flush with the slope surface.

4. The geotextile shall be placed on a smooth graded surface. The geotextile shall be placed in such a manner that it will not excessively stretch or tear upon placement of the overlying materials. Care should be taken to place the geotextile in intimate contact with the soil such that no void spaces exist between the underlying soil and the geotextile.

5. Construction plans will specifically detail the location and handling of spoils. Spoil material resulting from clearing, grubbing and channel excavation shall be disposed of in a manner which will:

   a. not cause an increase in flood stage,

   b. minimize overbank wash,

   c. not cause an adverse effect on the environmental integrity of the area,

   d. provide for the free flow of water between the channel and flood plain unless the valley routing and water surface profile are based on continuous dikes being installed,

   e. leave the right-of-way in the best condition feasible, and

   f. improve the aesthetic appearance of the site to the extent feasible.

6. Channel linings shall be established or installed immediately after construction or as soon as weather conditions permit.

7. Structures shall be installed according to lines and grades shown on the plan. The foundation for structures shall be cleared of all undesirable materials prior to the installation of the structures.

8. Materials used in construction shall be of permanency commensurate with the design frequency and life expectancy of the facility.

9. Earthfill, when used as a part of the structures, shall be placed according to the installation requirements for sediment basin embankments.

10. Construction operations shall be carried out in such a manner that erosion and air and water pollution will be minimized. State and local laws concerning pollution abatement shall be complied with.

11. Vegetation shall be established on all disturbed areas immediately after construction. If weather conditions cause a delay in establishing vegetation, the area shall be mulched in accordance with the standard for mulching. Refer to specification Ds1 - Disturbed Area Stabilization (With Mulching Only). Seeding, fertilizing and mulching shall conform to the standard for permanent vegetative cover. Refer to specification Ds3-Disturbed Area Stabilization (With Permanent Vegetation).

12. All temporary access roads or travelways shall be appropriately closed to exclude traffic.

13. Trees and other fallen natural vegetation

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. The velocity in the channel, in ft/sec, for when the channel is flowing at the bank-full discharge or 25-year frequency discharge, whichever is the lesser.

2. The type of lining to be used to stabilize the channel, i.e. vegetation (Ch-V: indicate type of vegetation and matting or blanket to be used), riprap (Ch-Rp: indicate average stone size), or concrete (Ch-C).

Construction Exit

Co

DEFINITION

A stone stabilized pad located at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, sidewalk or parking area or any other area where there is a transition from bare soil to a paved area.

PURPOSE

To reduce or eliminate the transport of mud from the construction area onto public rights-of-way by motor vehicles or by runoff.

CONDITIONS

This practice is applied at appropriate points of construction egress. Geotextile underliners are required to stabilize and support the pad aggregates.

DESIGN CRITERIA

Formal design is not required. The following standards shall be used:

Aggregate Size

Stone will be in accordance with National Stone Association R-2 (1.5 to 3.5 inch stone).

Pad Thickness

The gravel pad shall have a minimum thickness of 6 inches.

Pad Width

At a minimum, the width should equal full width of all points of vehicular egress, but not less than 20 feet wide.

Pad Length

The gravel pad shall have a minimum length of 50 feet for most stand alone or infrastructure projects. When the construction of a commercial or residential building is less than 50' from the paved access, the length shall be from the edge of existing pavement to the permitted building being constructed.

Washing

If the action of the vehicle traveling over the gravel pad does not sufficiently remove the mud, the tires should be washed prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with crushed stone and provisions that intercept the sediment-laden runoff and direct it into an approved sediment trap or sediment basin.

Location

The exit shall be located or protected to prevent sediment from leaving the site.

CONSTRUCTION SPECIFICATIONS

It is recommended that the ~~entrance~~ egress area be excavated to a depth of 3 inches and be cleared of all vegetation and roots.

Diversion Ridge

On sites where the grade toward the paved area is greater than 2%, a diversion ridge 6 to 8 inches high with 3:1 side slopes shall be constructed across the foundation approximately

15 feet above the road.

Geotextile

The geotextile underliner must be placed the full length and width of the entrance. Geotextile selection shall be based on AASHTO M288-98 specification:

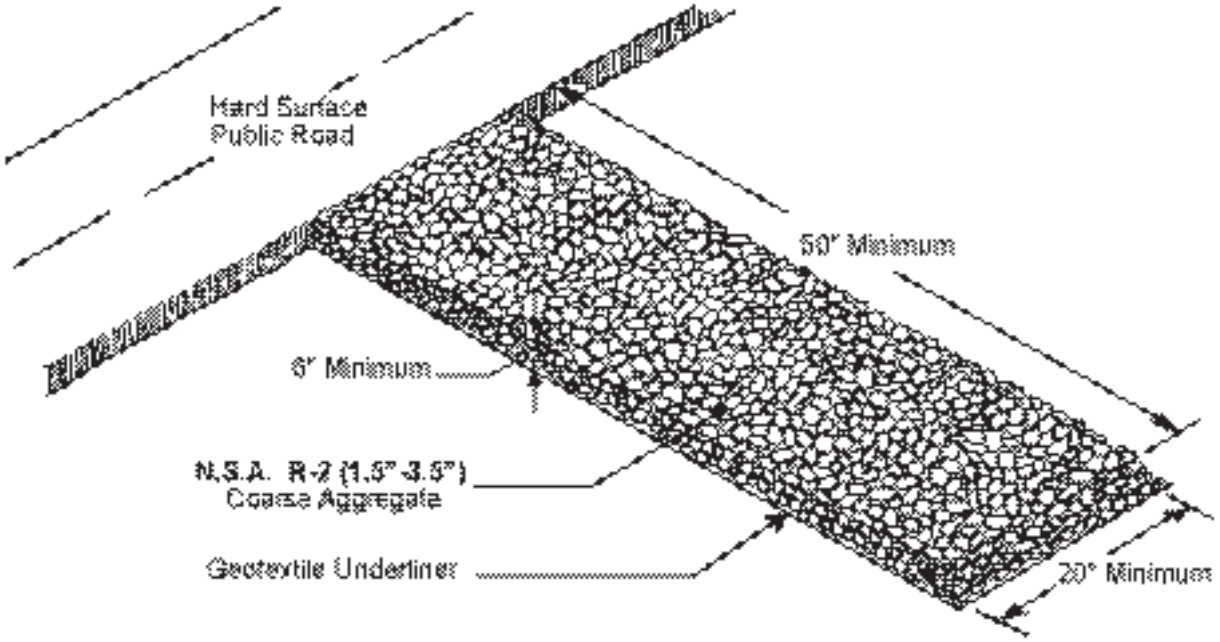
1. For subgrades with a CBR greater than or equal to 3 or shear strength greater than 90 kPa, geotextile must meet requirements of section AASHTO M288-96 Section 7.3, Separation Requirements.

2. For subgrades with a CBR between 1 and 3 or sheer strength between 30 and 90 kPa, geotextile must meet requirements of section AASHTO M288-96 Section 7.4, Stabilization Requirements.

MAINTENANCE

The exit shall be maintained in a condition which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with 1.5-3.5 inch stone, as conditions demand, and repair and/or cleanout of any structures to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles or site onto roadways or into storm drains must be removed immediately.

To Be Redrawn



CRUSHED STONE CONSTRUCTION EXIT

Figure 6-11.1

Construction Road Stabilization

Cr

DEFINITION

A travelway constructed as part of a construction plan including access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes.

PURPOSE

To provide a fixed route for travel for construction traffic and reduce erosion and subsequent regrading of permanent roadbeds between time of initial grading and final stabilization.

CONDITIONS

This practice is applicable where travelways are needed in a planned land use area or wherever stone-base roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic.

PLANNING CONSIDERATIONS

Areas graded for construction vehicle transport and parking purposes are especially susceptible to erosion. The exposed soil is continually disturbed, eliminating the possibility of stabilization with vegetation. The prolonged exposure of the roads and parking areas to surface runoff can create severe rilling and muddying of the areas, requiring regrading before paving. The soil removed during this process may enter streams and other waters of the state via stormwater management systems, compromising the water quality. Also, because the roads become so unstable during wet weather, they are virtually unusable, limiting access, and causing delays in construction.

DESIGN CRITERIA

TEMPORARY ROADS AND PARKING AREAS

The type of vehicle or equipment, speed, loads, climatic, and other conditions under which vehicles and equipment are expected to operate shall be considered.

Location

Temporary roads shall be located to serve the purpose intended, facilitate the control and disposal of water, control or reduce erosion, and make the best use of topographic features.

Temporary roads shall follow the contour of the natural terrain to minimize disturbance of drainage patterns. If a temporary road must cross a stream, the crossing must be designed, installed and maintained according to specification **Sr - Temporary Stream Crossing**.

Temporary parking areas should be located on naturally flat areas to minimize grading.

Grade and Alignment

The gradient and vertical and horizontal alignment shall be adapted to the intensity of use, mode of travel, and level of development.

Grades for temporary roads should not exceed ten percent except for very short lengths (200 feet or less), but maximum grades of 20 percent or more may be used if necessary for special uses. Frequent grade changes generally cause fewer erosion problems than long

continuous gradients.

Curves and switchbacks must be of sufficient radius for trucks and other large vehicles to negotiate easily. On temporary roads, the radius should be no less than 35 feet for standard vehicles and 50 feet for tractor-trailers.

Grades for temporary parking areas should be sufficient to provide drainage but should not exceed four percent.

Width

Temporary roadbeds shall be at least 14 feet wide for one-way traffic and 20 feet wide for two-way traffic. The width for two-way traffic shall be increased approximately four feet for trailer traffic. A minimum shoulder width shall be two feet on each side. Where turnouts are used, road width shall be increased to a minimum of 20 feet for a distance of 30 feet.

Side Slopes

All cuts and fills shall have side slopes designed to be stable for the particular site conditions and soil materials involved. All cut and fills shall be 2:1 or flatter to the extent possible. When maintenance by machine mowing is planned, side slopes shall be no steeper than 3:1.

Drainage

The type of drainage structure used will depend on the type of enterprise and runoff conditions. The capacity and design shall be consistent with sound engineering principles and shall be adequate for the class of vehicle, type of road, development, or use. Structures should be designed to withstand flows from a 25-year, 24-hour frequency storm or the storm specified in Title 12-7-1 of the Official Code of Georgia Annotated. Channels shall be designed to be on stable grades or protected with structures or linings for stability.

Water breaks or bars may be used to control surface runoff on low-intensity use roads.

Stabilization

Geotextile should be applied to the roadbed for additional stability. Geotextile selection shall be based on AASHTO M288-98 specification:

1. For subgrades with a CBR greater than or equal to 3 or shear strength greater than 90 kPa, geotextile must meet requirements of section AASHTO M288-96 Section 7.3, *Separation Requirements*.

2. For subgrades with a CBR between 1 and 3 or sheer strength between 30 and 90 kPa, geotextile must meet requirements of section AASHTO M288-96 Section 7.4, *Stabilization Requirements*.

A 6-inch course of coarse aggregate shall be applied immediately after grading or the completion of utility installation within the right-of-way. In areas experiencing “heavy duty” traffic situations, stone should be placed at an 8 to 10 inch depth to avoid excessive dissipation or maintenance needs.

All roadside ditches, cuts, fills, and disturbed areas adjacent to parking areas and roads shall be stabilized with appropriate temporary or permanent vegetation according to specification in **Ds2** and **Ds3** - **Disturbed Area Stabilization (With Temporary Seeding)** and **Disturbed Area Stabilization (With Permanent Vegetation)**.

PERMANENT ROADS AND PARKING AREAS

Permanent roads and parking areas shall be designed and constructed according to criteria established by the Georgia Department of Transportation or local authority. Permanent roads and parking areas shall be stabilized in accordance with this specification, applying an initial base course of gravel immediately following grading.

CONSTRUCTION SPECIFICATIONS

1. Trees, stumps, roots, brush, weeds, and other objectionable materials shall be removed from the work area.

2. Unsuitable material shall be removed from the roadbed and parking areas

3. Grading, subgrade preparation, and compaction shall be done as needed. Fill material shall be deposited in layers not to exceed 9 inches and compacted with the controlled movement of compacting and earth moving equipment.

4. The roadbed and parking area shall be graded to the required elevation. Subgrade preparation and placement of the surface course shall be in accordance with sound highway construction practice.

5. Structures such as culverts, pipe drops, or bridges shall be installed to the lines and grades shown on the plans or as staked in the field. Pipe conduits shall be placed on a firm foundation. Selected backfill material shall be placed around the conduit in layers not to exceed 6 inches. Each layer shall be properly compacted.

6. Roads shall be planned and laid out according to good landscape management principles.

MAINTENANCE

Roads and parking areas may require a periodic top dressing of gravel to maintain the gravel depth at 6 inches. Vegetated areas should be checked periodically to ensure a good stand of vegetation is maintained. Remove any silt or other debris causing clogging of roadside ditches or other drainage structure.

Stream Diversion Channel

Dc

DEFINITION

A temporary channel constructed to convey flow around a construction site while a permanent structure is being constructed in the stream channel.

PURPOSE

To protect the streambed from erosion and allow work “in the dry”.

CONDITIONS

Temporary stream diversion channels shall be used only on flowing streams with a drainage area less than one square mile. Structures or methodology for crossing streams with larger drainage areas should be designed by methods which more accurately define the actual hydrologic and hydraulic parameters which will affect the functioning of the structure. A Stream Buffer Variance from the Georgia EPD is required, and all other appropriate agencies, including the USACOE, must be contacted to ensure compliance with other laws.

PLANNING CONSIDERATIONS

Linear projects, such as utilities or roads, frequently cross and impact live streams creating a potential for excessive sediment loss into a stream by both the disturbance of the approach areas and by the work within the streambed and banks.

In cases where in-stream work is unavoidable, the amount of encroachment and time spent working in the channel shall be minimized. If construction in the streambed will take an extended period of time, substantial in-stream controls or stream diversion channel should be considered to prevent excessive sedimentation damage. To limit land-disturbance, overland pumping of the stream should be considered in low-flow conditions. Clearing of the stream bed and banks shall be kept to a minimum.

Table 6-12.1. STREAM DIVERSION CHANNEL LININGS

Lining Materials	Symbol	Acceptable Velocity Range
Geotextile, polyethylene film,or sod	Dc-A	0 -2.5 fps
Geotextile alone	Dc-B	2.5 -9.0 fps
Class I riprap and geotextile	Dc-C	9.0 -13.0 fps

DESIGN CRITERIA

Drainage Area

Temporary stream diversion channels ~~**shall**~~ **should not be used on streams with drainage areas greater than one square mile, unless specifically designed to accommodate the additional drainage area by the design professional. A certification statement and signature shall accompany the design.**

Size

The bottom width of the stream diversion shall be a minimum of six feet or equal to the bottom width of the existing streambed, whichever is greater.

Side Slopes

Side slopes of the stream diversion channel shall be no steeper than 2:1.

Depth and Grade

Depth and grade may be variable, dependent on site conditions, but shall be sufficient to ensure continuous flow of water in the diversion.

Channel Lining

A stream diversion channel shall be lined to prevent erosion of the channel and sedimentation in the stream. The lining is selected based upon the expected velocity of bankfull flow. Table 6-12.1 shows the selection of channel linings that may be used. Refer to specification ~~**Mb - Matting and Blankets**~~**Ss- Slope Stablization**.

Geotextile

Geotextiles should be used as a protective cover for soil or, if the channel is to be lined with rip-rap, as a separator between graded stone and the soil base. The geotextile will prevent erosion of the channel and the migration of soil particles from the subgrade into the graded stone. The geotextile shall be specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control Recommendations*. The geotextile should be placed immediately adjacent to the subgrade without any voids.

CONSTRUCTION SPECIFICATIONS

1. The channel shall be excavated, constructing plugs at both ends. Plugs can be constructed of compacted soil, riprap, sandbags or sheet piling.

2. Silt fence or a berm shall be placed along the sides of the channel to prevent unfiltered runoff from entering the stream. The berm can be constructed using the material excavated for the stream diversion.

3. The channel surface shall be smooth (to prevent tearing of the liner) and lined with the material specified in the plans. The outer edges of the geotextile shall be secured at the top of the channel with compacted soil.

4. The plugs are removed when the liner installation is complete, removing the downstream plug first.

5. As soon as construction in the streambed is complete, the diversion shall be replugged and backfilled. The liner should be inspected for damage and salvaged if possible.

6. Upon removal of the lining, the stream shall immediately be restored and properly stabilized.

MAINTENANCE

The stream diversion channel shall be inspected at the end of each day to make sure that the construction materials are positioned securely. This will ensure that the work area stays dry and that no construction materials float downstream. All repairs shall be made immediately.

To Be Redrawn

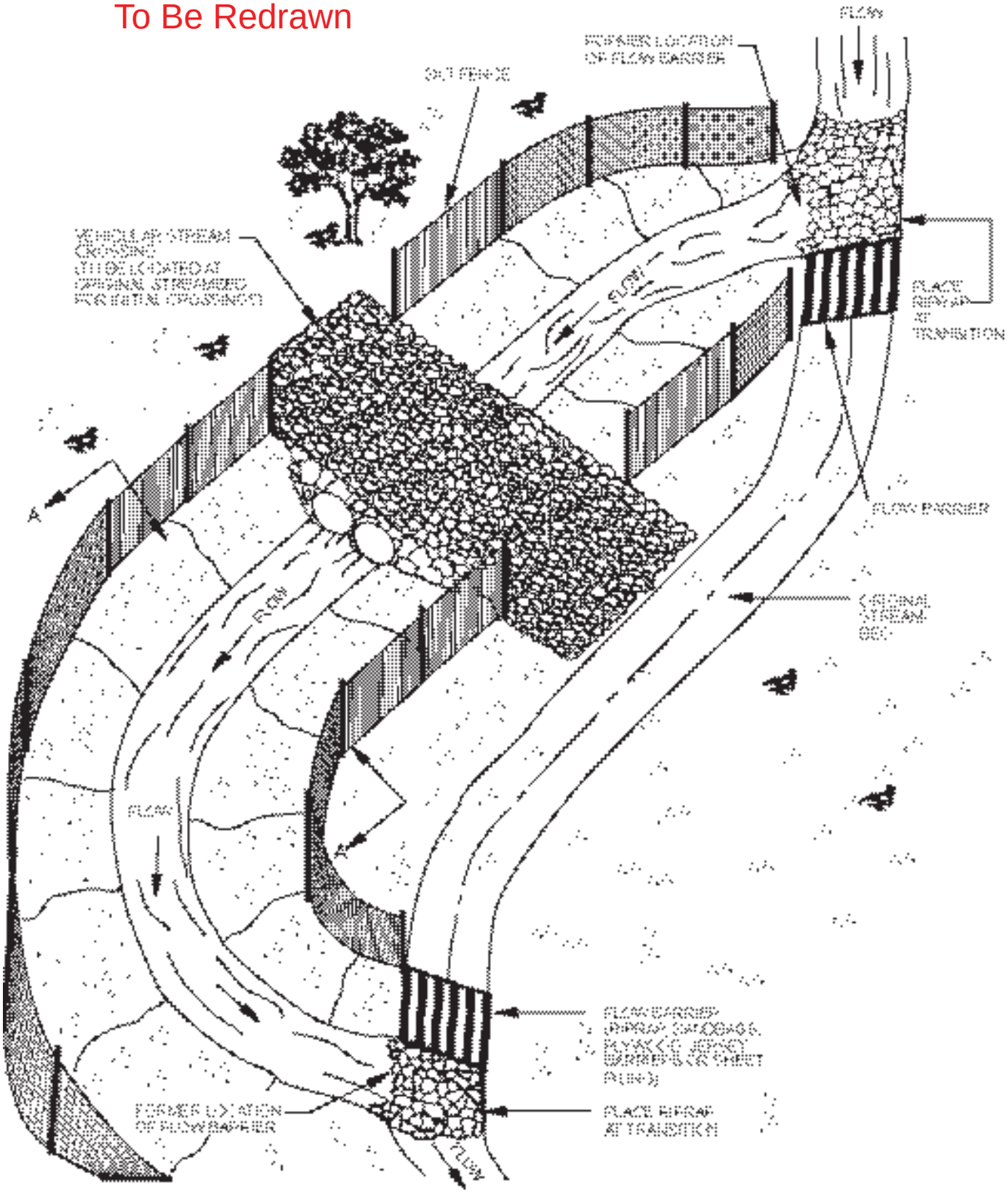


Figure 6-12.1. Stream Diversion Channel (perspective view)

To Be Redrawn

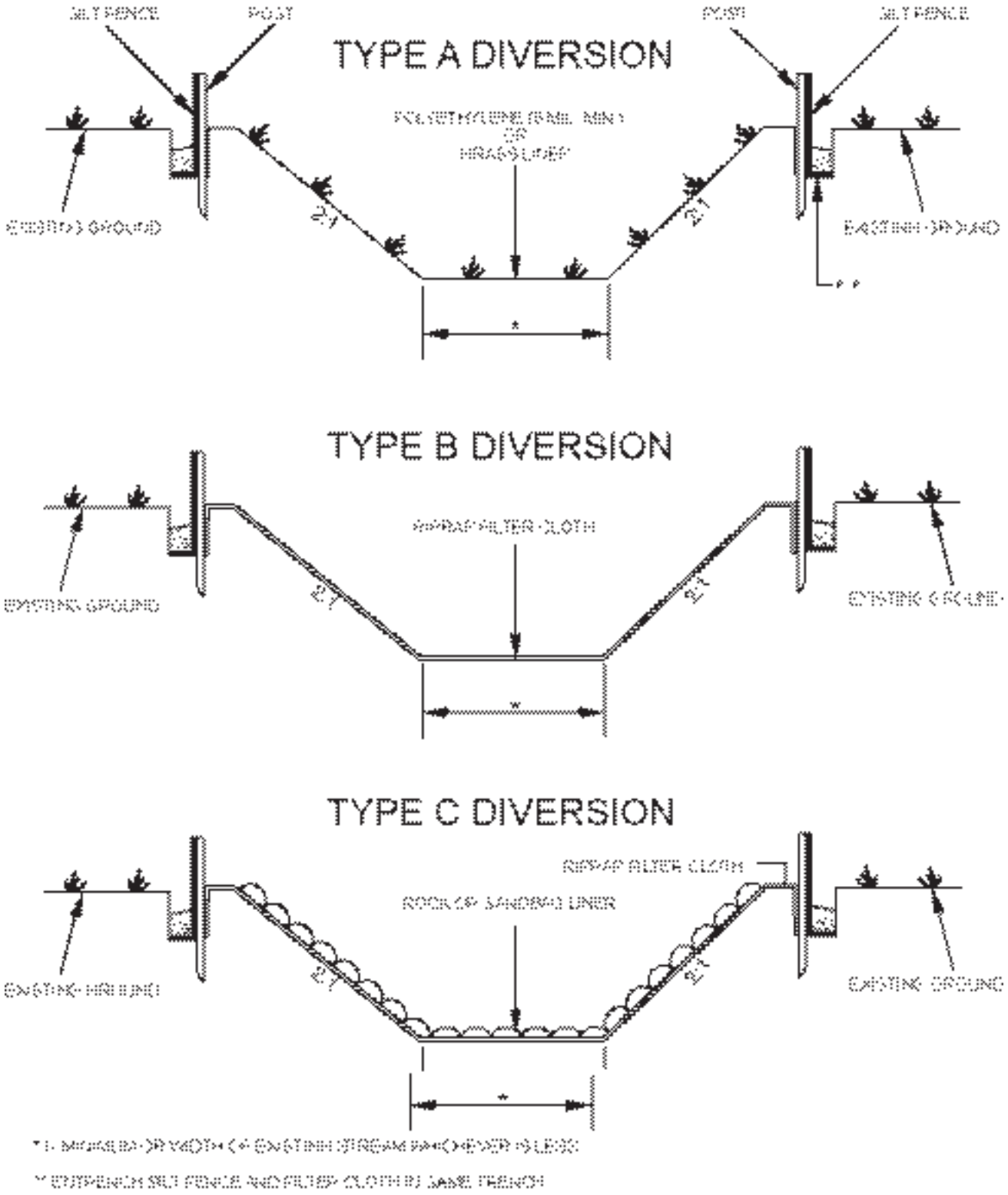


Figure 6-12.2. Stream Diversion Channel Linings

Diversion

Di

DEFINITION

A ridge of compacted soil, constructed above, across or below a slope.

PURPOSE

To reduce the erosion of steep, or otherwise highly erodible areas by reducing slope lengths, intercepting storm runoff and diverting it to a stable outlet at a non-erosive velocity.

CONDITIONS

Diversions are applicable when:

1. Runoff from higher areas is or has potential for damaging property, causing erosion, contributing to pollution, flooding, interfering with or preventing the establishment of vegetation on lower areas.
2. Surface and/or shallow subsurface flow is damaging sloping upland.
3. The length of slope needs to be reduced so that soil loss will be reduced to a minimum.

This standard applies to temporary and permanent diversions in developments involving land-disturbing activities.

DESIGN CRITERIA

Location

Diversion location shall be determined by considering outlet conditions, topography, land use, soil type, length of slope, seep planes (when seepage is a problem), and the development layout. Diversions should be tailored to fit the conditions for a particular field and local soil type(s).

A diversion consists of two components that must be designed - the ridge and the channel.

Ridge Design

The ridge shall be compacted and designed to have stable side slopes, which shall not be steeper than 2:1. The ridge shall be a minimum width of four feet at the design water elevation after settlement. Its design shall allow ten percent for settlement.

Channel Design

Land slope must be taken into consideration when choosing channel dimensions. On the steeper slopes, narrow and deep channels may be required. On the more gentle slopes, broad, shallow channels usually are applicable. The wide, shallow section will be easier to maintain. Since sediment deposition is often a problem in diversions, the designed flow velocity should be kept as high as the channel lining will permit.

Table 6-13.1 indicates the storm frequency required for the design of the diversion. The required storm frequency is based on the purpose of the diversion. The storm frequency is used to determine the required channel capacity, Q (peak rate of runoff).

The channel portion of the diversion may have a parabolic or trapezoidal cross-section. Detailed information for the design of these channels is provided in the specification **Wt - Stormwater Conveyance Channel**.

Outlets

Each diversion must have an adequate outlet. The outlet may be a constructed or natural waterway, a stabilized vegetated area or a stabilized open channel. In all cases, the outlet must discharge in such a manner as to not cause an erosion problem. Protected outlets shall be constructed and stabilized prior to construction of the diversion.

Stabilization

Channels shall be stabilized in accordance with item 5 of the construction specifications on page 6-94.

DIVERSIONS FOR ROADS AND UTILITY RIGHTS-OF-WAY

A detailed design is not required for this type of diversion. Diversions installed to divert water off a road or right-of-way shall consist of a series of compacted ridges of soil running diagonally across the road at a 30° angle. Ridges are constructed by excavating a channel up-stream for this type of diversion.

The compacted ridge height shall be 8-12" above the original road surface; the channel depth shall be 8-12" below the original road surface. Channel bottoms and ridge tops shall be smooth enough to be crossed by vehicular traffic. The maximum spacing between diversions shall be as follows:

Road Grade (Percent)	Distance Between Diversions (Feet)
1	400
2	250
5	125
10	80
15	60
20	50

Stable outlets shall be provided for each diversion.

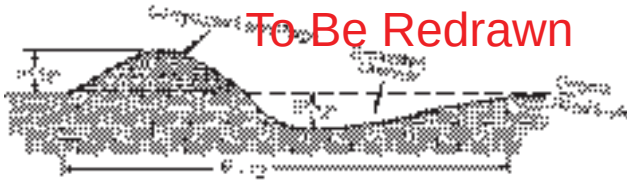


Figure 6-13.1. Typical Diversion Across Road

CONSTRUCTION SPECIFICATIONS

1. All trees, brush, stumps, obstructions, and other objectionable material shall be removed and disposed of so as not to interfere with the proper functioning of the diversion.

2. The diversion shall be excavated or shaped to line, grade, and cross section as required to meet the criteria specified herein and free of irregularities which will impede normal flow.

3. All fills shall be machine compacted as needed to prevent unequal settlement that would cause damage in the completed diversion.

4. All earth removed and not needed in construction shall be spread or disposed of so that it will not interfere with the functioning of the diversion.

5. Diversion channel shall be stabilized in accordance with specification **Ch - Channel Stabilization**.

Table 6-13.1. Diversion Design Criteria				
Diversion Type	**Land or Improvement Protected**	**Storm Frequency[1]**	**Freeboard**	**Minimum Top Width**
Temporary	Construction areas Building sites	10 yrs[2]	0.3’	4 feet
Permanent	Landscaped, recreation and similar areas.	25 yrs	0.3’	4 feet
	Dwellings, schools, commercial bldgs., and similar installations	50 yrs	0.5’	4 feet

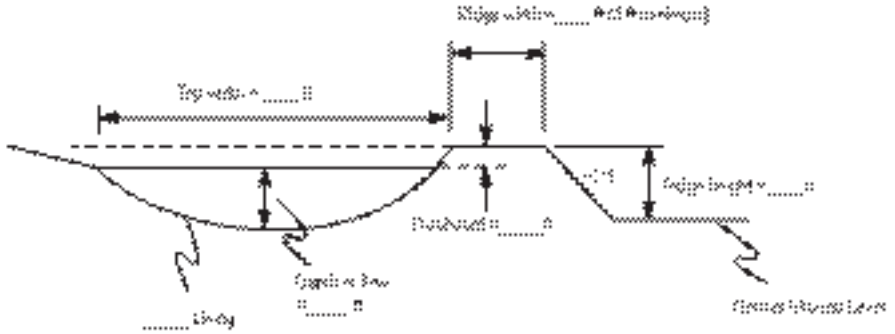
[1] Use 24-hr storm duration

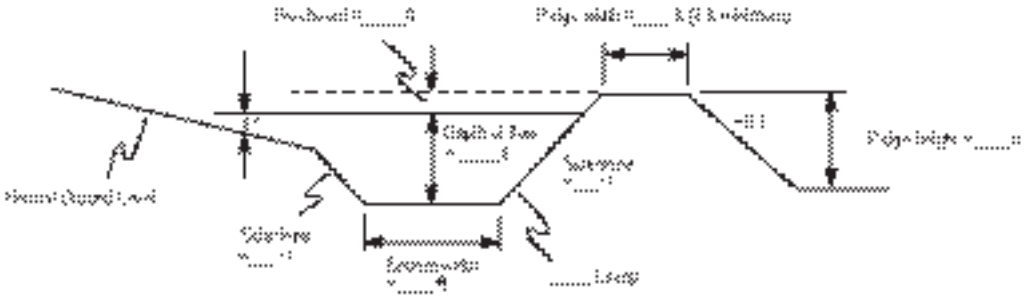
[2] Use 10 yrs or the storm for the storm frequency specified in Title 12 of the Official Code of Georgia Annotated

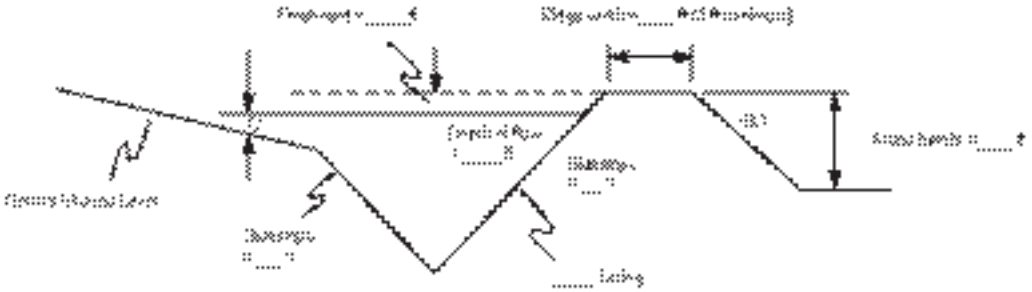
To Be Redrawn

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

Complete the appropriate detail drawing for the channel cross-section of choice:







Temporary Downdrain Structure

Dn1

DEFINITION

A temporary structure used to convey concentrated storm water down the face of cut or fill slopes.

PURPOSE

To safely conduct storm runoff from one elevation to another without causing slope erosion and allowing the establishment of vegetation on the slope.

CONDITIONS

Temporary downdrains are used on slopes where a concentration of storm water could cause erosion damages. **These structures are removed once the permanent stormwater disposal system is installed.**

DESIGN CRITERIA

Formal design is not required. The following standards shall be used:

Placement

The temporary downdrain shall be located on undisturbed soil or well-compacted fill.

Table 6-14.1. Pipe Diameter for Temporary Downdrain Structure

Maximum Drainage Area Per Pipe (acre)	Pipe Diameter (inches)
0.3	10
0.5	12
1.0	18

Diameter

The diameter of the temporary downdrain shall provide sufficient capacity required to convey the maximum runoff expected during the life of the drain. Refer to Table 6-14.1 for selecting pipe sizes.

Downdrain Inlet and Outlet

Diversions are used to route runoff to the downdrain's Tee or "L" inlet at the top of the slope. Slope the entrance 1/2" per foot toward the outlet. Thoroughly compact selected soil around the inlet section to prevent the pipe from being washed out by seepage or piping. A stone filter ring or check dam may be placed at the inlet for added sediment filtering capacity. Refer to **Cd - Check Dam** and **Fr - Stone Filter Ring**. These sediment filtering devices should be removed if flooding or bank overwash occurs.

Rock riprap shall be placed at the outlet for energy dissipation. A Tee outlet, flared end section, or other suitable device may be used in conjunction with the riprap for additional protection. See Figure 6-14.1. Refer to **St - Storm Drain Outlet Protection**.

Pipe Material

Design the slope drain using heavy-duty, flexible materials such as non-perforated, corrugated plastic pipe or specially designed flexible tubing. Use reinforced, hold-down grommets or stakes to anchor the pipe at intervals not to exceed 10 feet with the outlet end securely fastened in place. The pipe must extend beyond the toe of the slope.

CONSTRUCTION SPECIFICATIONS

A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. This creates voids from consolidation and piping causes washouts. Proper backfilling around and under the pipe "haunches" with stable soil material and hand compacting in 6-inch lifts to achieve firm contact between the pipe and the soil at all points will eliminate this type of failure.

1. Place slope drains on undisturbed soil or well-compacted fill at locations and elevations shown on the plan.

2. Slightly slope the section of pipe under the dike toward its outlet.

3. Hand tamp the soil under and around the entrance section in lifts not to exceed 6 inches.

4. Ensure that fill over the drain at the top of the slope has minimum dimensions of 1.5 ft. depth, 4 ft. top width, and 3:1 side slopes.

5. Ensure that all slope drain connections are watertight.

6. Ensure that all fill material is well-compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 feet apart.

7. For slopes steeper than 2:1, slope drains should be placed diagonally ~~Place the drain slightly diagonally~~ across the slope, extending the drain beyond the toe of the slope. Curve the outlet uphill and adequately protect the outlet from erosion.

8. If the drain is conveying sediment-laden runoff, direct all flows into a sediment trap or sediment basin.

9. Make the settled, compacted dike ridge no less than one foot above the top of the pipe at every point.

10. Immediately stabilize all disturbed areas following construction.

MAINTENANCE

Inspect the slope drain and supporting diversion after every rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized and the permanent stormwater disposal system is fully functional, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately. Refer to specifications **Ds3** and **Ds4 - Disturbed Area Stabilization (With Permanent Vegetation and Sodding)**, respectively, and **Ss - Slope Stabilization Product**..

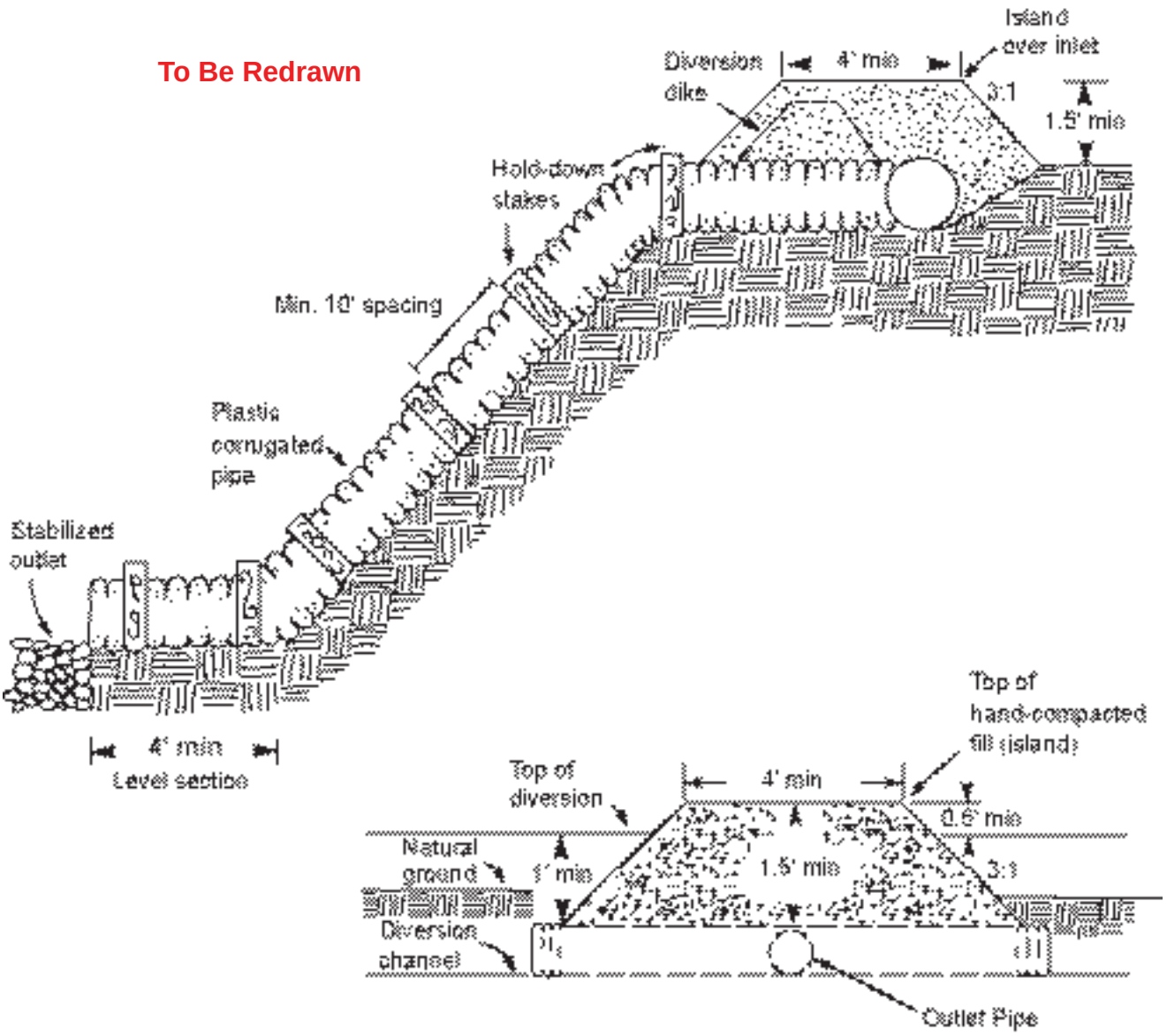
TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. **The drainage area for each downdrain**, in acres.

2. **The diameter of each downdrain**, in inches, based on Table 6-14.1.

3. **The dimensions of the outlet protection**, including flow rate, velocity, and apron length, upstream and downstream widths, average stone diameter and depth.

To Be Redrawn



Inlet Detail

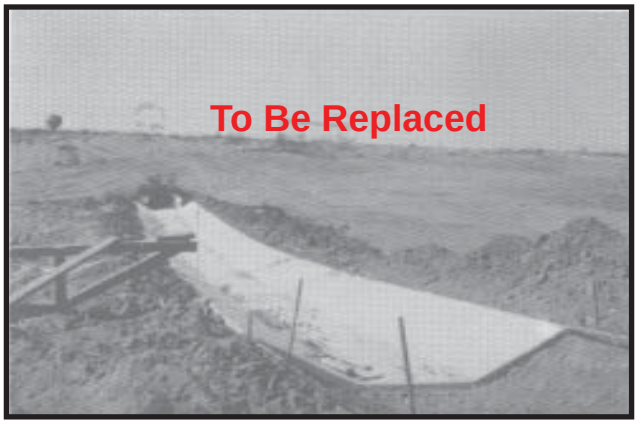
Make all pipe connections watertight and secure so that the joints will not separate in use.

DOWNDRAIN PIPE AND INLET DETAIL

Figure 6-14.1

Permanent Downdrain Structure

Dn2



DEFINITION

A permanent structure to safely convey surface runoff from the top of a slope to the bottom of the slope.

PURPOSE

The purpose of this standard is to convey storm runoff safely down cut or fill slopes to minimize erosion.

CONDITIONS

Several types of structures may be used as a permanent downdrain. All structures shall satisfy the standards and specification set forth by the Georgia Department of Transportation. The following types of structures may be used:

Paved Flume

The paved flume may have a parabolic, rectangular or trapezoidal cross-section.

Pipe

The pipe may be constructed of materials including steel, plastic, etc..

Sectional

A prefabricated sectional conduit of half round or third round pipe may be used.

Downdrain structures are to be used where concentrated water will cause excessive erosion on cut and fill slopes.

DESIGN CRITERIA

Permanent downdrain structures should be designed by professionals familiar with these structures.

Capacity

Flumes shall be adequately designed to safely convey runoff water concentrations down steep slopes based on a minimum 25-year, 24-hour storm in accordance with criteria in Appendix A of this manual.

Slope

The slope shall be sufficient to prevent the deposition of sediment.

Outlet Stabilization

Outlets must be stabilized using criteria in **St - Storm Drain Outlet Protection**.

MAINTENANCE

Inspect for damage after each rainfall.

Filter Ring

Fr

DEFINITION

A temporary stone barrier constructed at storm drain inlets and pond outlets.

PURPOSE

This structure reduces flow velocities, preventing the failure of other sediment control devices. It also prevents sediment from leaving the site or entering drainage systems, prior to permanent stabilization of the disturbed area.

CONDITIONS

Filter rings shall be used in conjunction with other sediment control measures, except where other practices defined in this manual are not appropriate (such as inlets to concrete flumes). They can be installed at or around devices such as inlet sediment traps, temporary downdrain inlets, and detention pond retrofits to provide additional sediment filtering capacity.

DESIGN CRITERIA

Formal design is not required. The following standards shall be used:

Location

The filter ring shall surround all sides of the structure receiving runoff from disturbed areas. It should be placed a minimum of four feet from the structure. The ring is not intended to substantially impound water, causing flooding or damage to adjacent areas.

The filter ring may also be placed below storm drains discharging into detention ponds, creating a centralized area, or “forebay”, for sediment accumulation. This provides for easier, more localized clean-out of the pond. If utilized above a retrofit structure, it should be a minimum of 8 to 10 feet from the retrofit.

Stone Size

When utilized at inlets with diameters less than 12 inches, the filter ring shall be constructed of stone no smaller than 3-5 inches (15 - 30 lbs.).

When utilized at pipes with diameters greater than 12 inches, the filter ring shall be constructed of stone no smaller than 10-15 inches (50 - 100 lbs.).

The larger stone can be faced with smaller filter stone on the upstream side for added sediment filtering capabilities. However, the smaller filter stone is more prone to clogging, requiring higher maintenance.

Height

The filter ring shall be constructed at a height no less than two feet from grade.

CONSTRUCTION SPECIFICATIONS

Mechanical or hand placement of stone shall be required to uniformly surround the structure to be supplemented. Refer to Appendix C for rock riprap specifications.

The filter ring may be constructed on natural ground surface, on an excavated surface, or on machine compacted fill.

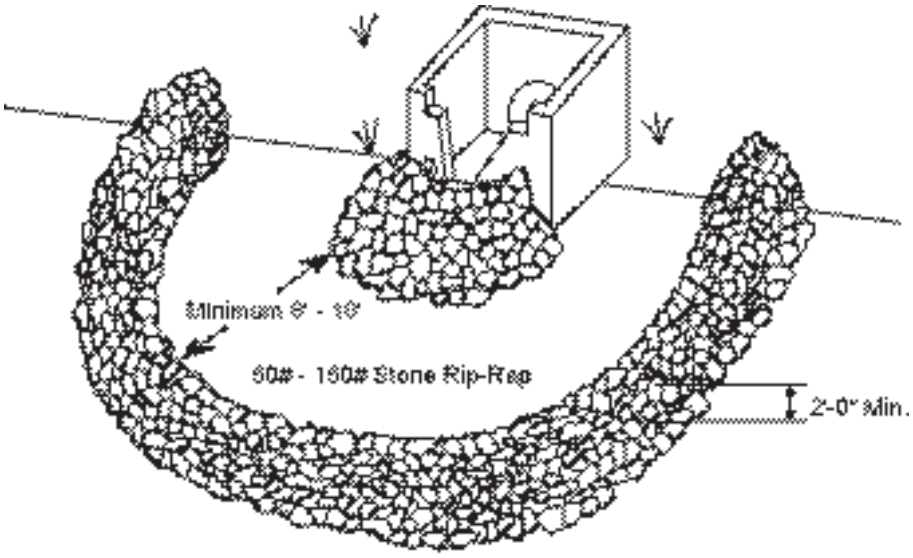
A common failure of filter rings is caused by their placement too close or too high above the structure it is enhancing. When utilized below a

storm drain outlet, it shall be placed such that it does not create a condition causing water to back-up into the storm drain and inhibit the function of the storm drain system.

MAINTENANCE

The filter ring must be kept clear of trash and debris. This will require continuous monitoring and maintenance, which includes sediment removal when one-half full. Structures are temporary and should be removed when the land-disturbing project has been stabilized.

To Be Redrawn

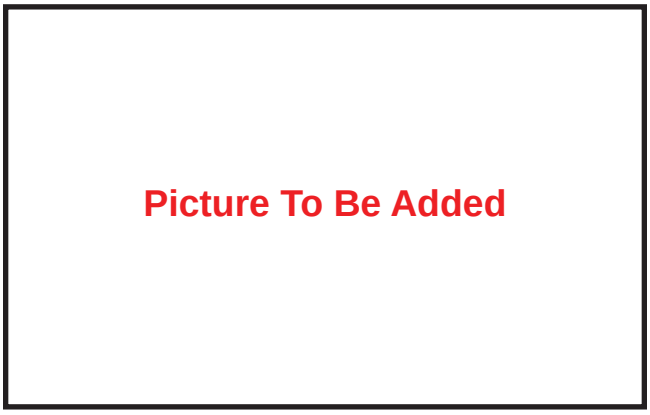


STONE FILTER RING

Figure 6-15.1

Floating Surface Skimmer

Fss



DEFINITION

A floating surface skimmer is a buoyant device that releases/drains water from the surface of sediment ponds, traps or basins at a controlled rate of flow. It "skims", or dewaters, from the water surface where sediment concentrations are at a minimum in the water column instead of draining from the bottom where sediment concentrations are their highest, and drains to a riser or the backside of a dam.

Floating surface skimmers release a low rate of flow draining the basin slowly at a constant rate. The inlet of the skimmer device is sized according to the basin volume and designed to drain the basin in a fixed amount of time. Traditional sediment basin outlet designs use a perforated riser for dewatering, which allows water to leave the basin from all depths.

PURPOSE

-To discharge clearer water from the surface of a sediment pond, trap or basin at a relatively uniform rate, rather than the more turbid and sediment-laden water from lower depths that is discharged through a traditional perforated riser;

-To reduce the retention time associated with meeting a desired water quality standard for discharge from a sediment pond, trap or basin.

CONDITIONS

The current principal spillway of most sediment basins is a vertical riser pipe. Water discharges through 1/2 inch perforated holes in the bottom half of the riser. Holes at lower elevations discharge water that has a high turbidity value. The bottom half of the riser is typically covered with 2 feet of ½- to ¾-inch gravel. Over time, the gravel filter surrounding the riser is coated with sediment that traps and detains water in the basin. This reduces the storage capacity for incoming runoff. Sediment in the trapped water is resuspended with each new inflow, and never has the opportunity to settle to the bottom. traps and detains water in the basin. This reduces the storage capacity for incoming runoff. Sediment in the trapped water is resuspended with each new inflow, and never has the opportunity to settle to the bottom.

DESIGN CRITERIA

A surface skimmer (FSS) replaces the riser pipe as the principal spillway, but DOES NOT REPLACE THE EMERCENCY OVERFLOW SPILLWAY. The skimmer only drains the basin from the crest of the emergency overflow spillway down to the bottom. Its flow capacity is too small to accommodate extreme storm events that exceed the available storage capacity, so an emergency spillway is required.

When rainfall events occur, the water level in the basin rises. Under the influence of gravity, sediment settles slowly toward the bottom, leaving clearer water at the surface. The skimmer floats at the surface as the water surface rises and discharges the cleaner water at a relatively uniform rate. By draining from the surface a skimmer can immediately begin removing relatively clear water from the pond, trap or basin, and thereby reduce the retention times as compared to using traditional outlets.

Figure 1. Floating Skimmers of Different Designs

Product Designs

One end of a rigid tube is connected to the barrel of the discharge system via a flexible coupling. The other end of the tube floats at the water surface. The flexible coupling allows the rigid tube to articulate as the water level changes. A screen at the inlet prevents floating trash from entering the tube. Each product (and each product size) has a unique design, including the associated hydraulics that are affected by the floatation, inlet, and connecting tube/coupling designs chosen. The discharge rate is dependent on the specific product design and can only be determined through product-specific testing as discussed in Appendix A.

Dewatering Rates.

Skimmers come in several sizes to accommodate a range of flows. The plans shall indicate a volume to be drained in a specified time period. A skimmer is then selected to satisfy this requirement. Appendix B presents a typical skimmer selection table based on product-specific testing in accordance with Appendix A.

Floatation Requirements

Floating surface skimmers which sink or completely suspend under the water surface are not acceptable. A portion of the skimmer must be visible above the water surface at all times. Vent holes are required on all skimmers to ensure the device drains by gravity flow. Inlets or orifices to the skimmer may be submerged no greater than 6 inches below the water surface. This should be verified as inherent to the product design during flow testing.

Trash Guard & Maintenance Rope

All Floating surface skimmer designs include a trash guard and maintenance rope in order to prevent and remove blockage from floating debris. Trash guards prevent larger debris from entering the skimmer which may cause internal blockage. The maintenance rope is used to remove trash and debris which accumulates on the outside of the trash guard. Ensure the maintenance rope is floatable.

Skimmer Pit

Excavate a shallow pit filled with riprap under the floating surface skimmer to account for sediment that accumulates on the sediment basin bottom around the skimmer. The pit allows the skimmer to completely drain the basin. At a minimum, the pit has dimensions of 4ft x 4ft with a minimum depth of 2 ft. Ensure the bottom of the pit is lower than the invert of the outlet barrel from the riser. Floating Skimmers that have a footed design which prevents the device from lodging in accumulated sediment do not require a skimmer pit.

CONSTRUCTION SPECIFICATIONS

Materials

Use floating surface skimmers made of PVC materials (Schedule 40 or greater).

Quality Assurance

At the time of delivery, provide a packing list containing complete identification, including but not limited to the following:

- •Manufacturer's name and location.
- •Manufacturer's telephone number and fax number.
- •Manufacturer's e-mail address and web address.
- •Skimmer name, model, and/or serial number.
- •Skimmer dimensions.
- •Certification that the skimmer meets the physical and performance criteria of this specification.

Installation

Install the device according to the manufacturer's instructions.

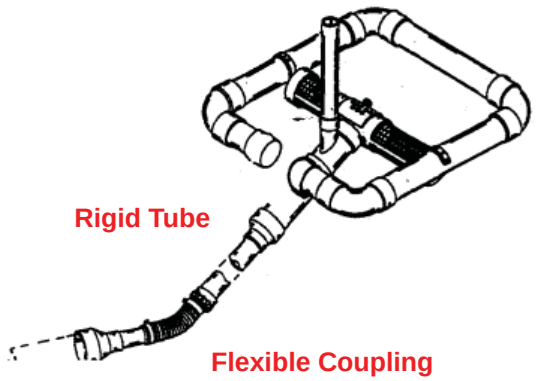


Figure 2. Skimmer Components

ADDITIONAL INFORMATION

A shut-off valve to regulate the flow discharge rate, installed at the discharge end of the barrel as it exits the embankment is recommended. A storm drain outlet protection device shall be installed at the barrel discharge point.

MAINTENANCE

Inspect Floating Skimmers together with the Sediment Basin inspections. Inspect the floating surface skimmer for any structural damage, clogging, or excessive sediment accumulation.

While draining the basin, the trash guard of the skimmer may clog with debris. Typically, a few jerks on the maintenance rope will clear the skimmer of debris and restore flow. If jerking the maintenance rope does not work, pull the skimmer to the embankment with the maintenance rope and manually remove all debris from the trash guard. An internal clog or blockage may require the device to be disassembled and repaired.

If the skimmer becomes stuck in the mud at the bottom of the basin it must be freed to allow for normal operation. This can typically be done by use of the maintenance rope.

Remove sediment deposits from the basin when approximately one-third of the storage volume has been lost to sediment accumulation or when the floating skimmer cannot settle low enough to drain the entire basin. Remove or pull the skimmer to a side embankment using the maintenance rope and remove sediment from the skimmer pit.

The skimmer remains the property of the contractor and may be used in other locations provided the materials meet the appropriate requirements contained in the Specification and/or on the Plans.

TO BE SHOWN ON THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN

When a FLOATING SURFACE SKIMMER is used, show the followin information along with each sediment pond, trap or basin being used on the site:

1. Pond, trap or basin size (length x width x depth) = _____

2. Time to - Drain (hrs) = _____

Gabion

Ga

DEFINITION

Gabions are large, multi-celled, welded wire or rectangular wire mesh boxes, used in channel revetments, retaining walls, abutments, check dams, etc.

PURPOSE

Rock-filled baskets, properly wired together, form flexible monolithic building blocks used for construction of erosion control structures. Gabions are used to stabilize steep or highly erosive slopes.

DESIGN CRITERIA

Construction plans and drawings should be prepared by professionals familiar with the use of gabions. Erosion and sediment control construction design should ensure that foundations are properly prepared to receive gabions, that the gabion structure is securely "keyed" into the foundations and abutment surfaces, and that rock used is durable and adequately sized to be retained in the baskets.

CONSTRUCTION SPECIFICATIONS

How the Gabion is Filled

The gabion is usually filled with 4 - 8 inch pieces of stone, preferably placed by hand, but sometimes dumped mechanically, into the basket. Hand-packing allows the complete filling of the basket; allowing the basket to gain strength and maintain its integrity. The filled gabion then becomes a large, flexible, and permeable building block from which a broad range of structures may be built. This is done by setting and wiring individual units together in courses and filling them in place. Details are provided by the manufacturer.

Geotextiles

It is recommended that geotextiles be used behind all gabion structures. Geotextiles shall be specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control Requirements*.

If there is seepage flow or unidirectional flow from the protected soil mass, the appropriate geotextile should be selected based on an appropriate filter design to prevent the build-up of hydrostatic pressure behind the geotextile.

Corrosion Resistance of Gabions

The wire mesh or welded wire used in gabions is heavily galvanized. For highly corrosive conditions, a PVC (polyvinyl chloride) coating must be used over the galvanizing. Such treatment is an economical solution to deterioration of the wire near the ocean, in some industrial areas, in polluted streams, and in soils such as muck and peat. However, extra care should be taken during construction and installation because the corrosion resistance of the baskets is compromised if the PVC coating is chipped-off. Also, baskets manufactured completely of plastic are available.

Flexibility

An outstanding advantage of the gabion is its flexibility of application. This property is especially important when a structure is on unstable ground or in areas where scour from waves or currents can undermine it.

Durability

Gabions are durable because they support plant growth which develops a living coating for the wire mesh and stones. After the first few years, the strength of the structure may be enhanced by the soil, silt, and roots that fill the voids between the individual stones.

Strength

Steel wire baskets have the strength and flexibility to withstand forces generated by water and earth masses. Also, the pervious nature of the gabion allows it to absorb and dissipate much of the energy developed. This is particularly so on coast protection installations where a compact gabion structure often remains long after a massive rigid structure fails.

Permeability

Hydrostatic heads do not develop behind a gabion wall. The wall is pervious to water and stabilizes a slope by the combined action of draining and retaining. Drainage is accomplished by gravity and by evaporation as the porous structure permits active air circulation through it. Moreover, as plant growth invades the structure, transpiration further assists in removing moisture from the backfill. This system is much more efficient than weep holes in standard masonry walls.

Economy

Gabion installations are more economical than rigid or semi-rigid structures for a number of reasons. The following are among the more important ones.

- Little maintenance is required.
- Gabion construction is simple and does not require skilled labor.
- Preliminary foundation preparation is unnecessary; the surface needs only to be reasonably level and smooth.
- No costly drainage provision is required because of the gabion's porosity.

Landscaping

Because gabions permit the growth of natural vegetation and maintain the natural environment of the area, they provide attractive and natural building blocks for decorative landscaping.

They can be used effectively and economically in parks, along highways, including use as a sound barrier, and around bridge approaches to create walkways, rock gardens, patios, and terraces ... to beautify the banks of lakes and ponds ... to accent trees and other plantings.

In fact, their application to decorative landscaping is limited only by the ingenuity of the landscaper.

Typical Installations

- ~~River training and~~ flood control:
  Gabion aprons
  Longitudinal works
  Training walls
  Revetments
  Bank paving
  Counterforts
  Drop structures or weirs
  Spurs, spur dikes, or groins
- Channel linings
- Retaining walls
- Bridge abutments and wings
- Marinas and boat ramps
- Culvert headwalls and outlet aprons
- Shore and beach protection

MAINTENANCE

Periodic inspection should be performed for signs of undercutting or excessive erosion at transition areas.

Source: National Crushed Stone Association

Grade Stabilization Structure

Gr

DEFINITION

A structure to stabilize the grade in natural or artificial channels.

PURPOSE

Grade stabilization structures are installed to stabilize the grade in natural or artificial channels, prevent the formation or advance of gullies, and reduce erosion and sediment pollution.

CONDITIONS

This standard applies to sites where structures are needed to stabilize channel grades but does not apply to sites where water is to be impounded.

DESIGN CRITERIA

Structures

Structures constructed of concrete, rock, masonry, steel, aluminum or treated wood or by soil bioengineering methods shall be designed in accordance with sound engineering practices. Design data for small reinforced concrete drop spillways and formless concrete chute spillways are contained herein.

Geotextile should be placed under stabilization structures such as revetment mats and riprap as part of a permanent erosion control system. The geotextile should be selected/specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control*.

Table 6-16.1

Adjacent Area	Storm Frequency
Residences, commercial buildings, recreational buildings, etc.	100 - year, 24 - hour storm
Recreation and landscaped areas	25 - year[2], 24 - hour storm[1]
Agricultural land	25 - year[2], 24 - hour storm[1]

[1] 50 percent of peak flood flow may be carried around island-type structures provided overbank flow damage from erosion and flooding can be tolerated. Peak flood flow will be determined by methods contained in Appendix A.

[2] Or the storm frequency specified in Title 12 of the Official Code of Georgia Annotated.

Capacity

The condition of adjacent areas is considered when determining the storm frequency used to design the grade stabilization structure. Structures shall be designed to protect areas from overbank flow damage up to and including storm frequencies specified in Table 6-16.1.

Embankment

Earthfill embankments shall have a minimum top width of 10 feet and side slopes of 3:1 or flatter.

Keyway

A keyway no less than 8 feet wide and 2 feet deep shall be constructed along the centerline of the structure and embankment.

Outlet

All structures shall discharge into stable

outlets.

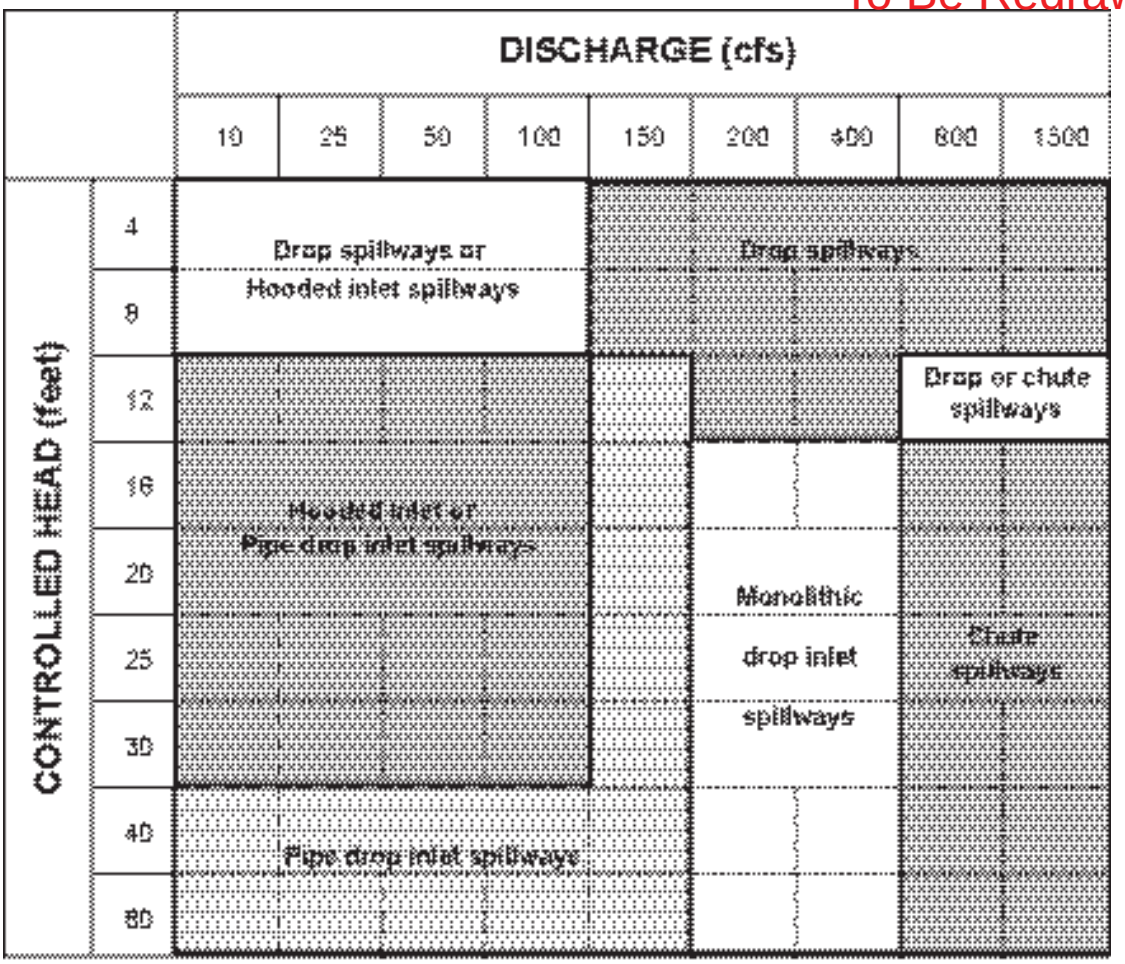
CONSTRUCTION SPECIFICATIONS

Excavations shall be dewatered prior to filling.

Structures shall be placed on compacted earthfill. Earthfill material shall be moderately to slowly permeable with the most plastic being used in the center of the embankment and adjacent to structures. Materials shall be constructed in 6 - 8 inch horizontal lifts and compacted to approximately 95% of standard density. The embankment shall be overbuilt 10% in height to allow for settlement. Embankment surfaces shall be completed to the required lines and grades.

Protective cover shall be applied immediately after completion of the structure. Refer to specifications **Ds3** and **Ds4 - Disturbed Area Stabilization (With Permanent Vegetation and Sodding)**, respectively, and **Ss - Slope Stabilization Product**.

To Be Redrawn



Note: Chart shows most economical structure as related to discharge and controlled head providing site conditions are adequate.

Figure 6-16.1

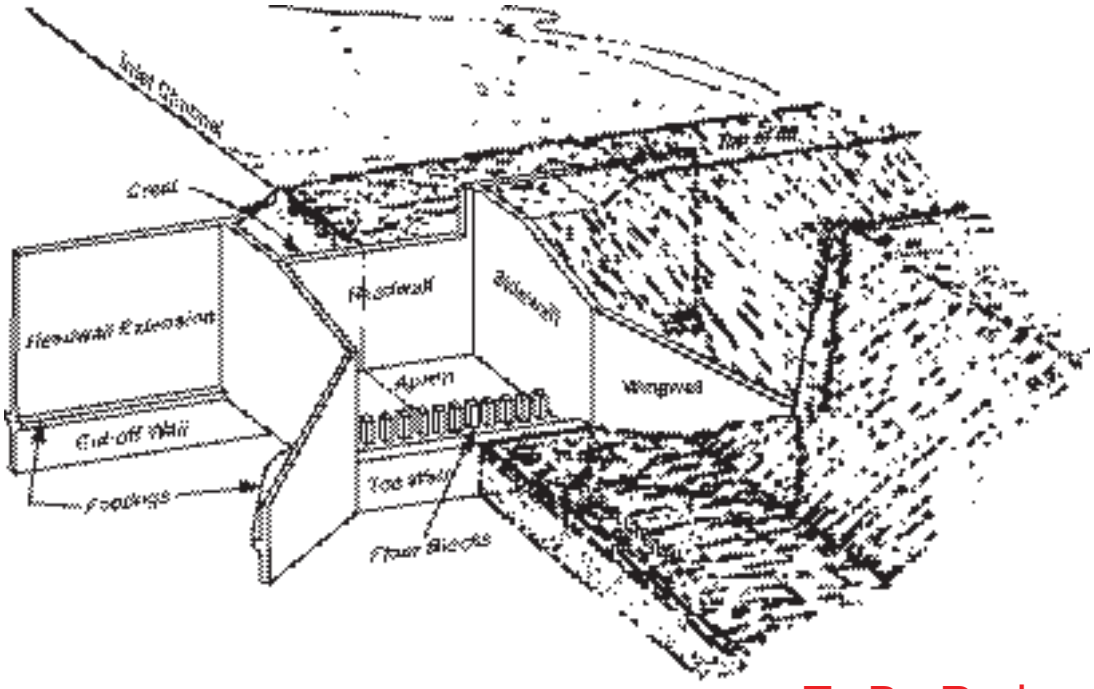


Figure 6-16.2

Planning and design of straight drop spillways normally require the assistance of an engineer. Local personnel may be trained to plan and install small drop spillway structures when standard plans are available.

Measurement locations for symbols F (overfall in feet), h (depth of weir in feet), s (depth of stilling pool in feet), and L (length of weir in feet) are shown in Figure 6-16.3

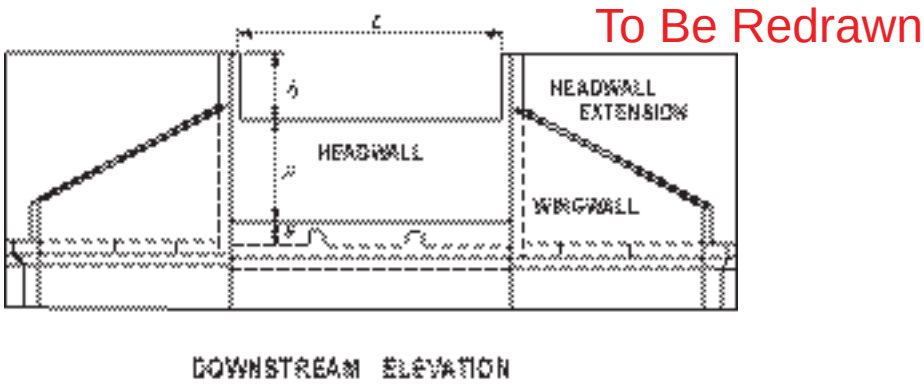
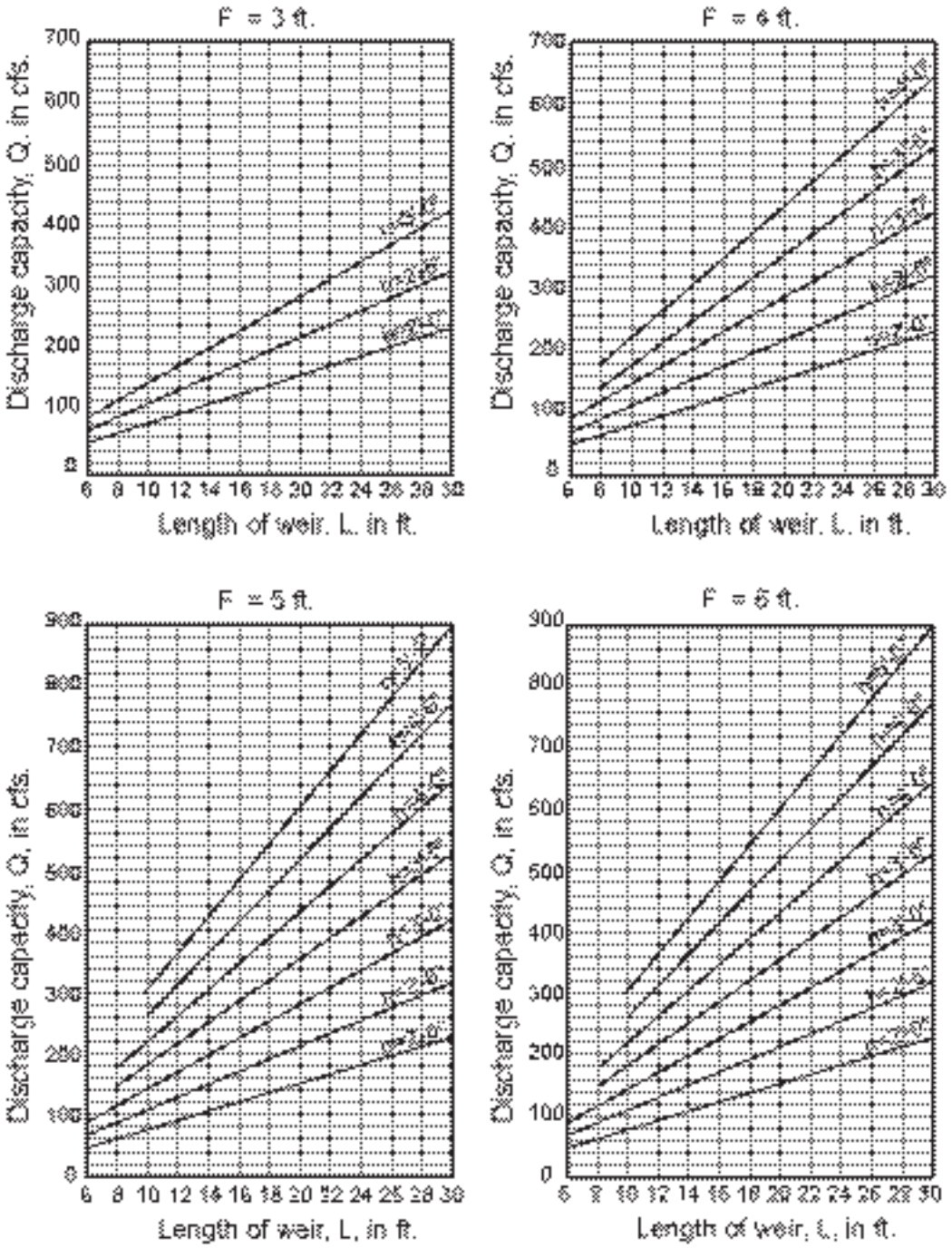


Figure 6-16.3 - Symbols For Straight Drop Spillway

Weir capacities for low-overall straight drop spillways can be determined from figure 6-16.4 for various combinations of F, h, and L.

To Be Redrawn



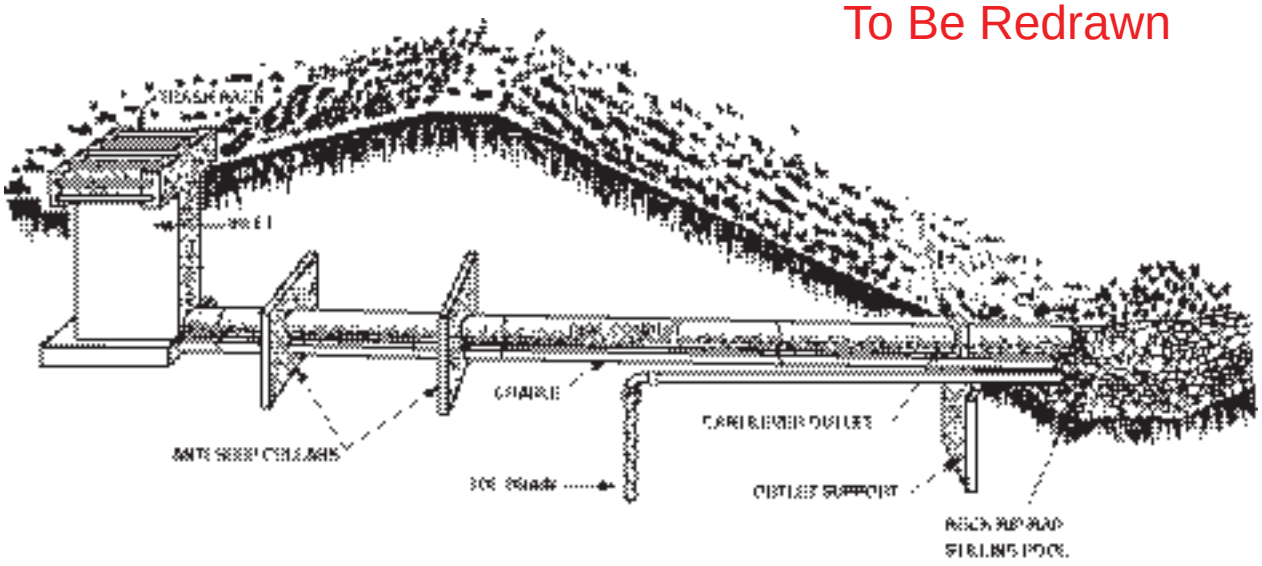
Note: h = total depth of weir, in feet (including freeboard)
c = net drop from crest to top of transverse sill, in feet
(For type B drops keep h ÷ F less than 0.75)

$$Q = \frac{3.1\,L\,h^{3/2}}{(1.50 + 0.01\,F)}$$

WEIR CAPACITY FOR STRAIGHT DROP SPILLWAYS

Figure 6-16.4

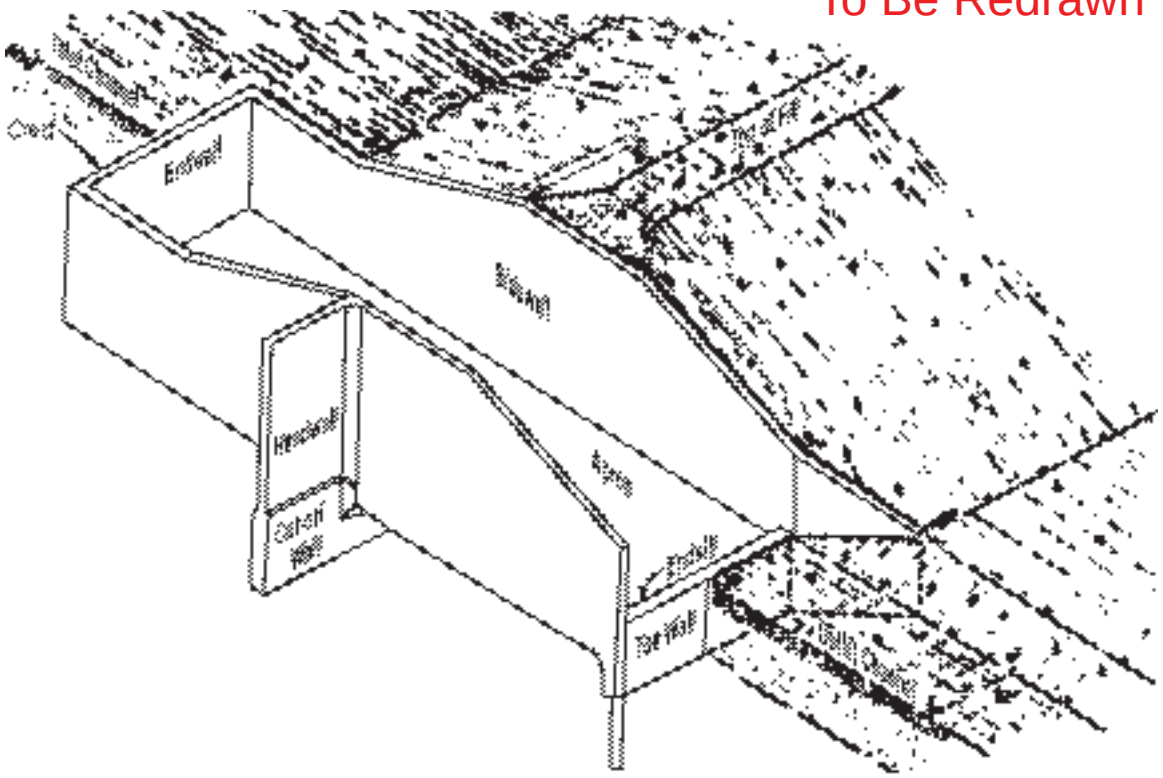
To Be Redrawn



DROP INLET SPILLWAY

Figure 6-16.5

To Be Redrawn



BOX INLET DROP SPILLWAY

Figure 6-16.6

To Be Redrawn

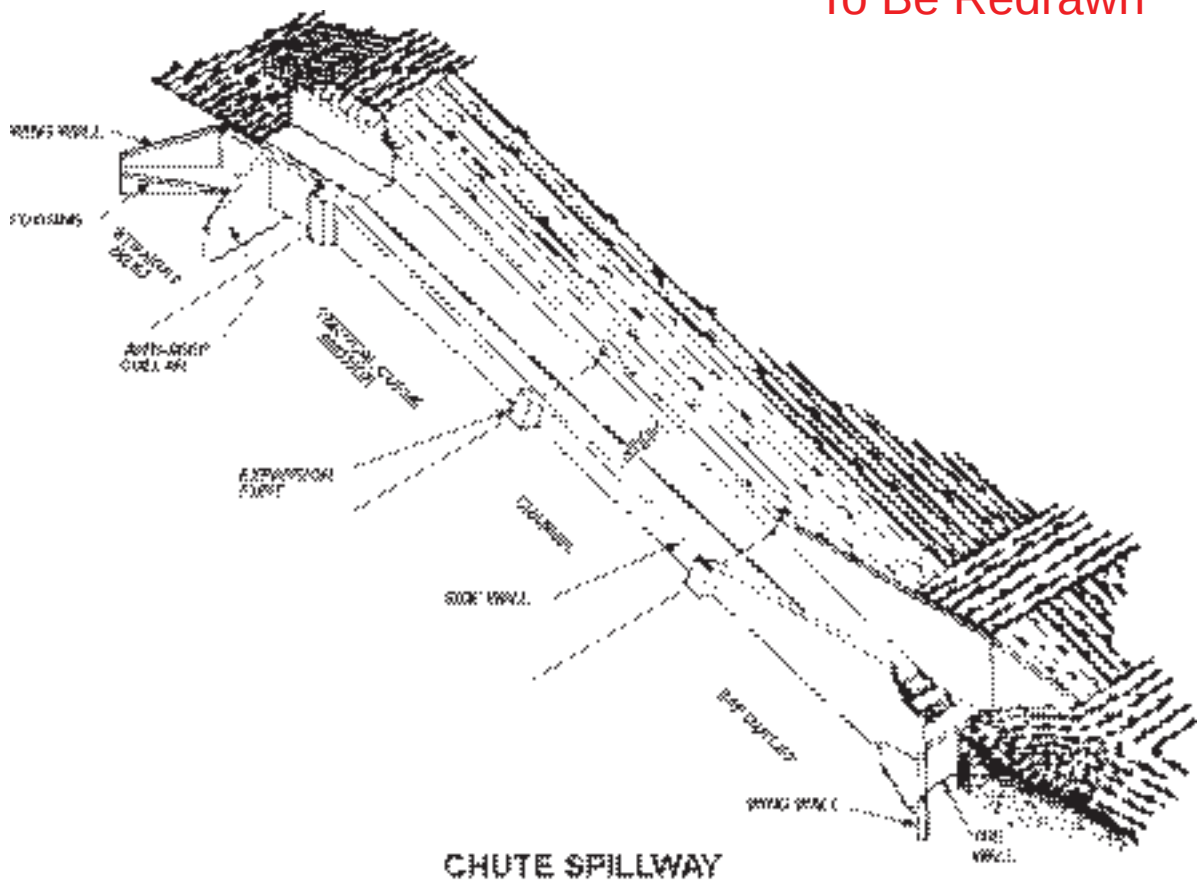


Figure 6-16.7

To Be Redrawn

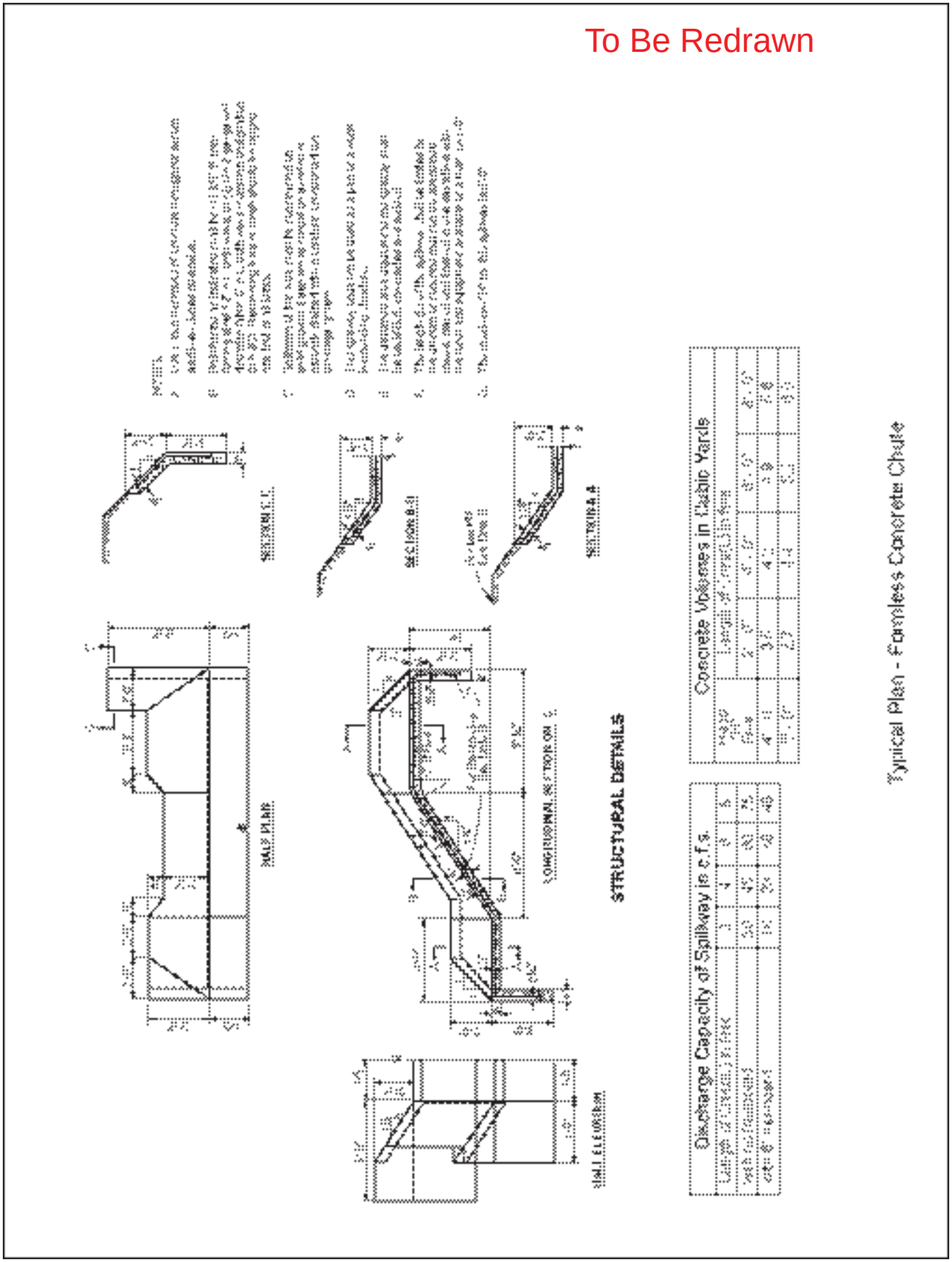
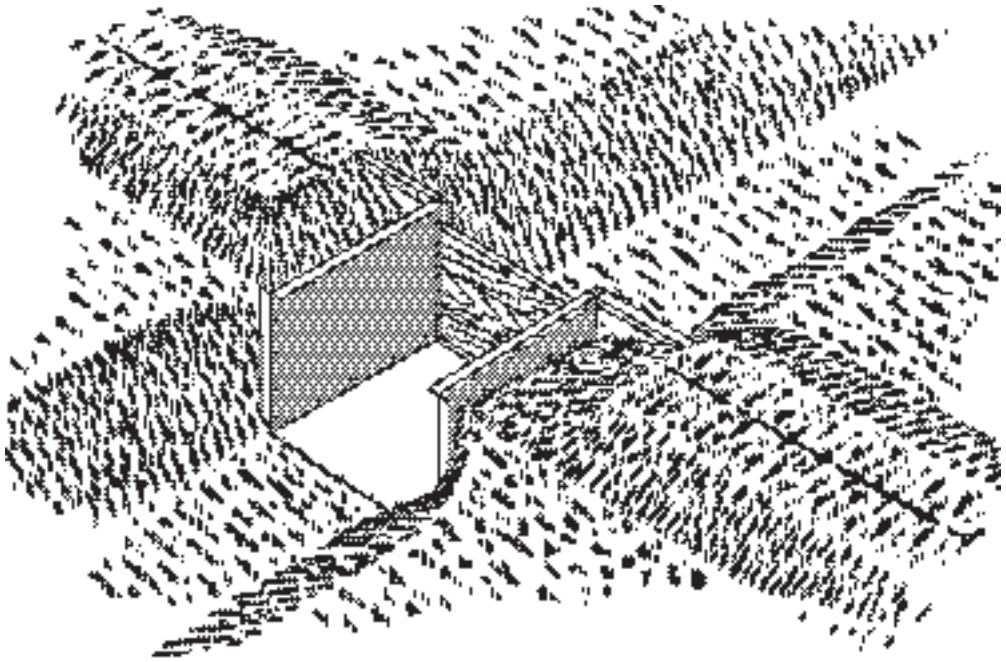


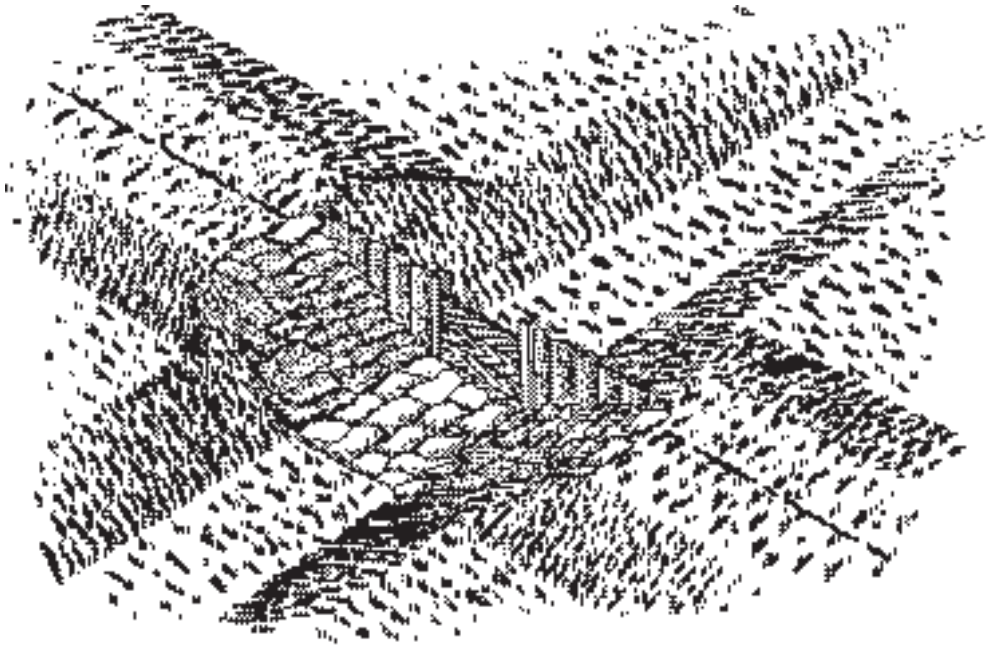
Figure 6-16.8



PREFABRICATED METAL STRUCTURE

Figure 6-16.9

To Be Redrawn



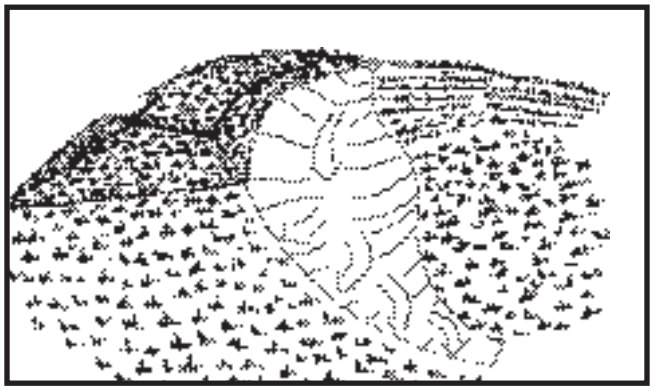
SHEET PILING HEADWALL WITH SAND-CEMENT BAG SIDEWALLS AND APRON.

SMALL, LOW COST WATER CONTROL STRUCTURES

Figure 6-16.10

Level Spreader

Lv



DEFINITION

A storm flow outlet device constructed at zero grade across the slope whereby concentrated runoff may be discharged at non-erosive velocities onto undisturbed areas stabilized by existing vegetation.

PURPOSE

To dissipate storm flow energy at the outlet by converting storm runoff into sheet flow and to discharge it onto areas stabilized by existing vegetation without causing erosion.

CONDITIONS

Where sediment-free storm runoff is intercepted and diverted onto undisturbed stabilized areas (*i.e.*, at diversion outlets, etc.). This practice applies only in those situations where the spreader can be constructed on undisturbed soil and where the area directly below the level lip is stabilized by existing vegetation. The water must not be allowed to reconcentrate below the point of discharge.

DESIGN CRITERIA

Length

A specific design for level spreaders will not be required. However, spreader length will be determined by estimating the peak stormflow from the 10-year, 24-hour storm or the storm specified in Title 12 of the Official Code of Georgia Annotated and selecting the appropriate length from Table 6-17.1.

Table 6-17.1

Designed Q10/24 (cfs)	**Minimum Length "L"** (feet)
up to 10	10
11 to 20	20
21 to 30	30
31 to 40	40
41 to 50	50

Outlets

Final discharge will be over the level lip onto an undisturbed, stabilized area. The outlet shall be generally smooth to create uniform sheet flow.

CONSTRUCTION SPECIFICATIONS

The minimum acceptable width shall be 6 feet. The depth of the level spreader as measured from the lip shall be at least 6 inches and the depth shall be uniform across the entire length of the measure.

The grade of the channel for the last 15 feet of the dike or diversion entering the level spreader shall be less than or equal to 1%.

The level lip shall be constructed on zero percent grade to insure uniform spreading of storm runoff (converting channel flow to sheet flow). For calculation purposes, a grade of 0.1% may be needed, however, the level spreader shall be installed at zero percent grade.

Level spreaders must be constructed on undisturbed soil (not on fill).

The entrance to spreader shall be graded in a manner to insure that runoff enters directly onto the zero percent graded channel.

Storm runoff converted to sheet flow must

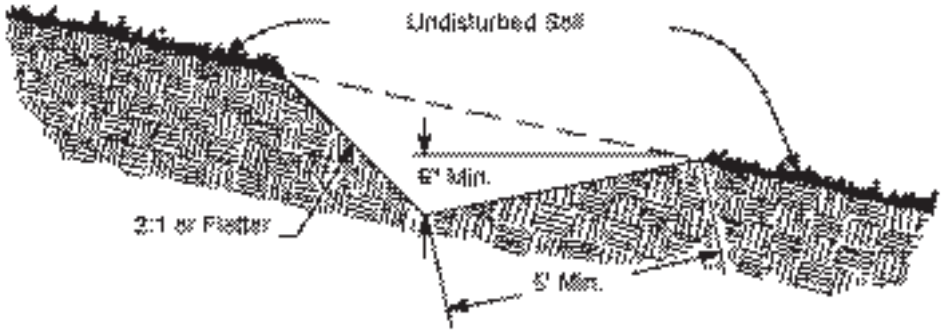
discharge onto undisturbed stabilized areas.

All disturbed areas shall be vegetated immediately after construction is completed. Refer to specifications **Ds3** and **Ds4 - Disturbed Area Stabilization (With Permanent Vegetation and Sodding)**, respectively and **Ss - Slope Stabilization Product**.

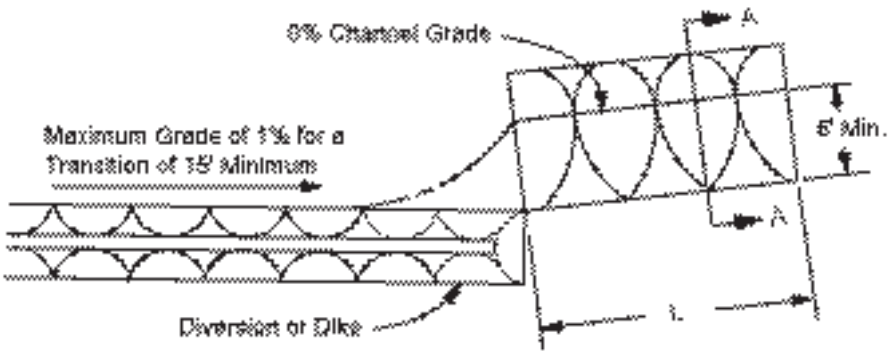
MAINTENANCE

Periodic inspection and maintenance must be provided.

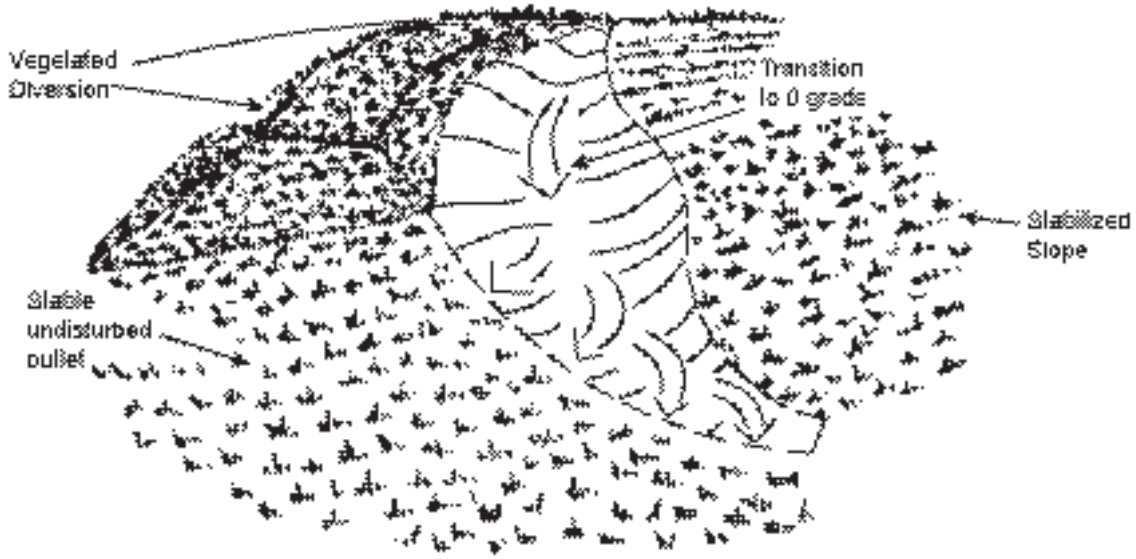
To Be Redrawn



SECTION A-A



PLAN



ISOMETRIC VIEW - (Not to Scale)

LEVEL SPREADER

Figure 6-17.1

Rock Filter Dam

Rd

DEFINITION

A ~~permanent or~~ temporary stone filter dam installed across ~~small streams or~~ drainageways or in conjunction with a temporary sediment trap.

PURPOSE

This structure is installed to serve as a sediment filtering device in drainageways or outlets for sediment traps. In some cases, it may also reduce the velocity of stormwater flow through a channel. This structure is not intended to substantially impound water. ~~Before structures of any kind are installed in flowing streams, the appropriate agencies and local officials should be contacted.~~

CONDITIONS

This practice is applicable for use as alternative sediment storage in small channels ~~which drain 50 acres or less~~ on project sites disturbing 5 acres or less. ~~The rock filter dam must be used in conjunction with other appropriate sediment control measures to reduce the amount of sediment reaching the channel. This practice may be used:~~

~~1. as an additional sediment control measure below construction projects such as culvert installations. dam construction, or any project that may involve grading activity directly in a stream, or~~

~~2. at the upstream end of ponds or lakes to trap incoming sediment loads.~~

DESIGN CRITERIA

~~Formal design is not required, but it is recommended that a qualified engineer be consulted before a structure of any kind is installed in a flowing stream. (Refer to Figure 6-18.1)~~ The rock filter dam shall be sized for the eintire drainage acreage and calculations for the sediment storage volume must be provided by the design profesional.

The following standards shall be followed:

Drainage Area

The drainage area to the dam shall not exceed 50 acres.

Height

The dam should not be higher than the channel banks or exceed the elevation of the upstream property line. The center of the rock dam should be at least ~~six~~ nine inches lower than the outer edges of the dam at the channel banks.

Side Slopes

The side slopes shall be 2:1 or flatter.

Location

The dam shall be located as close to the source of sediment as possible and so that it will not cause water to back up on upstream adjacent property or into state waters.

Stone Size

The stone size shall be determined by the design criteria established in **Riprap - Appendix C**. The rock dam can be faced with smaller stone on the upstream side for additional filtering effect. However, this may make the dam more prone to clogging.

~~Top~~ Width

The ~~width across the top of the dam should~~

~~be no less than 6 feet~~ top and bottom widths shall be calculated by the design professional.

Geotextile

Geotextiles should be used as a separator between the graded stone, the soil base, and the abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control Recommendations*. The geotextile should be placed immediately adjacent to the subgrade without any voids and extend five feet beyond the downstream toe of the dam to prevent scour.

CONSTRUCTION SPECIFICATIONS

Mechanical or hand placement will be required to insure that the rock dam extends completely across the channel and securely ties into both channel banks. The center of the dam must be no less than ~~six~~ nine inches lower than the lowest side, to serve as a type of weir. Gabions can be installed to serve as rock filter dams, but should follow recommended sizing and installation specifications. Refer to specification **Ga - Gabion**.

See Figure 6-18.1

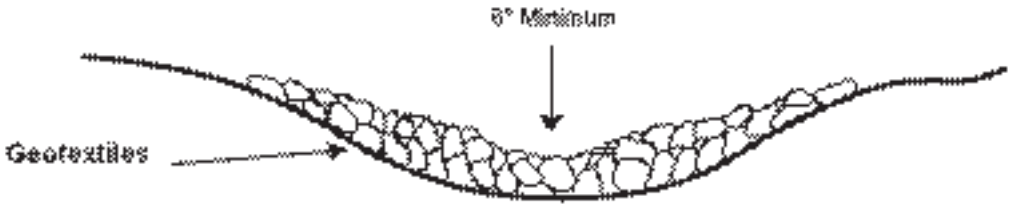
MAINTENANCE

Rock dams should be removed once disturbed areas have been stabilized. Periodic inspection and required maintenance must be provided. Sediment shall be removed when it reaches a depth of one-half of the original height of the dam.

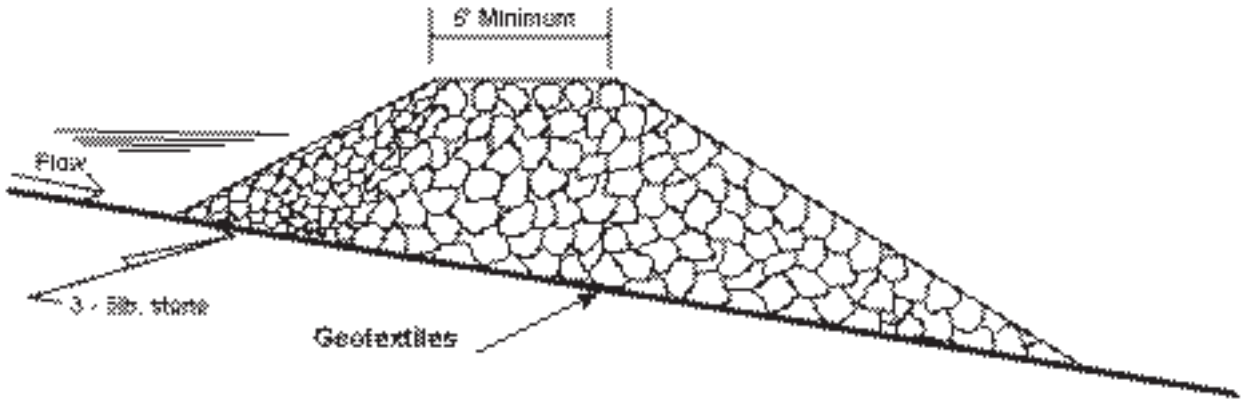
TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. **Figure 6-18.1**, noting rock size as specified in Appendix C.

To Be Redrawn



NOTE: Sediment Trap is to be cleaned out when volume becomes half full.



NOTE: Rock size determined according to specifications set forth in Appendix C.

Figure 6-18.1

Retaining Wall

Re

DEFINITION

A wall constructed of one or more of the following: concrete masonry, reinforced concrete cribbing, treated timbers, steel pilings, gabions, stone drywall, rock riprap, etc.

PURPOSE

To assist in the stabilization of cut or fill slopes where stable slopes are not attainable without the use of the wall.

CONDITIONS

Use in conjunction with cut or fill slopes which, because of space limitations or unstable material, do not allow the stable slope criteria listed above, *e.g.* cuts into steep hillsides on small lots or cuts into hillsides behind shopping centers to provide loading space.

DESIGN CRITERIA

General

The design of a retaining wall is a complicated process. Many factors must be taken into account such as: stresses and forces outside and within the wall, allowable height, minimum thickness. Other considerations are: foundation design with respect to loadings, bearing values of soils, footing dimensions. Additional design factors are safety hazards, subsurface and surface drainage and appearance.

Each situation requires a *specific design* which is within the capabilities of the design engineer.

Consideration should be given to all of the alternative methods with regard to construction of the wall. Some methods are:

1. Concrete masonry
2. Concrete cribbing
3. Gabions
4. Steel piling
5. Stone drywall
6. Rock riprap, etc.
7. Treated timbers
8. Geotextile wrapped-face wall
9. Geotextile reinforced steep slopes

Retrofitting

Rt

DEFINITION

A device or structure placed in front of a permanent stormwater detention pond outlet or roadway drainage structure to serve as a temporary sediment filter.

PURPOSE

~~This structure~~ Allows permanent stormwater detention basins structures to function as temporary sediment retention basins for land-disturbing projects, and allow appropriate road way drainage to be used for temporary sediment storage.

CONDITIONS

This standard applies under the following conditions:

1. **Shall not be used in ~~detention~~ basins on live streams** or in basins with a total contributing drainage area of 100 acres or more.

2. Shall only be used in ~~detention~~ basins large enough to store 67 cubic yards of sediment per acre of disturbed area in the project.

3. Shall be considered a temporary structure and will be removed as soon as project is permanently stabilized. All accumulated sediment shall be removed, and the pond or basin shall be brought to final grade (if possible), prior to the removal of the retrofit.

DESIGN CRITERIA

1. The height of the retrofit should be approximately one-half the height of the ~~stormwater management outlet~~ structure.

2. **~~The~~ A retrofitted dention pond must be capable of storing the required volume of sediment in addition to the required stormwater volume.** The required sediment storage volume shall be achieved by either excavating the basin or raising the outlet structure's invert to achieve 67 cubic yards per acre of sediment storage. Remove sediment when one-third of the sediment storage capacity, not total pond capacity, is lost to sediment accumulation. This volume shall be marked on the riser or by setting a marked post near the riser.

3. For effective trapping efficiency, the sediment delivery inlets should be at the upper end of the ~~basin~~ detention pond.

4. For effective trapping efficiency, the length-width ratio of the detention pond ~~basin~~ shall be at least 2:1. If the length-width ratio is not at least 2:1, the flow length shall be increased with the use of baffles installed within the basin.

5. Discharging from sediment basins and impoundments require outlet structures that withdraw water from the surface, unless infeasable.

CONSTRUCTION SPECIFICATIONS

The following types of structures are acceptable under the designated conditions:

Perforated Half-Round Pipe with Stone Filter

Rt -P

(See Figure 6-19.1)

a. Should be used only in detention ponds with less than 30 acre total drainage area.

b. Never to be used on exposed pipe end or winged headwall.

c. Diameter of half-round pipe should be 1.5 times the diameter of the principal pipe outlet or wider than the greatest width of the concrete weir.

d. Perforations and stone sizes are shown in Figure 6-19.1.

e. Shall be fixed by specified means (bolts, etc) to concrete outlet structure.

Slotted Board Dam with Stone

(See Figure 6-19.3) Rt -B

a. Can be used in detention ponds with drainage areas up to 100 acres, and on roadwaydrainage structures with drainage areas less than 30 acres.

b. Can be used with open end pipe outlets, winged headwalls, or concrete weir outlets.

c. Should be installed with minimum size 4x4 inch posts.

d. Boards should have 0.5-1.0 inch space between them.

e. Minimum size 3-4 inch stone filter shall be in-stalled around the upstream side of the board dam.

Silt Control Gate

Rt -Sg

(See figure 6-19.4)

The silt control gate may be used for temporary sediment storage on linear construction projects including roadway construction or maintenance, and utility line installation. The following specifications shall apply:

a. Shall only be used on roadway drainage structures with the following inlets: winged headwalls, tapered headwalls, straight headwalls, open end pipes, or flared end sections.

b. Drainage basin to the silt control gate shall not exceed 50 acres, and the disturbed area of the basin shall not exceed 5 acres.

c. Post shall be 4”x4” treated lumber, and face boards shall be 2”x6” treated lumber with no spacing allowed between the boards.

d. An approved type A or type C silt fence fabric shall be securely fastened to the front of the structure using staples or nails.

e. Sediment shall be removed and properly disposed of when it reaches one-third the height of the silt gate. Filter fabric shall be replaced when damaged or deteriorated.

f. Silt control gates should not be used as perimeter control alone, but instead be part of a treatment train that allows the drainage structure to discharges through another barrier before leaving the project.

All disturbed areas shall be vegetated immediately after construction with permanent vegetation. Refer to **Ds3** and **Ds4 - Disturbed Area Stabilization (With Permanent Vegetation)** and **Disturbed Area Stabilization (With Sodding)** and ~~**Mb - Matting and Blankets**~~ **Ss- Slope Stablization Products**.

MAINTENANCE

Retrofit structures shall be kept clear of trash and debris. This will require continuous monitoring and maintenance, which includes sediment removal when one-third of the sediment storage capacity has been lost. *Structures are temporary and shall be removed when disturbed areas have been permanently stabilized.*

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

Storage Calculations for Retrofitted Detion Ponds

1. Required stormwater storage = _____ cy
   (as determined by local ordinance)
2. Required sediment storage = _____ cy
   (67 cy/ac * _____ ac disturbed area)
3. Total required storage = _(1)_ + _(2)_ = _(3)_ cy
4. Available storage = _(4)_ cy
5. Is the available storage (4) greater than the total required storage (3)?
   _____ yes _____ no
6. If "no", the sediment storage capacity of the pond must be increased. Choose the method to be used:
   _____ Raise the invert of the outlet structure _____ inches
   _____ Undercut the pond _____ feet
   _____ Other _____
7. Clean-out elevation =_____ft
   (Elevation corresponding to 22 cy/ac *_____ac disturbed area)
8. Is the length-width ratio 2:1 or greater?
   _____ yes _____ no
9. If "no", the length of flow must be increased. Choose the method to be used:
   _____ Baffles (Type of baffle: _____)
   _____ Other _____

Note the CMP diameter and height if a half-round CMP retrofit is to be used.
Diameter =_____inches Height =_____feet

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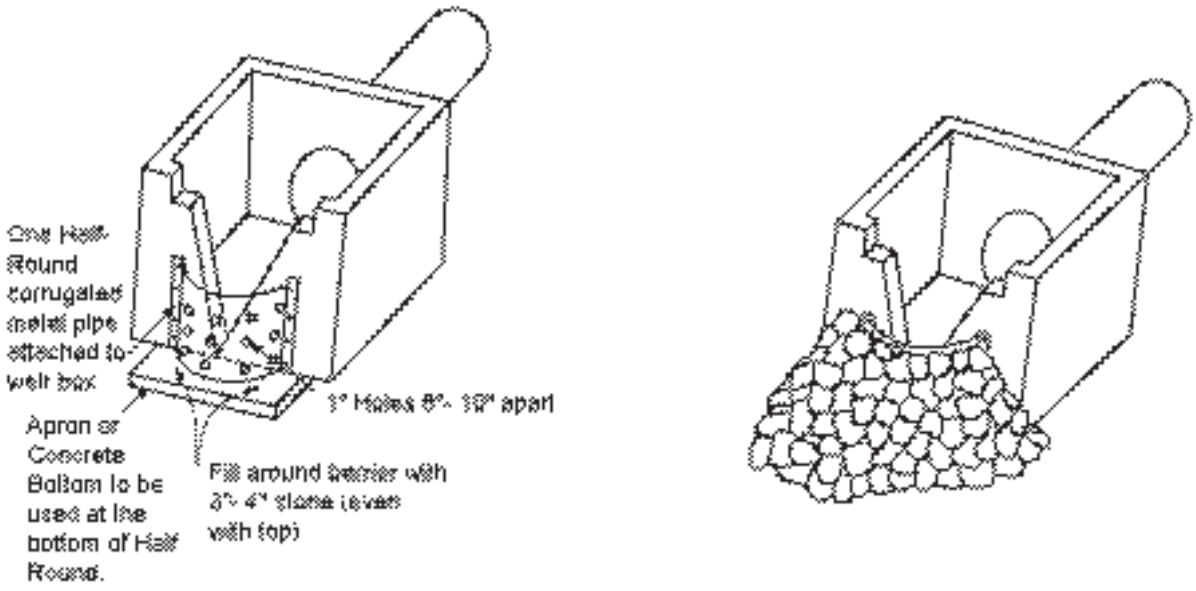

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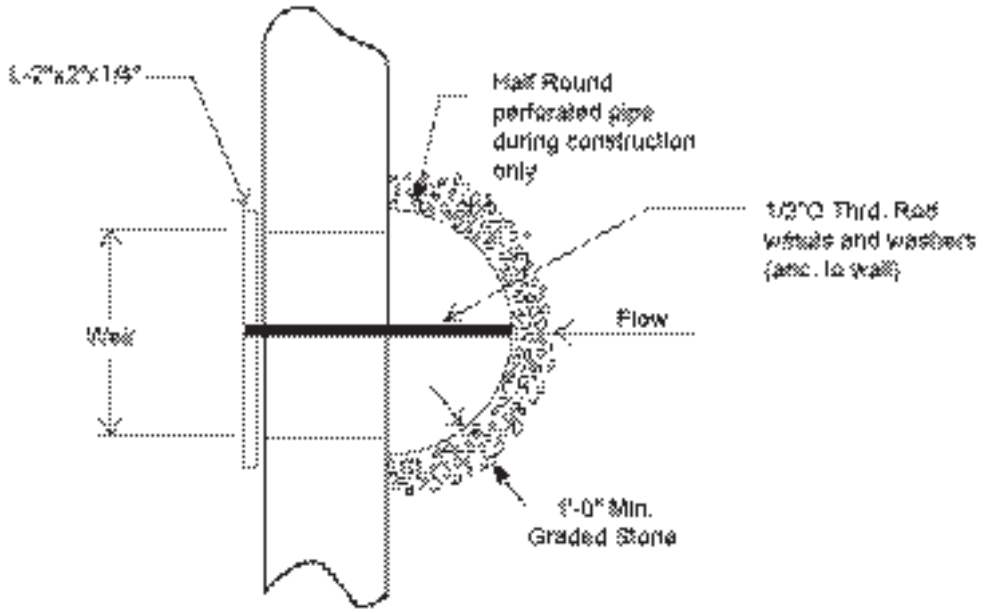
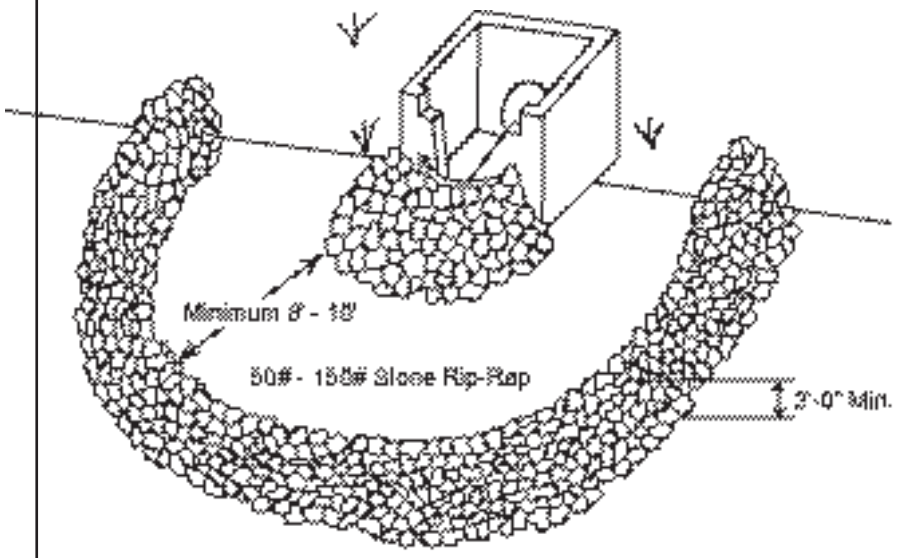


PLAN

PERFORATED HALF-ROUND PIPE WITH STONE FILTER

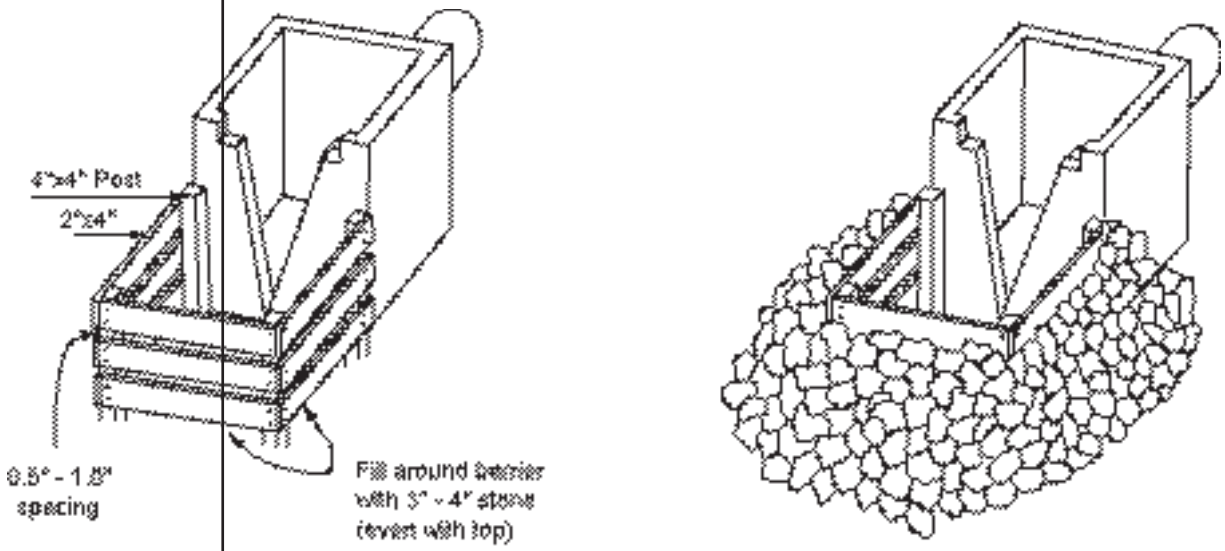
Figure 6-19.1

To Be Redrawn



STONE FILTER RING

Figure 6-19.2



SLOTTED BOARD DAM WITH STONE FILTER

Figure 6-19.3

Sediment Barrier

Sd1

SEE REVISED PRACTICE

DEFINITION

Sediment barriers are temporary structures typically constructed of silt fence supported by steel or wood posts. Other types of barriers may include sandbags, straw bales, brush piles or other filtering material.

PURPOSE

To prevent sediment carried by sheet flow from leaving the site and entering natural drainage ways or storm drainage system by slowing storm water runoff and causing the deposition of sediment at the structure.

CONDITIONS

Barriers should be installed where runoff can be stored behind the barrier without damaging the fence or the submerged area behind the fence.

Silt fence shall not be installed across streams, ditches, waterways, or other concentrated flow areas.

DESIGN CRITERIA

HAY OR STRAW BALES

Hay or straw bales retain sediment load transported by sheet flow from disturbed areas. The bales' comparatively low flow rate should be considered when choosing the appropriate sediment barrier. Ponding above the bale can occur rapidly. The slope lengths contributing runoff to a bale barrier cannot exceed those listed in Table 6-20.1. Straw and hay bales shall not be used if the project duration is expected to exceed three months.

Table 6-20.1. Criteria For Straw or Hay Bale Placement

Land Slope	Maximum Slope Length Above Bale
Percent	Feet
<2	75
2 to 5	50
5 to 10	35
10 to 20	20
>20	10

SILT FENCE

Like hay or straw bales, silt fence is designed to retain sediment transported by sheet flow from disturbed areas. Silt fence performs the same function as hay or straw bales, allows a higher flow rate, and is usually faster and cheaper to install. Approved silt fence fabrics are listed in the Georgia Department of Transportation Qualified Products List #36 (QPL-36). See Table 6-20.5 for current Georgia DOT silt fence specifications.

Where all runoff is to be stored behind the fence (where no stormwater disposal system is present), maximum slope length behind a silt fence shall not exceed those shown in Table 6-20.2. The drainage area shall not exceed 1/4 acre for every 100 feet of silt fence.

Table 6-20.2. Criteria For Silt Fence Placement

Land Slope	Maximum Slope Length Above Fence
Percent	Feet
<2	100
2 to 5	75
5 to 10	50
10 to 20	25
>20*	15

*In areas where the slope is greater than 20%, a flat area length of 10 feet between the toe of the slope to the fence should be provided.

Type A Silt Fence Sd1-A

This 36-inch wide filter fabric shall be used on developments where the life of the project is greater than or equal to six months.

Type B Silt Fence Sd1-B

Though only 22-inches wide, this filter fabric allows the same flow rate as Type A silt fence. Type B silt fence shall be limited to use on minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than six months.

Type C Silt Fence Sd1-C

Type C fence is 36-inches wide with wire reinforcement. The wire reinforcement is necessary because this fabric allows almost three times the flow rate as Type A silt fence. Type C silt fence shall be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10 feet.

Provide a riprap splash pad or other outlet protection device for any point where flow may top the sediment fence. Ensure that the maximum height of the fence at a protected, reinforced outlet does not exceed 2 ft and that support post spacing does not exceed 4 ft.

Alternative Silt Fence

Approved alternatives to the QPL#36 fabrics, and their applicationsmay be found on the GSWCC Website.

CONSTRUCTION SPECIFICATIONS

Sandbags Sd1-S
(if approved by local issuing authority)

Should be installed so that flow under or between bags is minimal. Anchoring with steel rods may be required if structure height exceeds two bags.

Hay or Straw Bales Sd1-Hb
(if approved by local issuing authority)

Bales will be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of 4 inches. Bales must be securely anchored in place by stakes or bars driven through the bales or by other acceptable means to prevent displacement. See Figures 6-20.1 and 6-20.2 for installation requirements.

Brush Barrier Sd1-Bb
(only during timber clearing operations)

Brush obtained from clearing and grubbing operations may be piled in a row along the perimeter of disturbance at the time of clearing and grubbing. Brush barriers should not be used in developed areas or locations where aesthetics are a concern.

Brush should be wind-rowed on the contour as nearly as possible and may require compaction. Construction equipment may be utilized to satisfy this requirement.

The minimum base width of the brush barrier shall be 5 feet and should be no wider than 10 feet. The height of the brush barrier should be between 3 and 5 feet.

If a greater filtering capacity is required, a commercially available filter fabric may be placed on the side of the brush barrier receiving the sediment-laden runoff. The lower edge of the fabric must be buried in a 6-inch deep trench immediately uphill from the barrier. The upper edge must be stapled, tied or otherwise fastened to the brush barrier. Edges of adjacent fabric pieces must overlap each other. See Figure 6-20.3.

Silt Fence

The manufacturer shall have either an approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100 feet.

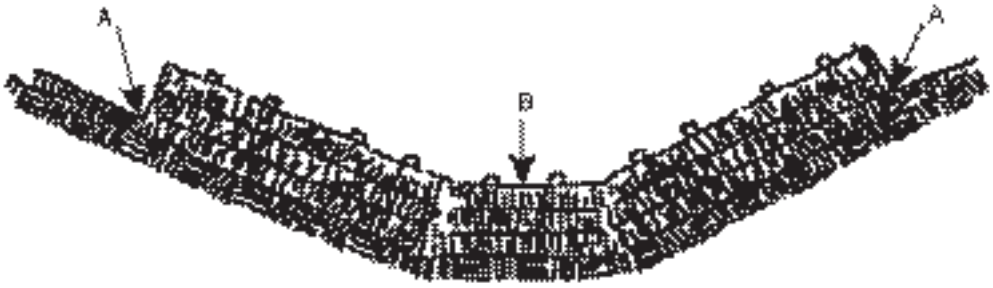
The temporary silt fence shall be installed according to the specification, as shown on the plans or as directed by the engineer. For installation of the fabric, see Figures 6-20.4, 6-20.5, and 6-20.6 respectively.

Post installation shall start at the center of the low-point (if applicable) with remaining posts spaced 6 feet apart for Type A and B silt fences and 4 feet apart for Type C silt fence. While Type A and B silt fences can be used with both wood and steel posts, only steel posts shall be used with Type C silt fence. For post size requirements, see Table 6-20.3. Fasteners for wood posts are listed in Table 6-20.4.

Along stream buffers and other sensitive areas, two rows of Type C silt fence or one row of Type C silt fence backed by haybales shall be used.

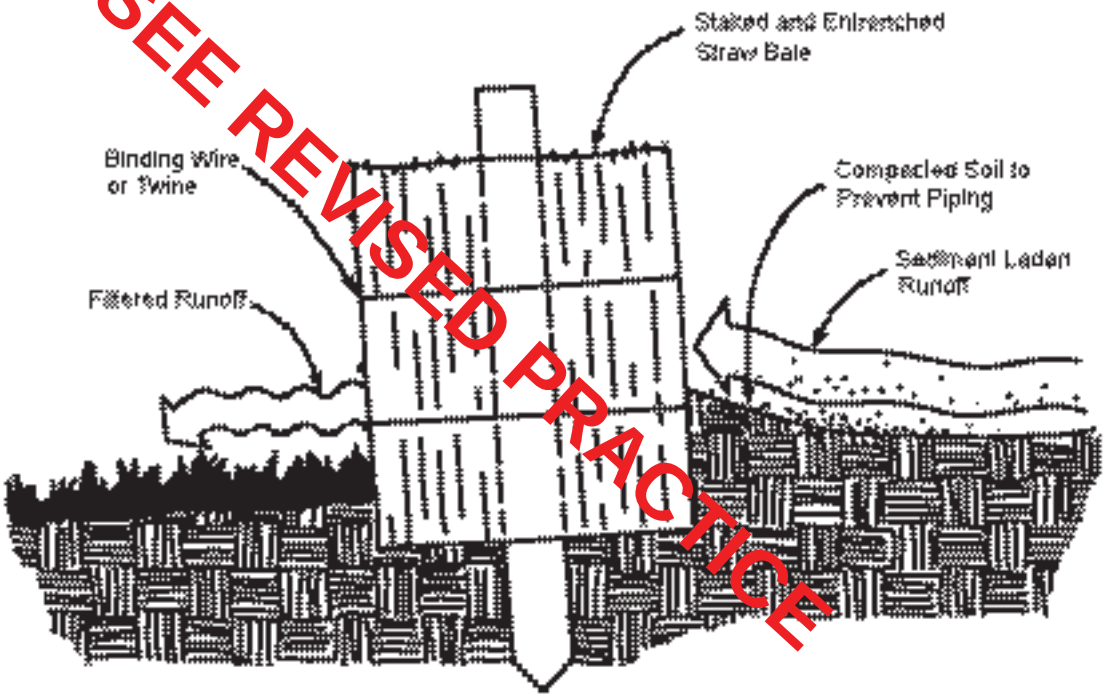
MAINTENANCE

Sediment shall be removed once it has accumulated to one-half the original height of the barrier. Filter fabric shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months). Temporary sediment barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed.



Points A should be higher than point B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

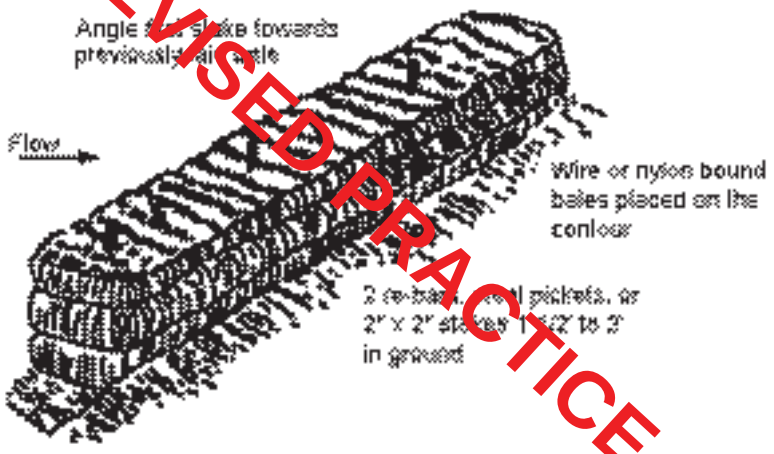


Note: Embed hay bales a minimum of 4 inches.

CROSS-SECTION OF A PROPERLY INSTALLED STRAW BALE

Figure 6-20.1

EMBEDDING DETAIL



ANCHORING DETAIL

NOTE:

- Anchor and embed into soil to prevent washout or water working under barrier
- Repair or placement must be promptly as needed

STAKED HAYBALE BARRIERS

Figure 6-20.2

BRUSH BARRIER DETAILS

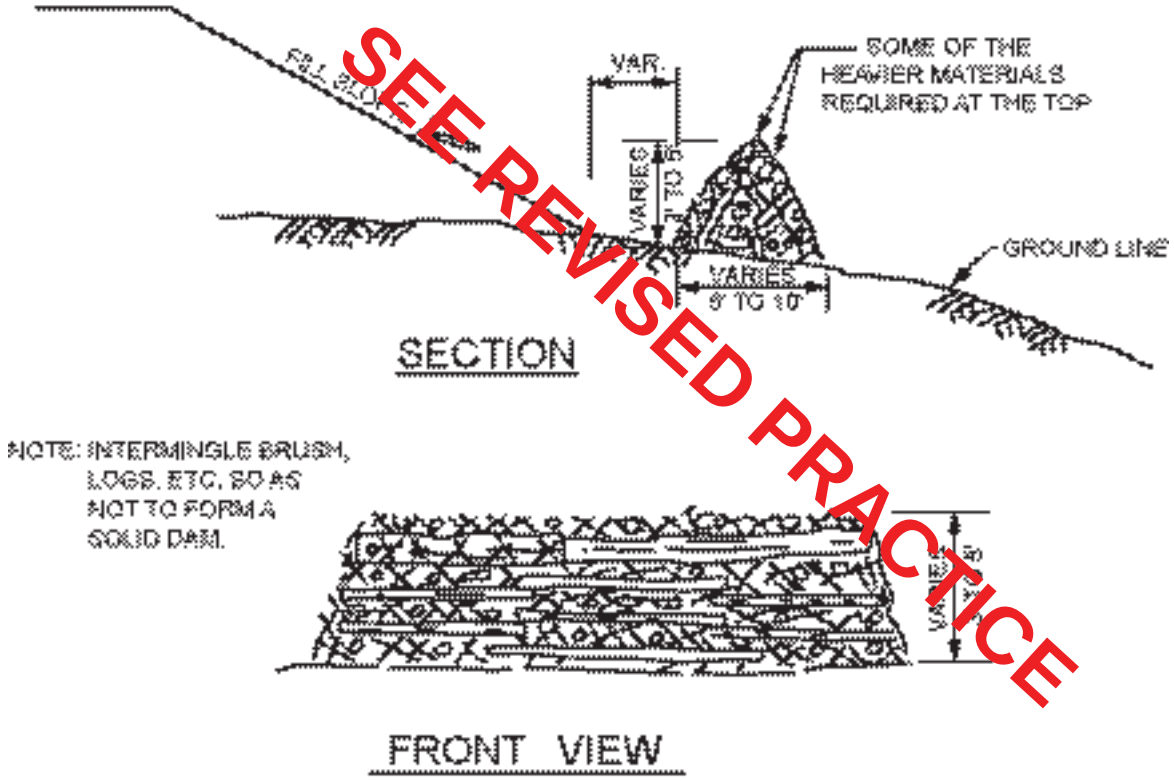


Figure 6-20.3

Table 6-20.3. Post Size

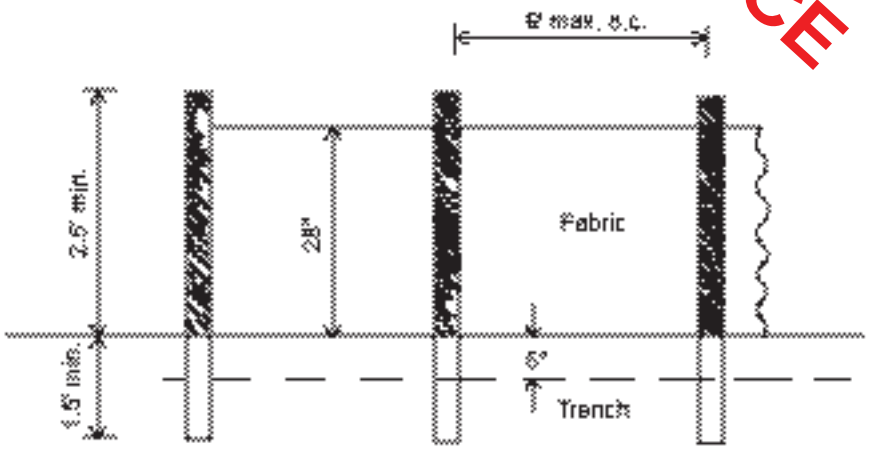
	Minimum Length	Type of Post	Size of Post
Type A	4’	Soft wood Oak Steel	3” dia. or 2x4 1.5” x 1.5” 1.3lb./ft. min.
Type B	3’	Soft wood Oak Steel	2” dia. or 2x2 1” x 1” .75lb./ft. min.
Type C	4’	Steel	1.3lb./ft. min.

Table 6-20.4. Fasteners For Wood Posts

	Gauge	Crown	Legs	Staples/Post
Wire Staples	17 min.	3/4” wide	1/2” long	5 min.
	Gauge	Length	Button Heads	Nail/Post
Nails	14 min.	1”	3/4”	4 min.

Note: Filter fabric may also be attached to the post by wire, cord, and pockets.

SIDE VIEW

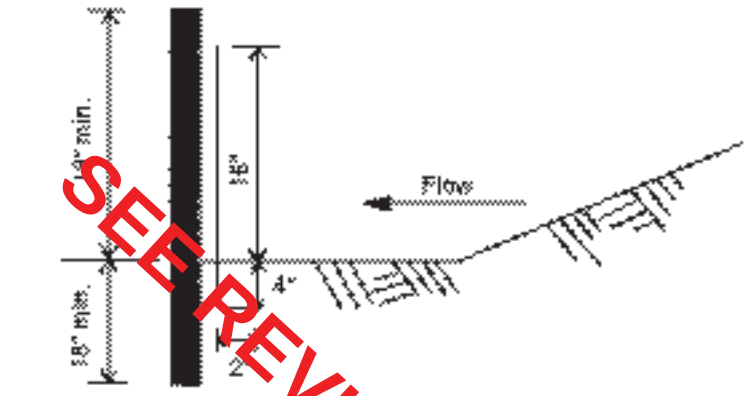


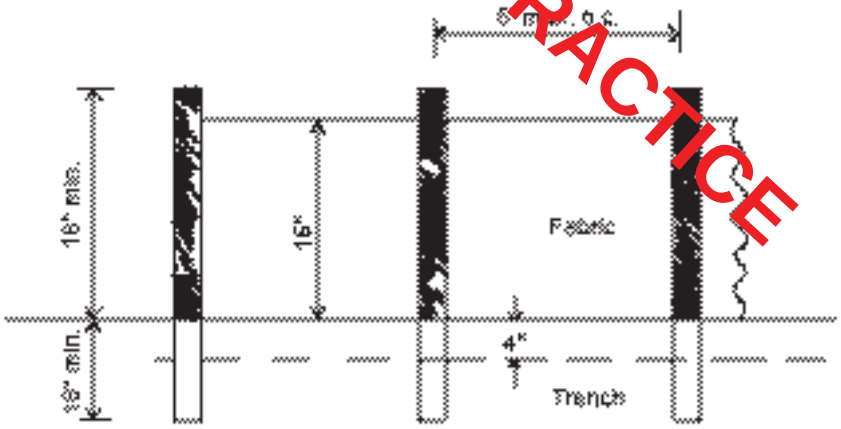
FRONT VIEW

NOTE:
Use 36" D.O.T. approved fabric.
Use wood or steel posts

SILT FENCE - TYPE A

Figure 6-20.4



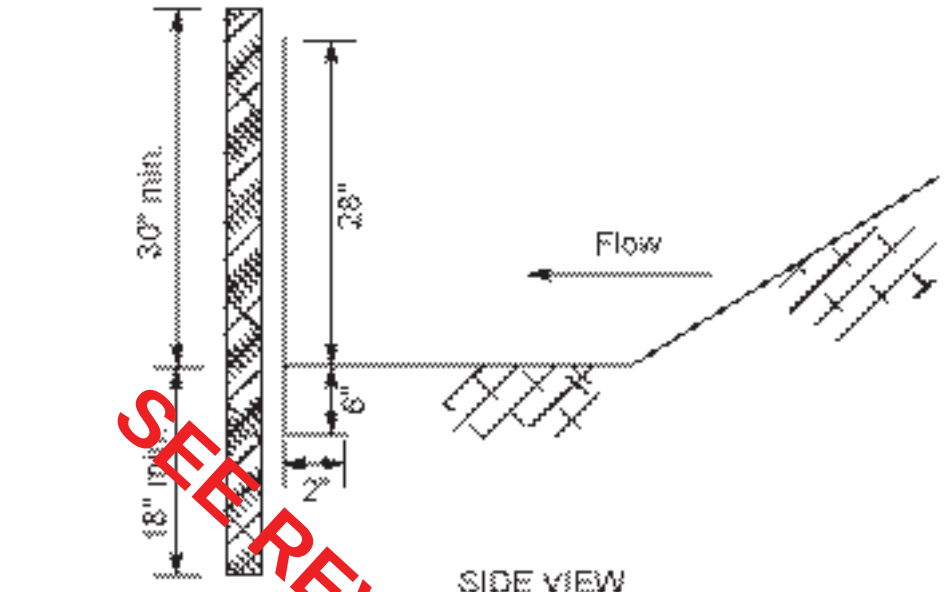


FRONT VIEW

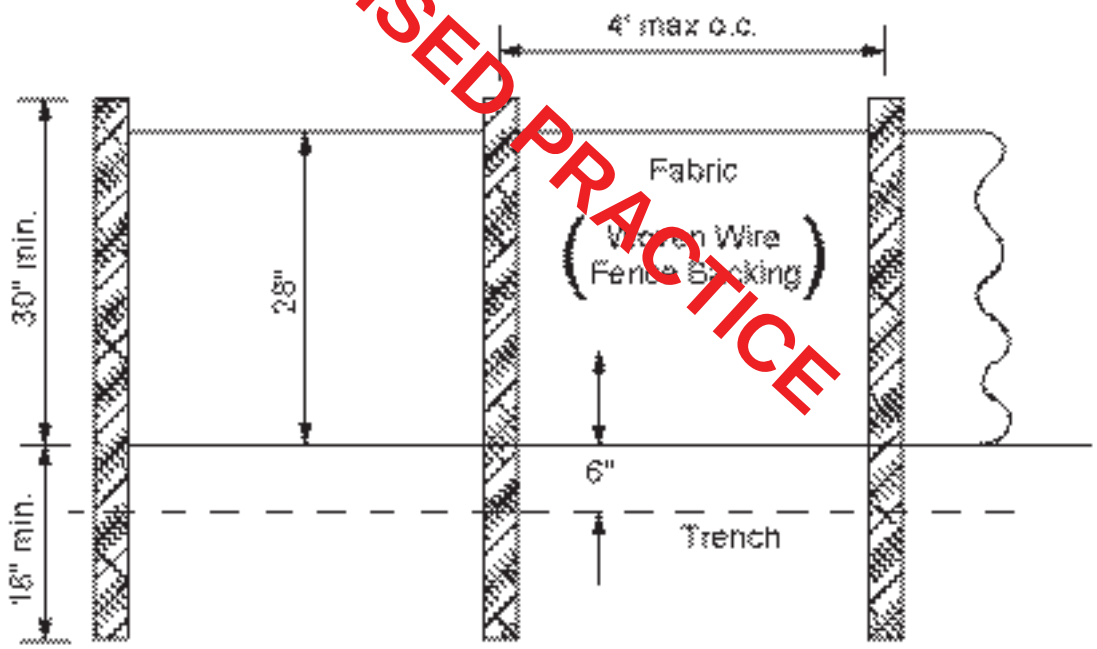
NOTE:
Use 2" D.O.T. approved fabric.
Use wood or steel posts

SILT FENCE - TYPE B

Figure 6-20.5



SIDE VIEW



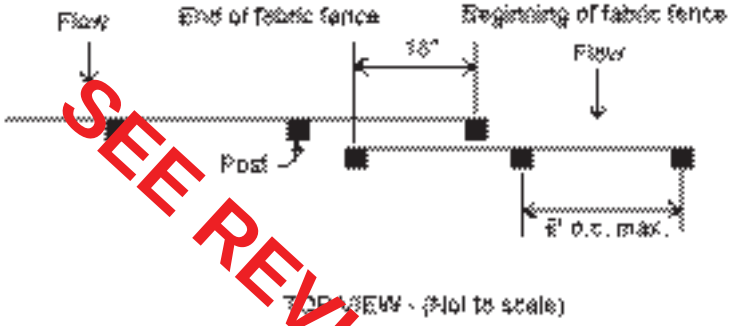
FRONT VIEW

NOTE:
Use 36" D.O.T. approved fabric.
Use steel posts.- only

SEE REVISED PRACTICE

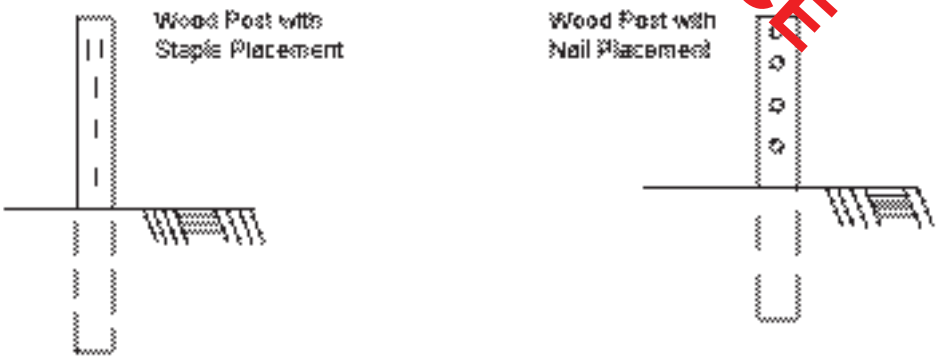
SILT FENCE - TYPE C

~~Figure 6-20.6~~



TOP VIEW - (Not to scale)

OVERLAP AT FABRIC ENDS



FRONT VIEWS

FASTENERS FOR SILT FENCES

Figure 6-20.7

Table 6-20.5

TYPE FENCE	A	B	C
Tensile Strength (Lbs. Min.) (1) (ASTM D-4632)	Warp - 120 Fill - 100	Warp - 120 Fill - 100	Warp - 260 Fill - 180
Elongation (% Max.) (ASTM D-4632)	40	40	40
AOS (Apparent Opening Size) (Max. Sieve Size) (ASTM D-4751)	#30	#30	#30
Flow Rate (Gal/Min/Sq. Ft.) (GDT-87)	25	25	70
Ultraviolet Stability (2) (ASTM D-4632 after 300 hours weathering in accordance with ASTM D-4355)	80	80	80
Bursting Strength (PSI Min.) (ASTM D-3786 Diaphragm Bursting Strength Tester)	175	175	175
Minimum Fabric Width (Inches)	36	22	36

(1) Minimum roll average of five specimens.

(2) Percent of required initial minimum tensile strength.

Sediment Barrier Sd1

Definition

Sediment Barriers are temporary structures made up of a porous material typical supported by steel or wood posts. Types of sediment barriers may include silt fence, brush piles, mulch berms, compost filter socks or other filtering material.

Purpose

To prevent sediment carried by sheet flow from leaving the site and entering natural drainage ways or storm drainage systems by slowing storm water runoff and causing the deposition and/or filtration of sediment at the structure. The barriers retain the soil on the disturbed land until the activities disturbing the land are completed and vegetation is established.

Conditions

Barriers should be installed where runoff can be stored behind the barrier without damaging the submerged area behind the barrier or the structure itself. Sediment barriers shall not be installed across streams, ditches, waterways, or other concentrated flow areas.

Performance Evaluation

For a product or practice to be approved as a sediment barrier, that product or practice must have a documented P-factor no greater than 0.045 for non-sensitive areas or a P-factor no greater than 0.030 for sensitive areas, as specified by GSWCC. For complete test procedures and approved products list please visit www.gaswcc.org.

Design Criteria

All sediment barriers shall meet the required P-factor performance level . Supporting information on testing can be found at www.gaswcc.org under Documents. Sediment barriers are designed to retain sediment transported by sheet flow from disturbed areas.

Where all runoff is to be stored behind the sediment barrier (where no storm water disposal system is present), maximum continuous slope length behind a sediment barrier shall not exceed those shown in Table 6-20.1. For longer slope lengths, slope interrupters must be used. The drainage area shall not exceed ¼ acre for every 100 feet of sediment barrier.

Table 6-20.1 Criteria for Sediment Barrier

Land Slope	Maximum Slope Length Above Fence
Percent	Feet
< 2	100
2 to 5	75
5 to 10	50
10 to 20	25
>20*	15
*In areas where the slope is greater than 20%, a flat area length of 10 feet between the toe of slope to the barrier should be provided.	

Placement

When using a sediment barrier the Design Professional must determine Type NS or Type S. It is important for the design professional to take into account the profile of the product for use on the site.

When using multiple types of sediment barriers on a site in a single run the barriers must be overlapped 18 inches or as specified by design professional. See Figure 6-20.2

Construction Specifications

Type Ns Sediment Barrier

Sd1-Ns

Nonsensitive areas

Sediment barriers being used as Type NS shall have a support spacing of no greater than 6 feet. on center, with each driven into the ground a minimum of 18 inches. Type NS sediment barriers shall have a P-factor no greater than 0.045.

Sd1-S

Type S Sediment Barrier

Sensitive areas

Sediment barriers being used as Type S shall have a support spacing of no greater than 4 feet on center, with each driven into the ground 18 inches. Type S sediment barriers shall have a P-factor no greater than 0.030.

Sediment Barriers should also provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment barrier. Ensure that the maximum height of the barrier at a protected, reinforced outlet does not exceed 1 foot and that the support spacing does not exceed 4 feet.

Filter Media Sock Specifications

Compost filter media used for sediment barrier filler material shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations including time and temperature data. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Test methods for the items below should follow US Composting Council Test Methods for theExamination of Composting and Compost guidelines for laboratory procedures:

A. PH – 5.0-8.0 in accordance with TMECC 04.11-A, “Electrometric pH Determinations for Compost”

B. Particle size – 99% passing a 2 inches (50mm) sieve and a maximum of 40% passing a 3/8 inches (9.5mm) sieve, in accordance with TMECC 02.02-B, “Sample Sieving for Aggregate Size Classification”. (Note- In the field, product commonly is between ½ in [12.5mm] and 2 inches [50mm] particle size.)

C. Moisture content of less than 60% in accordance with standardized test methods for moisture determination.

D. Material shall be relatively free (<1% by dry weight) of inert or foreign man made materials.

E. Sock containment system for compost filter media shall be a photodegradable or biodegradable knitted mesh material with 1/8 in to 3/8 in openings.

Brush Barrier

Sd1-BB

(Only during timber clearing operations)

Brush obtained from clearing and grubbing operations may be piled in a row along the perimeter of disturbance at the time of clearing and grubbing. Brush barriers should not be used in developed areas or locations where aesthetics are a concern.

Brush should be wind-rowed on the contour as nearly as possible and may require compaction. Construction equipment may be utilized to satisfy this requirement.

The minimum base width of the brush barrier shall be 5 feet and should be no wider 10 feet. The height of the brush barrier should be between 3 and 5 feet tall.

A brush barrier is a good tool to use in developing pasture in an agricultural situation to prevent sediment from leaving the site

until the pasture is stabilized.

If greater filtering capacity is required, a commercially available Sediment barrier may be placed on the side of the brush barrier receiving the sediment-laden runoff. The lower edge of the fabric must be buried in a 6-inch deep trench immediately uphill from the barrier. The upper edge must be stapled, tied or otherwise fastened to the brush barrier. Edges of adjacent fabric pieces must overlap each other. See figure 6-20.2.

Installation

The manufacturer shall label the sediment barrier with both the manufacturer and product name every 100 feet. The product shall be labeled clearly at least once per free standing section of the sediment barrier. Temporary sediment barriers shall be installed according to this specification, as shown on the plans or as directed by the engineer.

For installation of the barriers, see Figures 6-20.3, 6-20.4 6-20.5 respectively. It is important to remember that not all sediment barriers need to be trenched into the ground but most taller sediment barriers do. Post installation shall start at the center of a low point (if applicable) with the remaining posts spaced no greater than 6 feet apart for Type NS sediment barriers and no greater than 4 feet apart for Type S sediment barriers. For post size requirements see, see Table 6-20.6. Fasteners for wood posts are listed in Table 6-20.7.

Static Slicing Method

The static slicing machine pulls a narrow blade through the ground to create a slit 12" deep, and simultaneously inserts the silt fence fabric into this slit behind the blade. The blade is designed to slightly disrupt soil upward next to the slit and to minimize horizontal compaction, thereby creating an optimum condition for compacting the soil vertically on both sides of the fabric. Compaction is achieved by rolling a tractor wheel along both sides of the slit in the ground 2 to 4 times to achieve nearly the same or greater compaction as the original undisturbed soil. This vertical compaction reduces the air spaces between soil particles, which minimize infiltration. Without this compaction infiltration can saturate the soil, and water may find a pathway under the fence. When a silt fence is holding back several tons of accumulated water and sediment, it needs to be supported by posts that are driven 18 inches into the soil. Driving in the posts and attaching the fabric to them completes the installation.

Trenching Method

Trenching machines have been used for over twenty-five years to dig a trench for burying part of the filter fabric underground. Usually the trench is about 6" wide with a 6" excavation. Post setting and fabric installation often precede compaction, which make effective compaction more difficult to achieve. EPA supported an independent technology evaluation (ASCE 2001), which compared three progressively better variations of the trenching method with static slicing method. The static slicing method performed better than two lower performance levels of the trenching method, and was as good as or better than the trenching method's highest performance level. The best trenching method typically required nearly triple the time and effort to achieve results comparable to the static slicing method.

Along all state waters and other sensitive areas, two rows of Type S sediment barriers shall be used. The two rows Type S should be placed a minimum of 36 inches apart.

Maintenance

Sediment shall be removed once it has accumulated to one-half the original height of the barrier. This is extremely

important when selecting BMPs with a lower profile.

Sediment barriers shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the product is reduced (approximately six months) or the height of the product is not maintaining 80% of its properly installed height.

Temporary sediment barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed.

References

ASCE 2001. Environmental Technology Verification Report for Installation of Silt Fence Using the Tommy Static Slicing Method, CERF Report #40565. Washington, DC: American Society of Civil Engineers. www.epa.gov/etv/pubs/08_vs_tommy.pdf

ASTM 2003. Standard Practice for Silt Fence Installation, D 6462-03(2008). West Conshohocken, PA: American Society of Testing Materials International. www.astm.org/SEARCH/search-reskin.html?query=D6462-03&siteType=store-standards&searchType=standards-full

Carpenter, Thomas 2000. Silt Fence That Works. Ankey, Iowa: Thomas Carpenter. www.tommy-sfm.com/pages/resources/ Silt%20Fence%20That%20Works%20Manual.pdf

Fifield, Jerald S. 2011. Designing and Reviewing Effective Sediment and Erosion Control Plans, 3rd Edition. Santa Barbara, CA: Forester Press.

U.S. Environmental Protection Agency 2007. Developing Your Stormwater Pollution Prevention Plan, EPA 833-R-06-004. Washington: EPA. Available from EPA hardcopy 800-490-9198 or www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

To Be Re-drawn

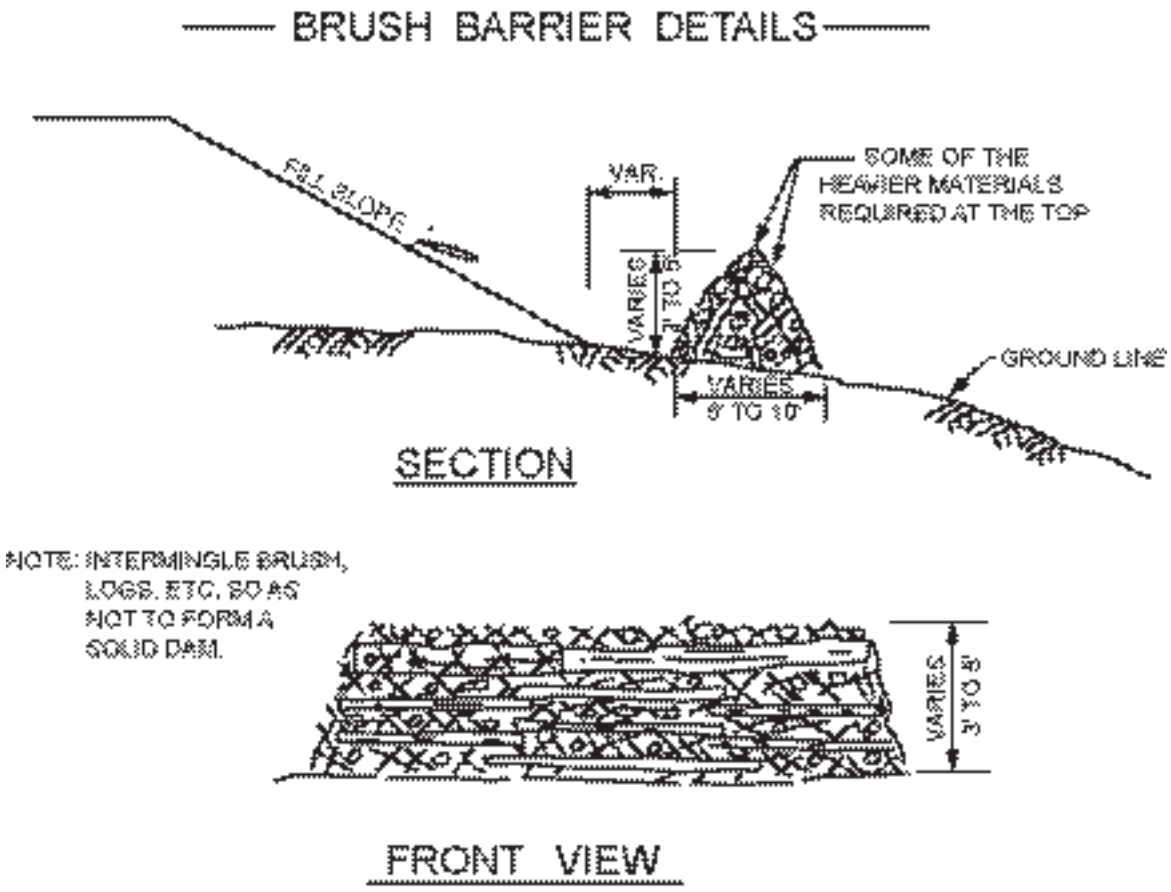
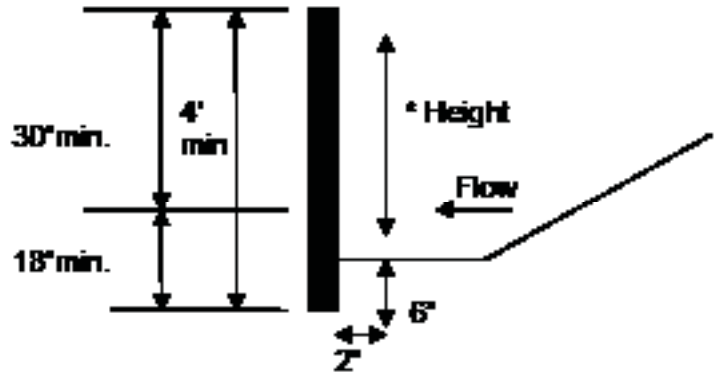
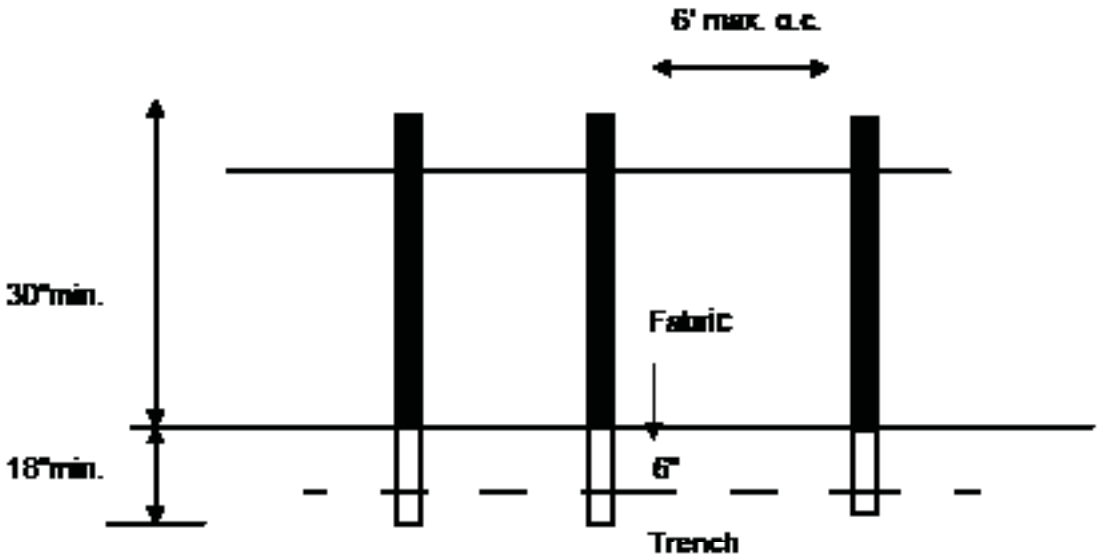


Figure 6-20.2



SIDE VIEW

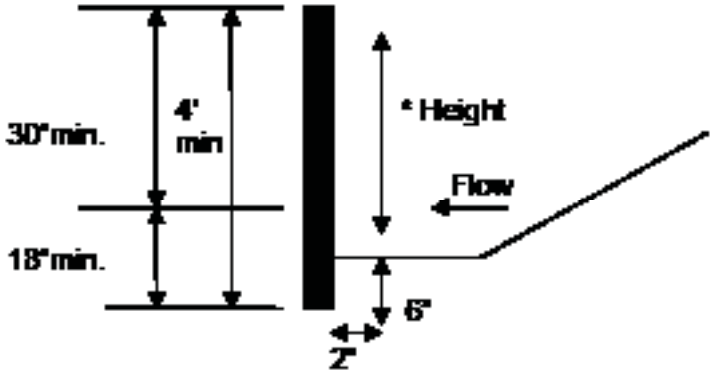


FRONT VIEW

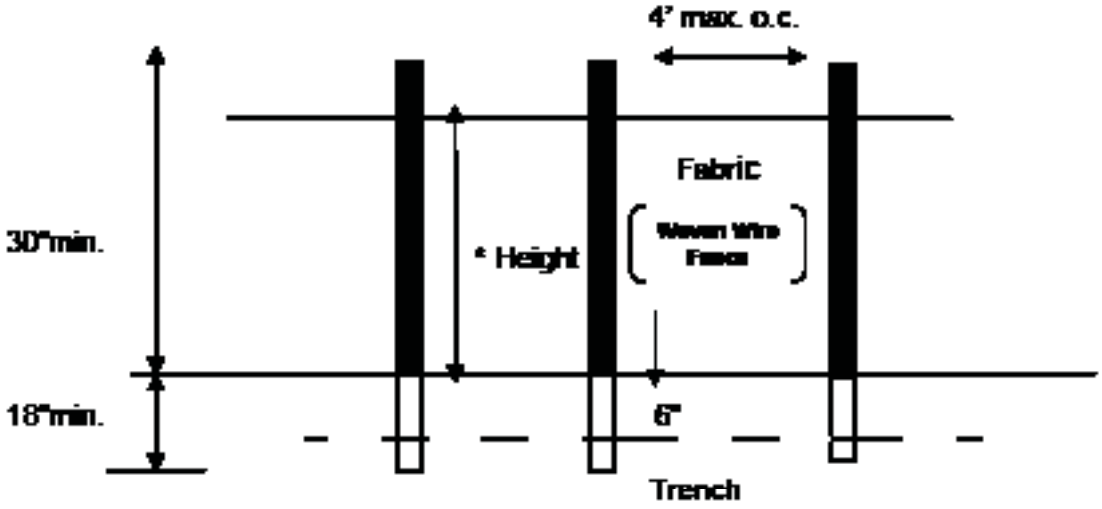
Note: Use wood or steel Posts per figure 6.20.6 or as specified by ES&PC Plan
*The height of fabric must be shown on plans

SILT FENCE - TYPE A

Figure 6-20.3



SIDE VIEW

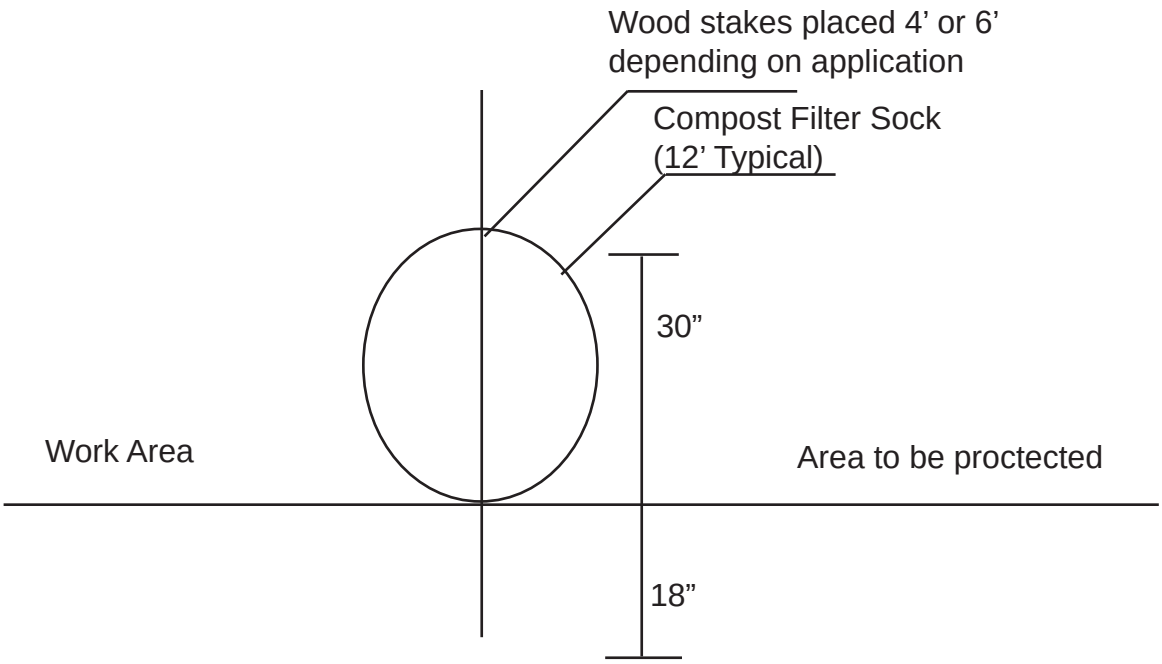


FRONT VIEW

Note: Use wood or steel posts per figure 6.20.6 or as specified by ES&PC Plan
*The height of fabric must be shown on plans

SILT FENCE - TYPE C

Figure 6-20.4



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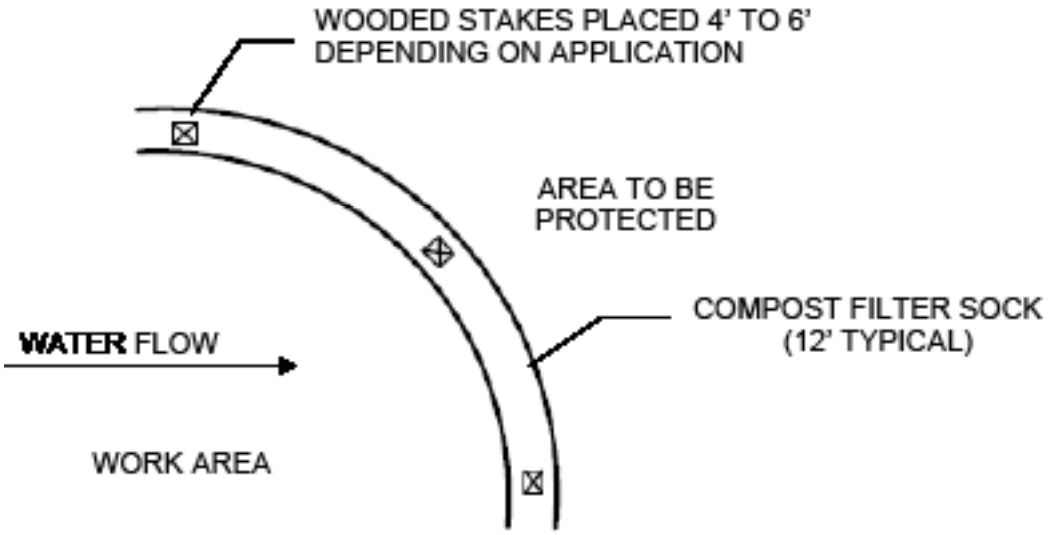

PLAN NTS

COMPOST FILTER SOCK

NTS

Figure 6-20.5

Table 6-20.6 Post Size			
Type	Min Length	Type of Post	Size of Post
A	4’	Soft wood Oak Steel	3”dia or 2x4 1.5” x1.5” 1.3lb./ft. min
C	4”	Steel Oak	1.3lb./ft. min 2”x2”

Table 6-20.7 Fasteners for Wood Posts				
	Guage	Crown	Legs	Staples / Post
Wire Staples	17 min.	3/4” wide	1/2” long	5 min.
	Guage	Length	Button Heads	Nail/ Post
Nails	14 min.	1”	3/4”	4 min.
Note: Filter Fabric may also be attached to the post by wire, chors, and pockets or any other method provided mimimum P-factor, as required by GSWCC, is met.				

Inlet Sediment Trap Sd2

DEFINITION

A temporary protective device formed around a storm drain drop inlet to trap sediment.

PURPOSE

To prevent sediment from leaving the site, or from entering storm drainage systems, prior to permanent stabilization of the disturbed area.

CONDITIONS

Sediment traps should be installed at or around all storm drain drop inlets that receive runoff from disturbed areas.

DESIGN CRITERIA

Many sediment filtering devices can be designed to serve as temporary sediment traps. Sediment traps must be self-draining unless they are otherwise protected in an approved fashion that will not present a safety hazard. *The drainage area entering the inlet sediment trap shall be no greater than one acre.*

If runoff may bypass the protected inlet, a temporary dike should be constructed on the down slope side of the structure. Also, a stone filter ring may be used on the up slope side of the inlet to slow runoff and filter larger soil particles. Refer to **Fr - Stone Filter Ring**.

Excavated Inlet Sediment Trap

An excavation may be created around the inlet sediment trap to provide additional sediment storage. The trap shall be sized to provide a minimum storage capacity calculated at the rate of 67 cubic yards per acre of drainage area. A minimum depth of 1.5 feet for sediment storage should be provided. Side slopes shall not be steeper than 2:1.

CONSTRUCTION SPECIFICATIONS

Sediment traps may be constructed on natural ground surface, on an excavated surface, or on machine compacted fill provided they have a non-erodible outlet.

Filter Fabric with Supporting Frame

Sd2 -F

This method of inlet protection is applicable where the inlet drains a relatively flat area (slope no greater than 5%) and shall not apply to inlets receiving concentrated flows, such as in street or highway medians. As shown in Figure 6-21.1, Type C silt fence supported by steel posts shall be used. The stakes shall be spaced evenly around the perimeter of the inlet a maximum of 3 feet apart, and securely driven into the ground, approximately 18 inches deep. The fabric shall be entrenched 12 inches and backfilled with crushed stone or compacted soil. Fabric and wire shall be securely fastened to the posts, and fabric ends must be overlapped a minimum of 18 inches or wrapped together around a post to provide a continuous fabric barrier around the inlet.

Baffle Box

Sd2 -B

For inlets receiving runoff with a higher volume or velocity, a baffle box inlet sediment trap should be used. As shown in Figure 6-21.2, the baffle box shall be constructed of 2” x 4” boards spaced a maximum of 1 inch apart or of plywood with weep holes 2 inches in diameter.

The weep holes shall be placed approximately 6 inches on center vertically and horizontally. Gravel shall be placed outside the box, all around the inlet, to a depth of 2 to 4 inches. The entire box is wrapped in Type C filter fabric that shall be entrenched 12 inches and backfilled.

Block and Gravel Drop Inlet Protection

Sd2 -Bg

This method of inlet protection is applicable where heavy flows are expected and where an overflow capacity is necessary to prevent excessive ponding around the structure. As shown in Figure 6-21.3, one block is placed on each side of the structure on its side in the bottom row to allow pool drainage. The foundation should be excavated at least 2 inches below the crest of the storm drain. The bottom row of blocks are placed against the edge of the storm drain for lateral support and to avoid washouts when overflow occurs. If needed, lateral support may be given to subsequent rows by placing 2" x 4" wood studs through block openings. Hardware cloth or comparable wire mesh with 1/2 inch openings shall be fitted over all block openings to hold gravel in place. Clean gravel should be placed 2 inches below the top of the block on a 2:1 slope or flatter and smoothed to an even grade. DOT #57 washed stone is recommended.

Gravel Drop Inlet Protection

Sd2-G

This method of inlet protection is applicable where heavy concentrated flows are expected. As shown in Figure 6-21.4, stone and gravel are used to trap sediment. The slope toward the inlet shall be no steeper than 3:1. A minimum 1 foot wide level stone area shall be left between the structure and around the inlet to prevent gravel from entering the inlet. On the slope toward the inlet, stone 3 inches in diameter and larger should be used. On the slope away from the inlet, 1/2 to 3/4 inch gravel (#57 washed stone) should be used at a minimum thickness of 1 foot.

Sod Inlet Protection

Sd2-S

This method of inlet protection is applicable only at the time of permanent seeding, to protect the inlet from sediment and mulch material until permanent vegetation has become established. As shown in Figure 6-21.6, the sod shall be placed to form a turf mat covering the soil for a distance of 4 feet from each side of the inlet structure. Sod strips shall be staggered so that adjacent strip ends are not aligned.

Excavated Inlet Sediment Trap

The sediment trap shall be placed immediately around the inlet. The excavation shall be constructed immediately outside of the sediment trap and provide a minimum depth of 1.5 feet for sediment storage.

Curb Inlet Protection

Sd2-P

Once pavement has been installed, a curb inlet filter shall be installed on inlets receiving runoff from disturbed areas. **This method of inlet protection shall be removed if a safety hazard is created.**

One method of curb inlet protection uses "pigs-in-a-blanket" - 8-inch concrete blocks wrapped in filter fabric. See Figure 6-21.5. Another method uses gravel bags constructed by wrapping DOT #57 stone with filter fabric, wire, plastic mesh, or equivalent material.

A gap of approximately 4 inches shall be left between the inlet filter and the inlet to allow for overflow and prevent hazardous ponding in the roadway. *Proper installation and maintenance are crucial due to possible ponding in the roadway, resulting in a hazardous condition.*

Several other methods are available to prevent the entry of sediment into storm drain inlets. Figure 6-21.7 shows of one of these

alternative methods.

MAINTENANCE

The trap shall be inspected daily and after each rain and repairs made as needed.

Sediment shall be removed when the sediment has accumulated to one-half the height of the trap. Sediment shall be removed from curb inlet protection immediately. For excavated inlet sediment traps, sediment shall be removed when one-half of the sediment storage capacity has been lost to sediment accumulation. Sod inlet protection shall be maintained as specified in **Ds4 - Disturbed Area Stabilization (With Sodding)**.

Sediment shall not be washed into the inlet. It shall be removed from the sediment trap and disposed of and stabilized so that it will not enter the inlet, again.

When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed, and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, then smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

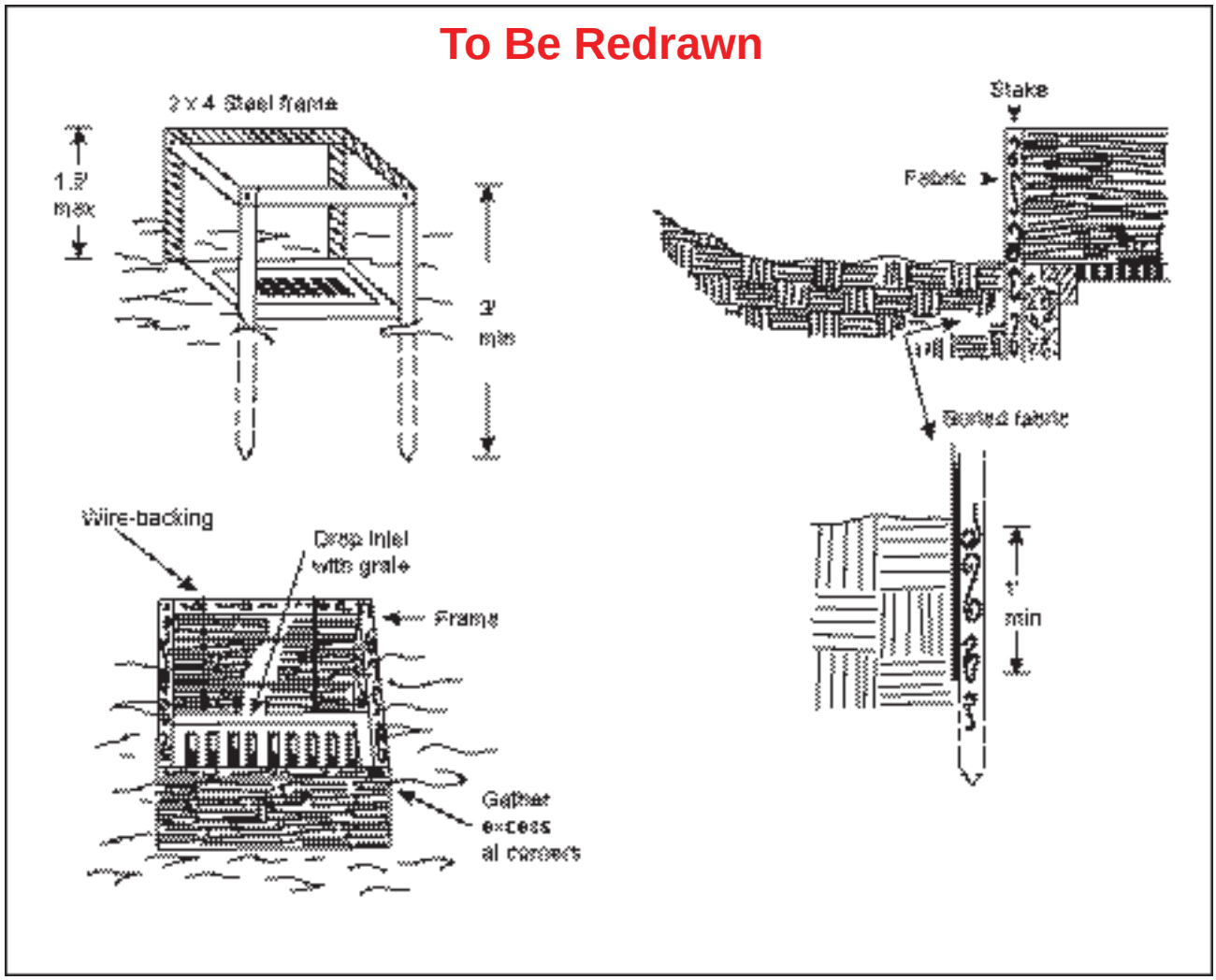

Figure 6-21.1 - Fabric and Supporting Frame For Inlet Projection

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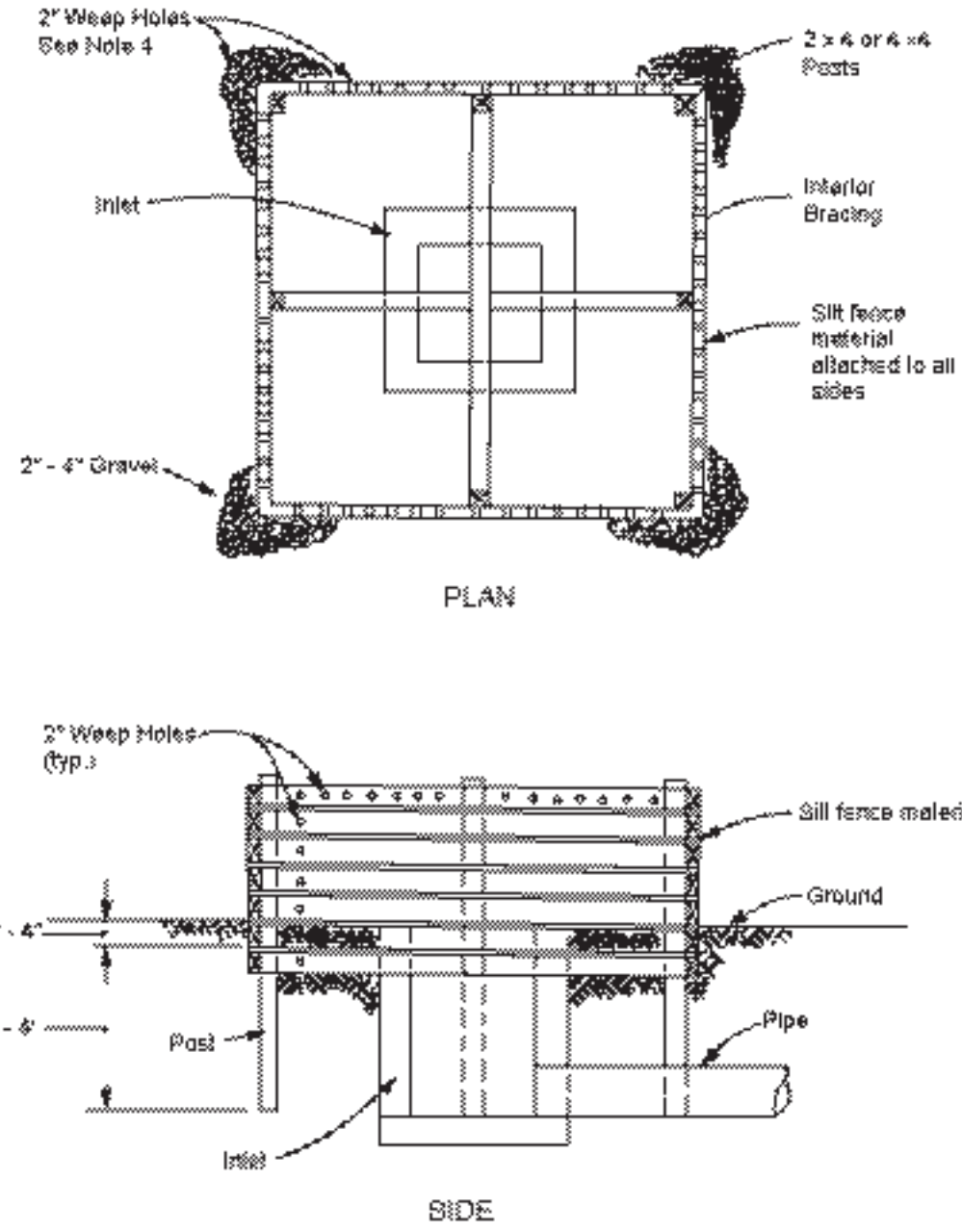


BAFFLE BOX

Figure 6-21.2

To Be Redrawn

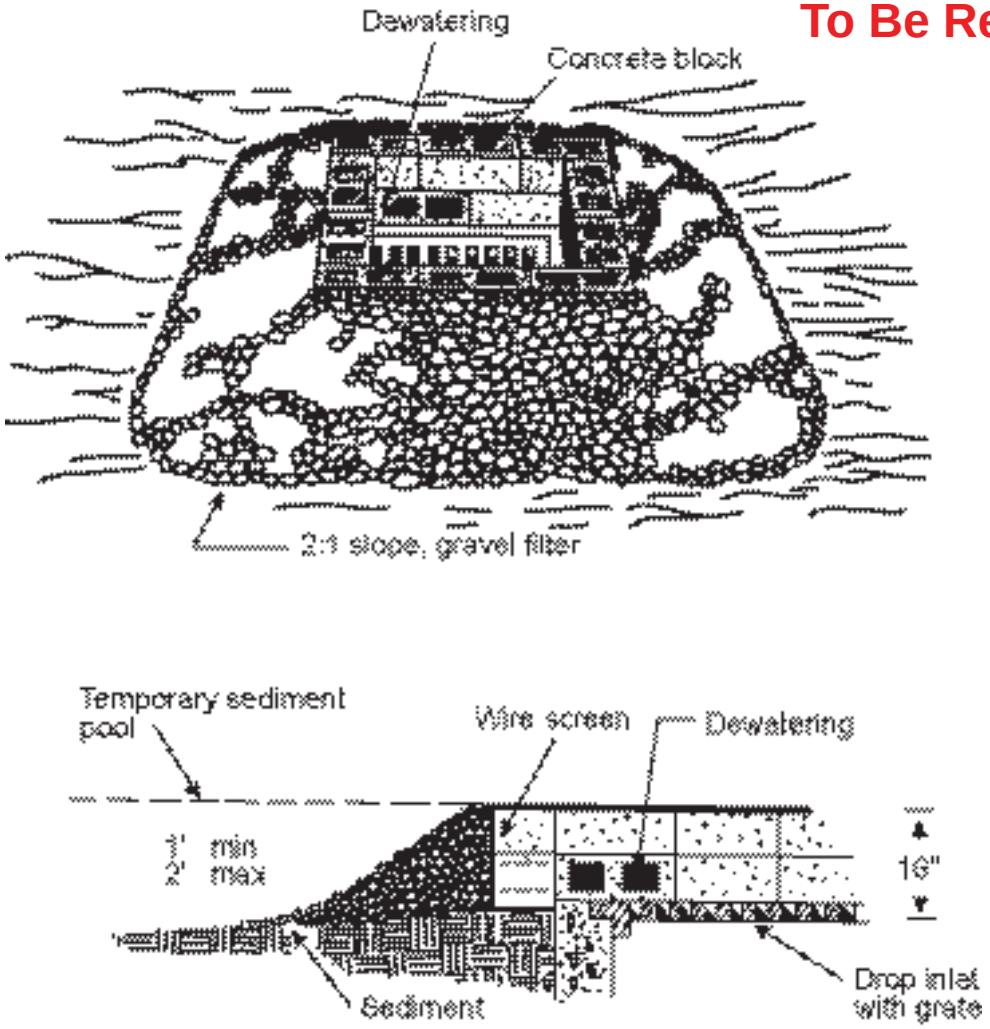


Figure 6-21.3 - Block and Gravel Drop Inlet Protection

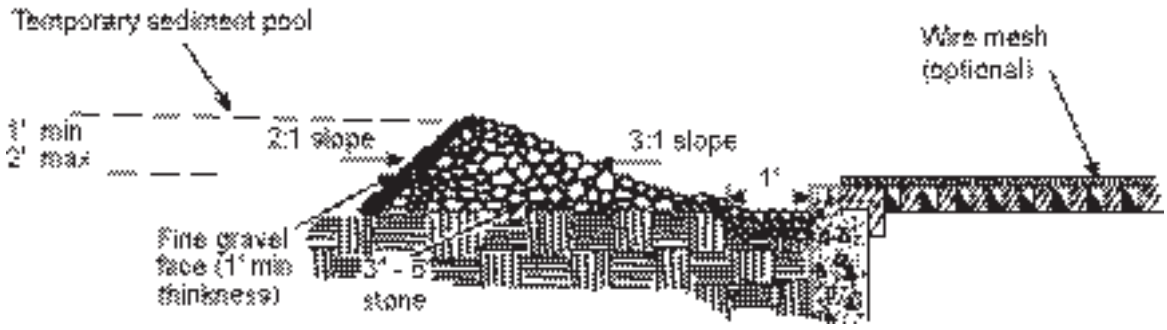
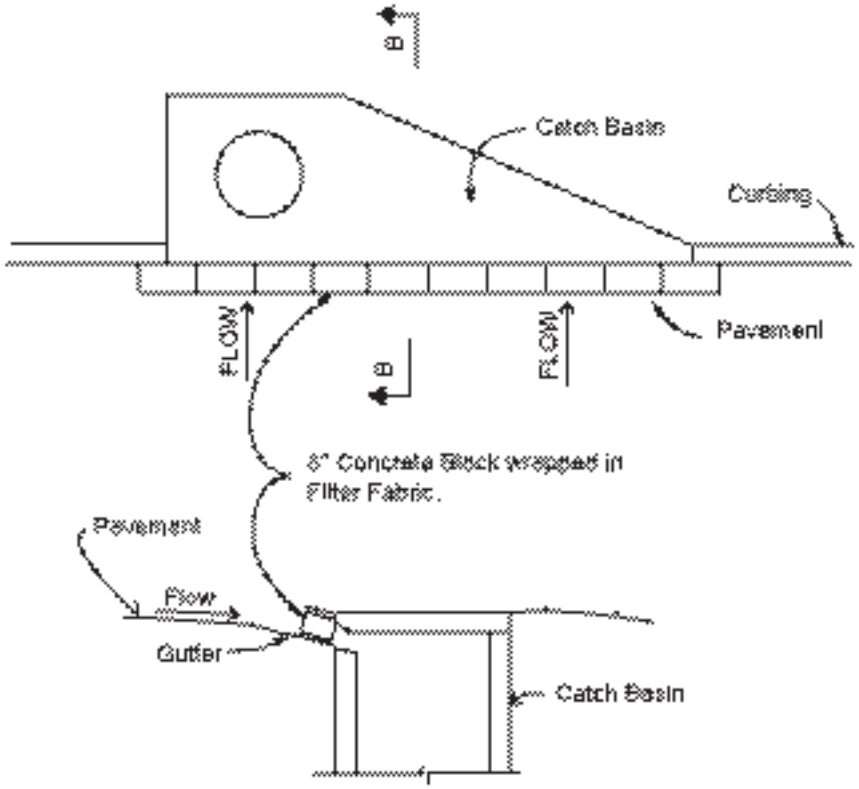


Figure 6-21.4 - Gravel Drop Inlet Protection (Gravel Donut)

To Be Redrawn



SECTION B-B

NOTE:
Install filter after any asphalt pavement installation.

CURB INLET FILTER
"PIGS IN BLANKET"

Figure 6-21.5

To Be Redrawn

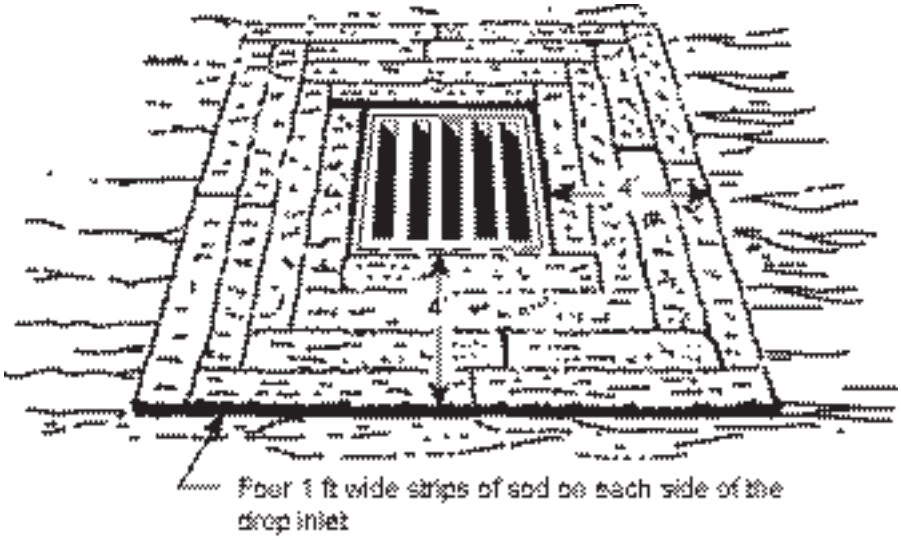


Figure 6-21.6 - Sod Strips Protect Inlet Area From Erosion (source: Va SWCC)

Figure 6-21.7 - Alternative Inlet Sediment Trap

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

If the **EXCAVATED INLET SEDIMENT TRAP** is used, show the following information:

1. **Drainage area** = _____ ac
2. Required sediment storage = 67 cy/ac * drainage area
   Required sediment storage = 67 cy/ac * _____ ac
   Required sediment storage = _____ cy = _____ cf
3. Assume excavation **depth** (minimum of 1.5 ft.) = _____ ft
4. Assume **slope of sides** (shall not be steeper than 2:1) = __ :1
5. Determine required surface area
   SA_{min} = Required sediment storage / excavation depth
   SA_{min} = _____ cy / _____ ft
   SA_{min} = _____ sf
6. Assume shape of excavation and determine dimensions.
   (A rectangular shape with 2:1 length to width ratio is recommended.)
   Shape: _____
   Dimensions: l = _____ ft w = _____ ft diameter (*if applicable*) = _____ ft

Provide a detail showing the depth, length and width, or diameter (*if applicable*), and side slopes of the excavation.

Temporary Sediment Basin

Sd3

DEFINITION

A basin created by the construction of a barrier or dam across a concentrated flow area or by excavating a basin or by a combination of both. A sediment basin typically consists of a dam, a pipe outlet, and an emergency spillway. The size of the structure will depend upon the location, size of the drainage area, soil type, and rainfall pattern.

PURPOSE

To detain runoff waters and trap sediment from erodible areas in order to protect properties and drainage ways below the installation from damage by excessive sedimentation and debris. The water is temporarily stored and the bulk of the sediment carried by the water drops out and is retained in the basin while the water is automatically released.

CONDITIONS

This practice applies to critical areas where physical site conditions, construction schedules, or other restrictions preclude the installation or establishment of erosion control practices to satisfactorily reduce runoff, erosion, and sedimentation. The structure may be used in combination with other practices and should remain in effect until the sediment-producing area is permanently stabilized.

This standard applies to the installation of temporary (to be removed within 18 months) sediment basins on sites where: (1) failure of the structure would not result in loss of life or interruption of use or service of public utilities, and (2) the drainage area does not exceed 150 acres.

DESIGN CRITERIA

Compliance With Laws and Regulations

Design and construction shall comply with state and local laws, ordinances, rules and regulations. Basins shall be constructed according to the approved erosion and sediment control plan unless modified by the design engineer.

Location

Sediment basins shall never be placed in live streams. They should be located so that storm drains discharge into the basin. The sediment basin should be located to obtain the maximum storage benefit from the terrain and for ease of clean-out of the trapped sediment. It should be located to minimize interference with construction activities and construction of utilities.

Volume

The sediment storage volume of the basin, as measured to the elevation of the crest of the principal spillway, shall be at least 67 cubic yards per acre for the disturbed area draining into the basin (67 cubic yards is equivalent to 1/2 inch of sediment per acre of drainage area). *The entire drainage basin area should be used for this computation*, rather than the disturbed area alone, to help ensure adequate trapping efficiency. *Sediment shall be removed*

from the basin when approximately one-third of the storage volume has been lost to sediment accumulation. This volume shall be marked on the riser or by setting a marked post near the riser.

Surface Area

Studies (Barfield and Clar, 1985) indicate that the following relationship between surface area and peak inflow rate gives a trapping efficiency from greater than 75% for clay loam to 95% for loamy sandy soils.

$$A = 0.01q$$

where A is basin surface area in acres and q is peak inflow rate in cfs. Area is measured at the crest of the principal spillway riser. The minimum peak inflow rate is determined from a 2-year, 24-hour storm.

Shape

It is recommended that the designer of a sediment basin incorporate features to maximize detention time within the basin. Suggested methods of accomplishing this objective are:

1. Length to width ratio greater than 2:1, where length is the distance between the inlet and outlet.

2. A wedge shape with the inlet located at the narrow end.

3. Installation of baffles or diversions.

Procedure for Determining or Altering Sediment Basin Shape

As specified in the Standard and Specification, the pool area at the elevation of crest of the principal spillway shall have a length to width ratio of at least 2:1. The purpose of this requirement is to minimize the "short-circuiting" effect of the sediment-laden inflow to the riser and thereby increasing the effectiveness of the sediment basin. The purpose of this procedure is to prescribe the parameters, procedures and methods of determining and modifying the shape of basin.

The length of the flow path (L) is the distance from the point of inflow to the riser (outflow point). The point of inflow is the point that the stream enters the normal pool (pool level at the riser crest elevation). The pool area (A) is the area of the normal pool. The effective width (We) is equal to the Area (A) divided by the length (L). The length to width ratio (L:W) is found by the equation:

$$L:W = l/We \text{ where } We = A/L$$

In the event there is more than one inflow point, *any inflow point which conveys more than 30 percent of the total peak inflow rate shall meet the length-width ratio criteria.*

The required basin shape may be obtained by proper site selection, by excavation, or by constructing a baffle in the basin. The purpose of the baffle is to increase the effective flow length from the inflow point to the riser. Baffles shall be placed mid-way between the inflow point and the riser. The baffle length shall be as required to provide the minimum 2:1 length-width ratio. The effective length (Le) shall be the shortest distance the water must flow from the inflow point around the end of the baffle to the outflow point. Then:

$$L:W = Le/We \text{ where } We = A/Le$$

Three examples are shown on the following pages. Note that for the special case in example C the water is allowed to go around both ends of the baffle and the effective length, Le = L1a + L1b = L2a + L2d. Otherwise, the length-width ratio computations are the same as shown above. This special case procedure for computing Le is allowable only when the two flow paths are equal, *i.e.*, when L1 = L2. A baffle detail is also shown. For examples of sediment basin baffles, refer to Figure 6-22.2.

The dimensions necessary to obtain the required basin volume and surface area shall be clearly shown on the plans to facilitate plan

review, construction and inspection.

Spillways

Runoff may be computed by the method outlined in Appendix A. Other approved equivalent methods may be used. Runoff computations shall be based upon the worst soil-cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure. *The combined capacities of the principal and emergency spillway shall be sufficient to pass the peak rate of runoff from a 25-year, 24-hour frequency storm.* Even if the principal spillway is designed to convey the peak rate of runoff from a 25-year, 24,-hour storm, an emergency spillway shall be present.

1. **Principal spillway** - A spillway consisting of a vertical pipe or box type riser joined (watertight connection) to a pipe which shall extend through the embankment and outlet beyond the downstream toe of the fill shall be provided. See figure 6-22.3. The metal gauge thickness shall comply with DOT or NRCS specifications. The discharge shall be based on a 2-year, 24-hour storm for the total drainage area without causing flow through the emergency spillway. The appropriate disturbed soil cover condition shall be used. *The minimum size of the pipe shall be 8 inches in diameter.* Principal spillway capacities may be determined from Table 6-22.1. Weir flow discharge above the crest of the riser may be determined from Table 6-22.2. Principal spillway pipe, riser pipe, and trash rack proportions are shown in Table 6-22.2.

    a. **Crest elevation** - The crest elevation of the riser shall be a minimum of one foot below the elevation of the control section of the emergency spillway.

    b. **Watertight barrel assembly** - The riser and all pipe connections shall be completely water tight except for the inlet opening at the top or dewatering openings, and shall not have any other holes, leaks, rips or perforations.

    c. **Dewatering the basin** - Retention time within the basin is an important factor in effective sediment retention. The method used to dewater the sediment basin may be selected from the following two methods:

Perforated Riser Pipe - The perforated riser pipe is the conventional method for dewatering a sediment basin. The lower half of the riser is perforated with 1/2-inch holes spaced approximately 3-inches apart. It is covered with two feet of 3 to 4 inch stone.

Skimmer Outlet - The skimmer-type dewatering device operates at the surface of the ponded water and will not withdraw sediment from the submerged volume of the basin. As compared to conventional perforated risers, skimmers discharge a 45 percent less mass of sediment. However, skimmers are mechanically more complex and will require frequent inspection and maintenance in order to operate as designed. See Figure 6-22.4.

    d. **Trash rack and anti-vortex device** - A trash rack and anti-vortex device shall be securely installed on top of the riser and may be the type as shown in Figure 6-22.5.

    e. **Base** - The riser shall have a base attached with a watertight connection and shall have sufficient weight to prevent flotation of the riser. *A concrete base 18" thick with the riser embedded 9-inches in the base is recommended.* Computations shall be made to design a base which will prevent flotation. See Figure 6-22.6 and Table 6-22.3 for details.

    f. **Anti-Seep Collars** - One anti-seep collar shall be installed around the pipe, near the center of the dam, when **any** of the following conditions exist:

        1. The settled height of the dam is greater than 15 feet.

        2. The conduit is smooth pipe larger

than 8” in diameter.

3. The conduit is corrugated metal pipe larger than 12” in diameter.

Use an anti-seep collar with an 18-inch projection for heads (H) less than or equal to 10 feet and a 24-inch projection for heads (H) greater than 10 feet. The anti-seep collar and its connection shall be watertight.

g. **Outlet** - An outlet shall be provided, including a means of conveying the discharge in an erosion-free manner to an existing stable area. Where discharge occurs at the property line, drainage easements will be obtained in accordance with local ordinances. Adequate notes and references will be shown on the erosion and sediment control plan. Protection against scour at the discharge end of the pipe spillway shall be provided. Measures may include excavated plunge pools, riprap, impact basins, revetments, or other approved methods. Refer to specification **St - Storm Drain Outlet Protection**.

h. For typical features of a temporary sediment basin, see Figure 6-22.1.

2. **Emergency Spillway** - *The entire flow area of the emergency spillway shall be constructed in undisturbed ground (not fill).* The emergency spillway cross-section shall be trapezoidal with a minimum bottom width of eight feet. This spillway channel shall have a straight control section of at least 20 feet in length and a straight outlet section for a minimum distance equal to 25 feet. See Figure 6-22.7.

a. **Capacity** - The minimum capacity of the emergency spillway shall be that *required to pass the peak rate of runoff from the 25-year, 24-hour frequency storm, less any reduction due to flow in the principal spillway.* The appropriate disturbed soil cover condition shall be used. Emergency spillway dimensions may be determined by using the method described in this section. Refer to Table 6-22.4 and Figure 6-22.7.

b. **Velocities** - *The velocity of flow in the exit channel shall not exceed 5 feet per second for vegetated channels.* For channels with erosion protection other than vegetation, velocities shall be within the non-erosive range for the type of protection used. Vegetation, riprap, asphalt or concrete shall be provided to prevent erosion. Refer to specification Ch - Channel Stabilization.

c. **Freeboard** - Freeboard is the difference between the design high water elevation in the emergency spillway and the top of the settled embankment. *The freeboard shall be at least one foot.*

Entrance of Runoff Into Basin

Points of entrance of surface runoff into excavated sediment basins shall be protected to prevent erosion and sediment generation. Dikes, swales or other water control devices shall be installed as necessary to direct runoff into the basin. Points of runoff entry should be located as far away from the riser as possible, to maximize travel time. Refer to **St - Storm Drain Outlet Protection**.

CONSTRUCTION SPECIFICATIONS

Site Preparation

Areas under the embankment and under structural works shall be cleared, grubbed, and stripped of top-soil. All trees, vegetation, roots and other objectionable material shall be removed and disposed of by approved methods. In order to facilitate clean-out or restoration,

the pool area (measured at the top of the pipe spillway) will be cleared of all brush and trees.

Cut-off Trench

A cut-off trench will be excavated along the center-line of earth fill embankments. *The minimum depth shall be 2 feet.* The cut-off trench shall extend up both abutments to the riser crest elevation. The minimum bottom width shall be 4 feet, but wide enough to permit operation of compaction equipment. The side slopes shall be no steeper than 1:1. Compaction requirements shall be the same as those for the embankment. The trench shall be drained during the backfilling and compaction operations.

Embankment

The fill material shall be taken from approved areas shown on the plans. It shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW & SP) shall be placed in the downstream section of the embankment. Areas on which fills are to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. *Fill material shall be placed in six-inch to eight-inch thick continuous layers over the entire length of the fill.* Compaction shall be obtained by routing and hauling the construction equipment over the fill so that the entire surface of the fill is traversed by at least one wheel or tread track of the equipment or by the use of a compactor. *The embankment shall be constructed to an elevation 5 percent higher than the design height to allow for settlement.*

Principal Spillway

The riser shall be securely attached to the pipe or pipe stub by welding the full circumference making a watertight structural connection. The pipe stub must be attached to the riser at the same percent (angle) of grade as the outlet conduit. The connection between the riser and the riser base shall be watertight. All connections between pipe sections must be achieved by approved watertight band assemblies. The pipe and riser shall be placed on a firm, smooth foundation of impervious soil as the embankment is constructed. Breaching the embankment is unacceptable. Pervious materials such as sand, gravel, or crushed stone shall not be used as backfill around the pipe or anti-seep collar. *The fill material around the pipe spillway shall be placed in four inch layers and compacted under and around the pipe to at least the same density as the adjacent embankment.* Care must be taken not to raise the pipe from firm contact with its foundation when compacting under the pipe haunches. A minimum depth of two feet of hand compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment.

Emergency Spillway

The emergency spillway shall be installed in undisturbed ground. The achievement of planned elevations, grades, design width, entrance and exit channel slopes are critical to the successful operation of the emergency spillway and must be constructed within a tolerance of ± 0.2 feet. If the emergency spillway requires erosion protection other than vegetation, *the lining shall not compromise the capacity of the emergency spillway, e.g.* the emergency spillway shall be over-excavated so that the lining will be flush with the slope surface.

Vegetative Treatment

Stabilize the embankment and all other disturbed areas in accordance with the appropriate permanent vegetative measure, Ds3, immediately following construction. *In no case shall the embankment remain unstabilized for more than seven (7) days.* Refer to specifications **Ds2, Ds3, and Ds4 - Disturbed Area Stabilization (Temporary Seeding, Permanent Vegetation, and Sodding)** respectively.

Erosion and Pollution Control

Construction operations will be carried out in such a manner that erosion and water pollution will be minimized. State and local law concerning pollution abatement shall be complied with.

Safety

State and local requirements shall be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.

MAINTENANCE

Repair all damages caused by soil erosion or construction equipment at or before the end of each working day.

Sediment shall be removed from the basin when it reaches the specified distance below the top of the riser. *Sediment shall not enter adjacent streams or drainageways during sediment removal or disposal.* The sediment shall not be deposited downstream from the embankment, adjacent to a stream or floodplain.

FINAL DISPOSAL

When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with approved sediment control plan. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. *If the site is scheduled for future construction, then the embankment and trapped sediment must be removed, safely disposed of, and backfilled with a structural fill.* When the basin area is to remain open space, the pond may be pumped dry, graded and backfilled.

TO BE SUBMITTED WITH/ON THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN

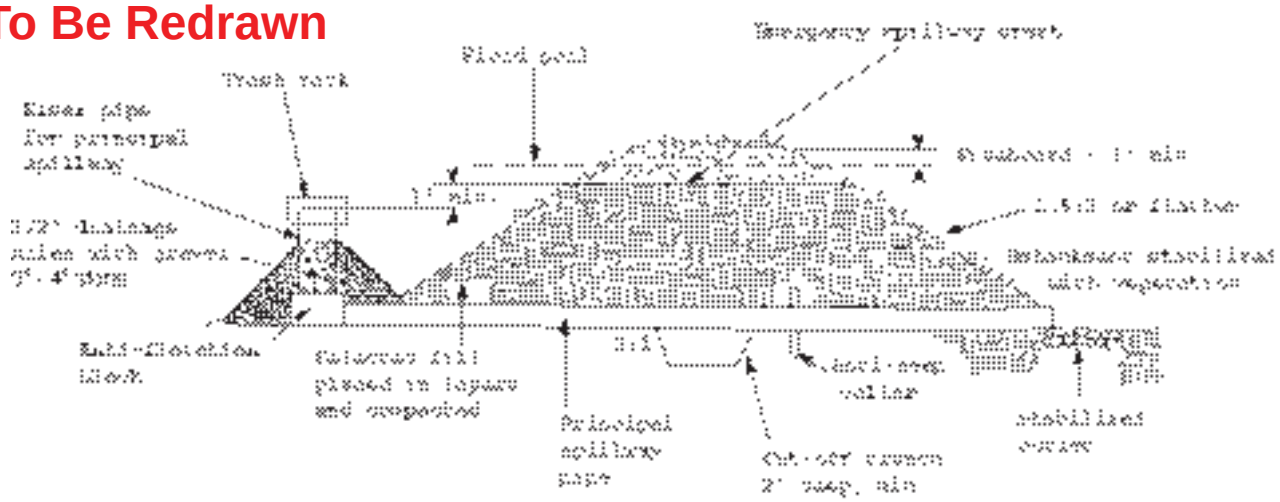
On the ES&PC Plan

1. The specific location of the basin, showing existing and proposed contours.
2. Maintenance equipment access points.
3. Completed Figures 6-22.8 and 6-22.9. (details for the cross section of dam, principal spillway, and emergency spillway, and profile of emergency spillway).
4. Details of trash rack, concrete riser base, and outlet structure assembly. (Refer to Figures 6-22.4 to 6-22.7.)

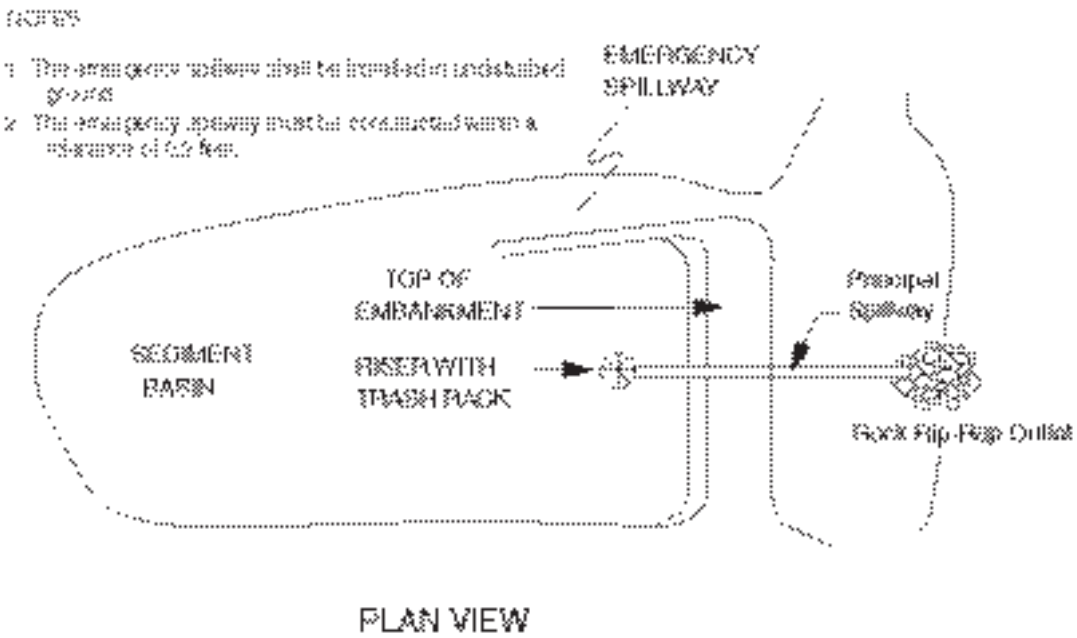
On 8 1/2” x 11”Sheet(s)

1. Hydrological study, including information regarding stage/storage relationship.
2. Temporary sediment basin design sheet, p. 6-168 to 6-170.
3. Completed Figures 6-22.8 and 6-22.9 (details for the cross section of the dam, principal spillway, and emergency spillway, and profile of emergency spillway).

To Be Redrawn



CROSS SECTION



PLAN VIEW

Figure 6-22.1 - Basic Components of a Temporary Sediment Basin

To Be Redrawn

SEDIMENT BASIN BAFFLES

Examples: Plan Views - not to scale

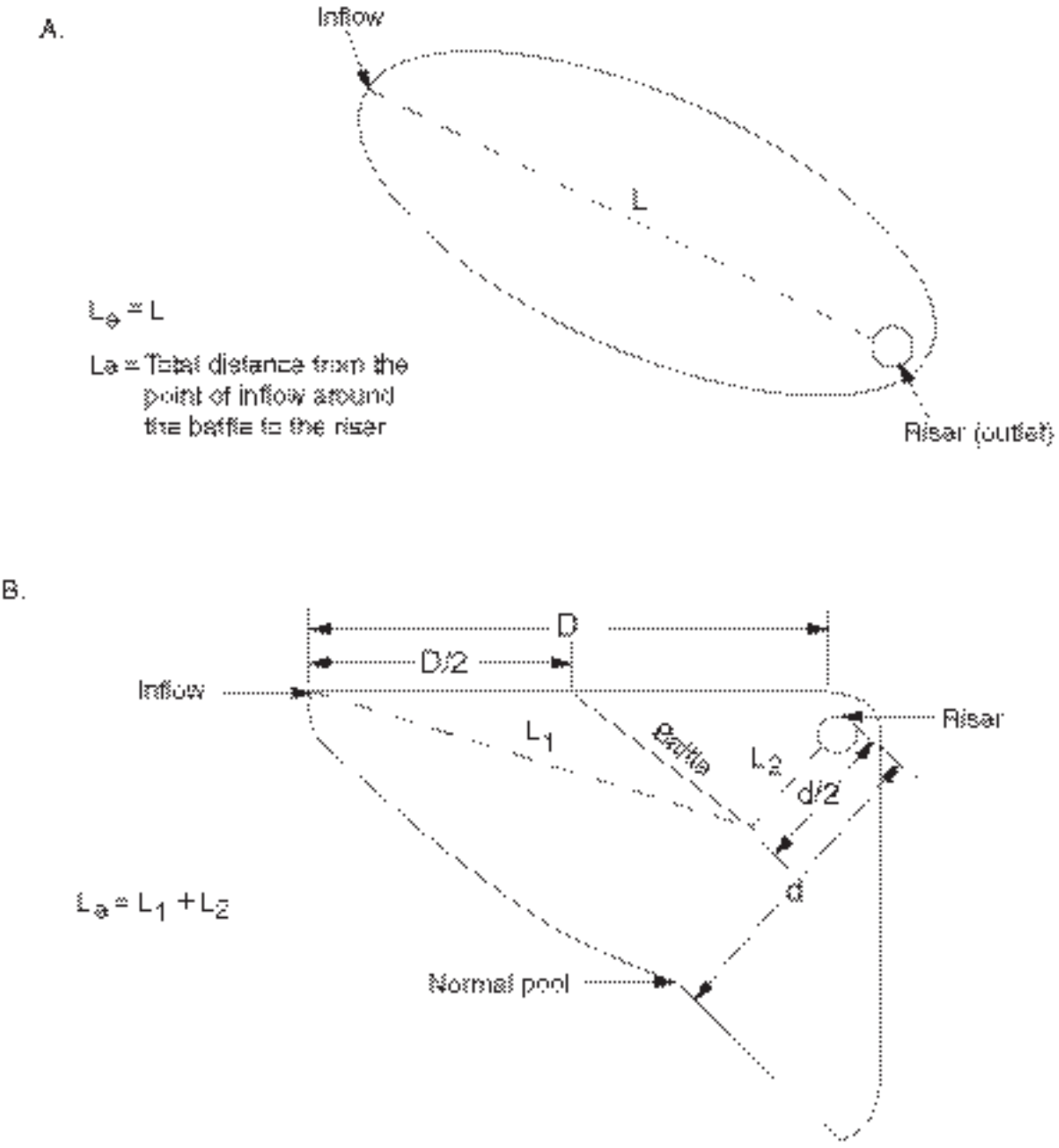


Figure 6-22.2 (Sheet 1 of 2)

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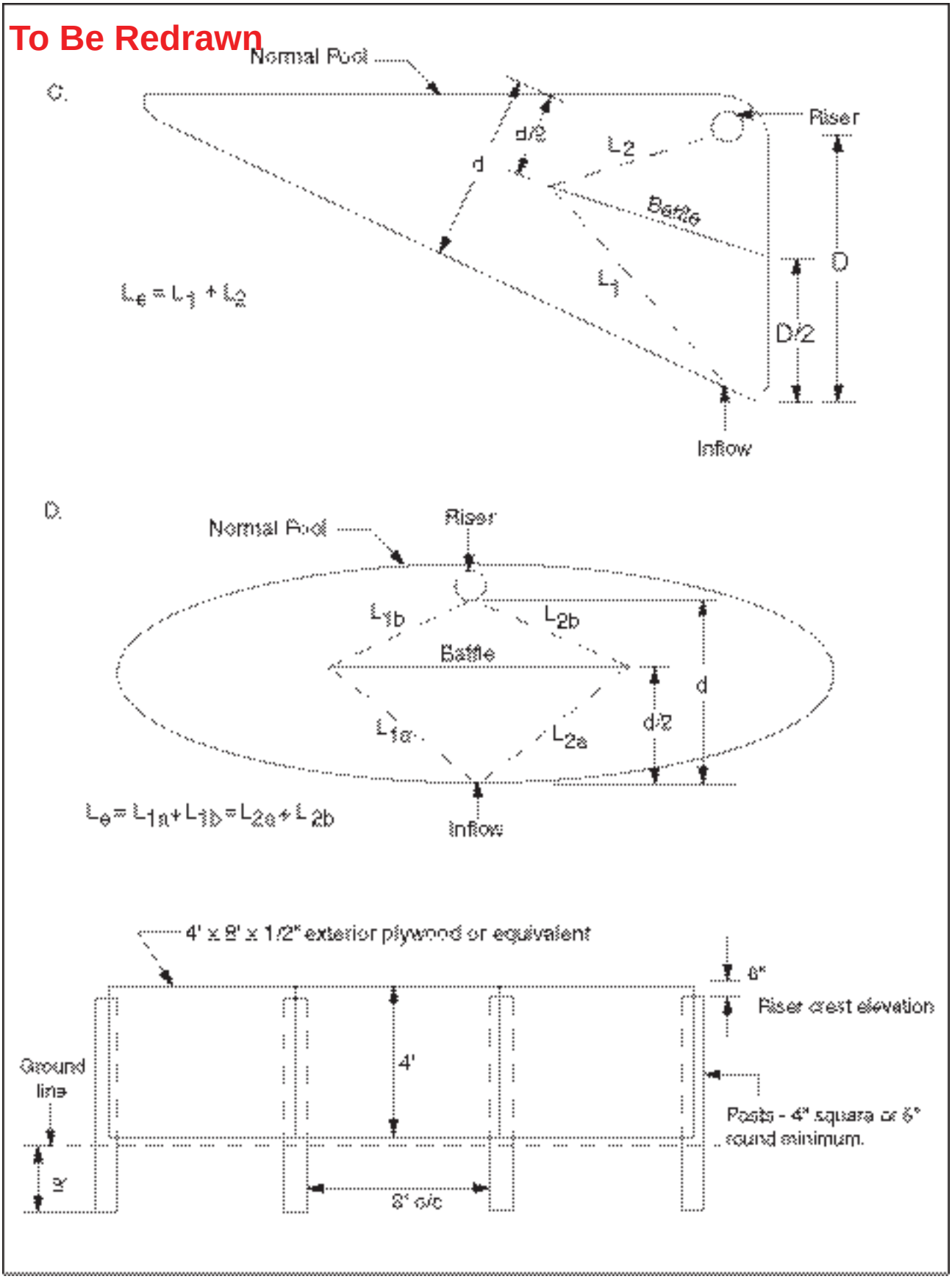
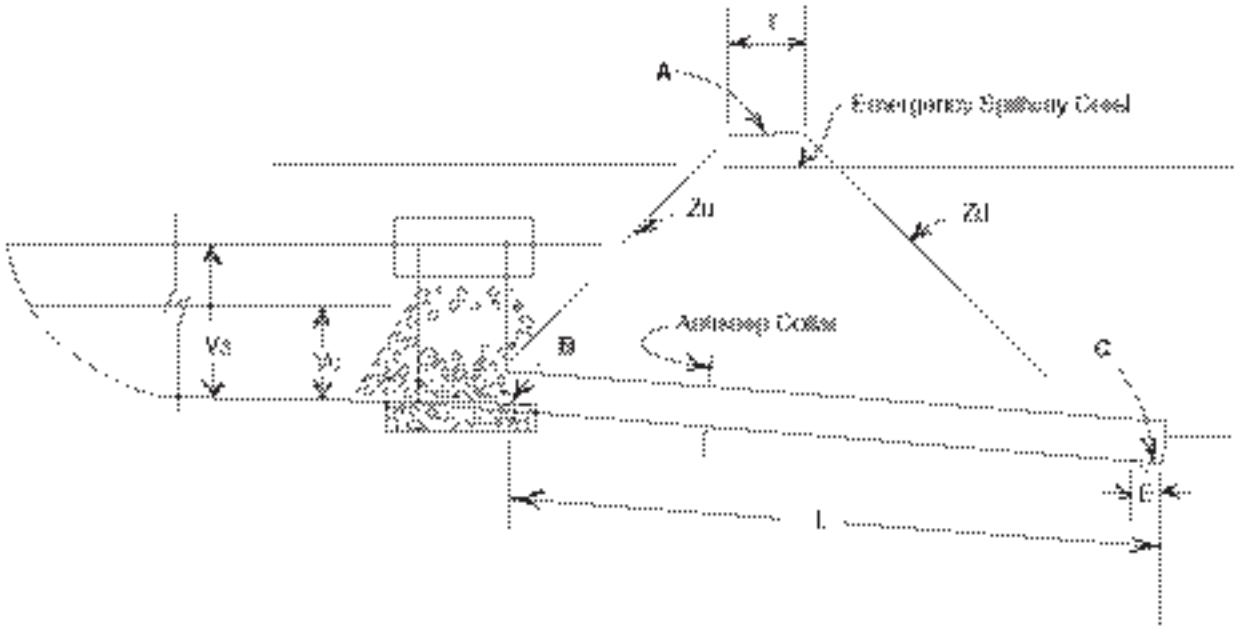


Figure 6-22.2 (Sheet 2)

To Be Redrawn



PRINCIPAL SPILLWAY DESIGN

W = Top width of dam, ft

Zu = Upstream side slope

Zd = Downstream side slope

A = Top of dam elevation

B = Lowest elevation of pipe at weir

C = Lowest elevation of pipe at outlet

E = Extended length of pipe beyond toe of dam

L = Total length of pipe, ft.

L = [A - (B + C) /2] [Zu + Zd] + W + E

Figure 6-22.3

Table 6-22.1. Pipe Flow Chart For Corrugated Metal Pipe Drop Inlet Principal Spillway Conduit

For Corrugated Metal Pipe Inlet $K_m = K_a + K_b = 1.0$ and 70 Feet of Corrugated Metal Conduit (full flow assumed), n = 0.025
(Note correction factors for pipe lengths other than 70 feet)

	Diameter Of Pipe In Inches							
H, in feet	8”	12”	18”	24”	30”	36”	42”	48”
	Discharge In Cubic Feet Per Second							
3	1.22	3.43	9.48	19.1	32.6	49.9	71.2	96.5
4	1.40	3.97	10.9	22.1	37.6	57.7	82.3	111
5	1.57	4.43	12.2	24.7	42.1	64.5	92.0	125
6	1.72	4.86	13.4	27.0	46.1	70.6	101	136
7	1.86	5.25	14.5	29.2	49.8	76.3	109	147
8	1.99	5.61	15.5	31.2	53.2	81.5	116	158
9	2.11	5.95	16.4	33.1	56.4	86.5	123	167
10	2.22	6.27	17.3	34.9	59.5	91.2	130	176
11	2.33	6.58	18.2	36.6	62.4	95.6	136	185
12	2.43	6.87	19.0	38.2	65.2	99.9	142	193
13	2.53	7.15	19.7	39.8	67.8	104	148	201
14	2.63	7.42	20.5	41.3	70.4	108	154	208
15	2.72	7.68	21.2	42.8	72.8	112	159	216
16	2.81	7.93	21.9	44.2	75.2	115	165	223
17	2.90	8.18	22.6	45.5	77.5	119	170	230
18	2.98	8.41	23.2	46.8	79.8	120	174	236
19	3.06	8.64	23.9	48.1	82.0	126	179	243
20	3.14	8.87	24.5	49.4	84.1	129	184	249
L, in feet	Correction Factors For Other Pipe Lengths							
30	1.41	1.36	1.29	1.24	1.21	1.18	1.15	1.13
40	1.27	1.23	1.20	1.17	1.14	1.12	1.11	1.10
50	1.16	1.14	1.12	1.10	1.09	1.08	1.07	1.06
60	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.03
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	0.94	0.95	0.95	0.96	0.96	0.97	0.97	0.97
90	0.89	0.90	0.91	0.92	0.93	0.94	0.94	0.95
100	0.85	0.86	0.88	0.89	0.90	0.91	0.92	0.93
120	0.79	0.90	0.82	0.83	0.85	0.86	0.87	0.89
140	0.73	0.75	0.77	0.79	0.81	0.82	0.84	0.85
160	0.69	0.70	0.73	0.75	0.77	0.79	0.80	0.82

Temporary Sediment Trap

Sd4

DEFINITION

A small temporary pond that drains a disturbed area so that sediment can settle out. The principle feature distinguishing a temporary sediment trap from a temporary sediment basin is the lack of a pipe or riser.

PURPOSE

To collect and store sediment from uphill sites cleared and or graded during construction. Intended for use on small tributary areas with no unusual drainage features. Effective against course sediment, but not against silt or clay particles that remain suspended.

CONDITIONS

Temporary sediment traps are constructed early in the construction process at locations that will require minimal clearing and grading. Natural draws or swells are favorable locations to build the traps. They should be easily accessible for frequent maintenance and inspections. Temporary sediment traps shall never be placed in live streams.

DESIGN CRITERIA

Design and construction shall comply with laws, ordinances, rules and regulations on the local, state and federal level.

The total drainage area of a temporary sediment trap is 1 to 5 acres, depending on type of construction.

The height of a temporary sediment trap embankment shall not exceed 5.5 feet as measured from the downstream toe of slope to the top of the berm. Top width of an embankment shall be at least as wide as the height of the sediment trap embankment, with a minimum width of 3 feet.

Maximum pond depth of a sediment trap is 4 feet as measured from the bottom of the trap to the invert of the emergency spillway. Slopes shall not exceed 2:1 (H:V) for excavated areas and for compacted embankments. Side slopes should be (3:1) or flatter allowing people and equipment to safely negotiate slopes or to enter the sediment trap.

The length to width ratio must be greater than (2:1) (L:W) for the principal flowpaths in order to maximize residence time of storm-water within the sediment trap. Baffles may be required to prevent short-circuiting of the flow.

A typical baffle design uses 4’x8’ sheets of exterior grade plywood 1/2 inch thick, mounyed on 4”x4” hardwood posts.

Volume

Minimum volume of a temporary sediment trap shall be 67 cubic yards per acre for the total drainage area. The volume shall be measured at an elevation equivalent to the spillway invert.

Volume of a temporary sediment trap in heavily disturbed areas should be 134 cubic yards for the total drainage area. This includes an upper area with a minimum of 67 cubic yards per acre drained which is dewatered using on othe outlet design methods

provided, and a lowere wet zone for sediment storage and settling.

The volume should be calculated from existing and proposed contours, or by measured cross sections. An approximate method for calculating the volume of traps using a natural draw is:

V = 0.4 x A x D

V = sediment storage volume (below invert of emergency spillway)
A = Surface area (at level of emerency spillway)
D = Maximum depth (from emergency spillway invert)

The cleanout volume for a temporary sediment trap is 1/4 of the total storage volume. Cleanout volume shall be calculated and marked with a stake at the outlet of the trap.

CONSTRUCTION SPECIFICATIONS

The basic design guidlines are applicable to the type of temporary sediment trap constructed. The main differences are with regards to the typy of outlet structures. The following types of construction are acceptable under the designated conditions:

Overflow (SD4-A)

An overflow temporary sediment trap is limited to small areas less than 1 acre, typically with gentle slopes (1 or 2 percent) and without major grading operations. The maximum life span of an overflow trap is 6 months. If water enters the trap with very low velocities, the same amount of water will be slowly displaced and leave the other end of the sediment trap. Silt fence, straw bale barriers or grass filter strips are used to “polish” the overflow water as it leaves the sediment trap.

Combination Straw Bale and Silt Fence Outlet (SD4-B)

The combination outlet uses straw bales and silt fence to dewater the sediment trap. Proper installation and staking of the straw bales, and wire backing on the silt fence are required for the materials to resist 1 foot or more of ponded water. The combination straw bale and silt fence outlet is limited to 1 acre total drainage area, and has a life span of less than 1 year. This type of outlet reqires frequent maintenance and adjustments to ensure the released stormwater is free from sediment.

Rock Outlet (Sd4-C)

The rock outlet relies on filtering through layers of aggregate, rock or riprap material to dewater the sediment trap. It is the most sturdy of the sediment trap designs and generally requires less maintenance. It can be used for drainage acres up to 5 acres and has a life span of 1 year.

Emergency Spillway

The emergency overflow outlet of a temporary sediment trap must be stabilized with rock, geotextile, vegetation or another suitable material which is resistant to erosion. It must be installed to safely convey stormwater runoff for the 10-year storm event.

BMP details for the Sd4 are being drawn and will be included in the final draft of this Manual

References:

City of Knoxville
City of Knoxville BMP Manual Best Management Practices, Knoxville, TN, May 2003

Seep Berm SpB

Definition
A seep berm is a linear control device constructed as a diversion perpendicular to the direction of the runoff to enhance dissipation and infiltration of runoff, while creating multiple sedimentation chambers with the employment of intermediate dikes.

Purpose
To allow the 2 year storm event, 24 hour design storm to seep out while allowing larger flows to be diverted to a sediment storage area.

Conditions
Seep Berms should be installed where runoff can be stored behind the Seep Berm without damaging the berm or submerged area behind the intermediate dike points. Seep Berms are usually employed down-gradient of construction sites near the boundary of development.

This standard applies under the following conditions:

1. Seep berms shall not be used above fill slopes that have not achieved permanent stabilization meeting the definition of final stabilization.

2. Seep berms shall be designed by the design professional for use on a site.

Seep Berms shall not be installed across streams, ditches, waterways, or other concentrated flow areas.

Design Criteria

The seep berm shall have a minimum width of 12 inches across the top of berm and shall not be taller than 4 feet in height. The top of berm may vary or stay constant. The storage area should be identified (shaded) on the plans.

Two or more intermediate dikes in a series shall be used for drainage areas greater than one acre. Maximum spacing between dikes should be such that the toe of the upstream dike is at the same elevation as the top of the downstream dike. Intermediate dikes shall pass the 25 year storm event.

If a fill berm is utilized it is very important that it has proper compaction and receives the proper stabilization. Fill berms should be stabilized with a slope stabilization meeting the c-factor. Stabilization and applying seed at 70% germination or better shall occur prior to other land disturbing activities taking place in the drainage basin.

Berm storage volumes can be figured as a function of berm height and watershed gradient. The volumes shall be calculated using 67 cubic yards per acre drained to the berm. Detailed calculations shall be shown on the plans when using the seep berms for sediment storage. If a berm encounters different gradients then it should be calculated using the steepest slope in that run, existing or proposed. Clean out markers must be placed at each intermediate dike using a sediment storage calculation.

Construction Specifications
Seep berms are readily constructed using typical on-site construction equipment. The earthen berm shall be compacted. This can be easily done through tracking by a

skid-loader with a full bucket, tracking with a dozer and applying pressure with the bucket of a track hoe or rubber tired backhoe (min. 90% std.protor test).

Three general options are applicable for seep placement.

1. Seeps can be placed during the construction of the berm, but then care must be exerted when compacting above the seeps.

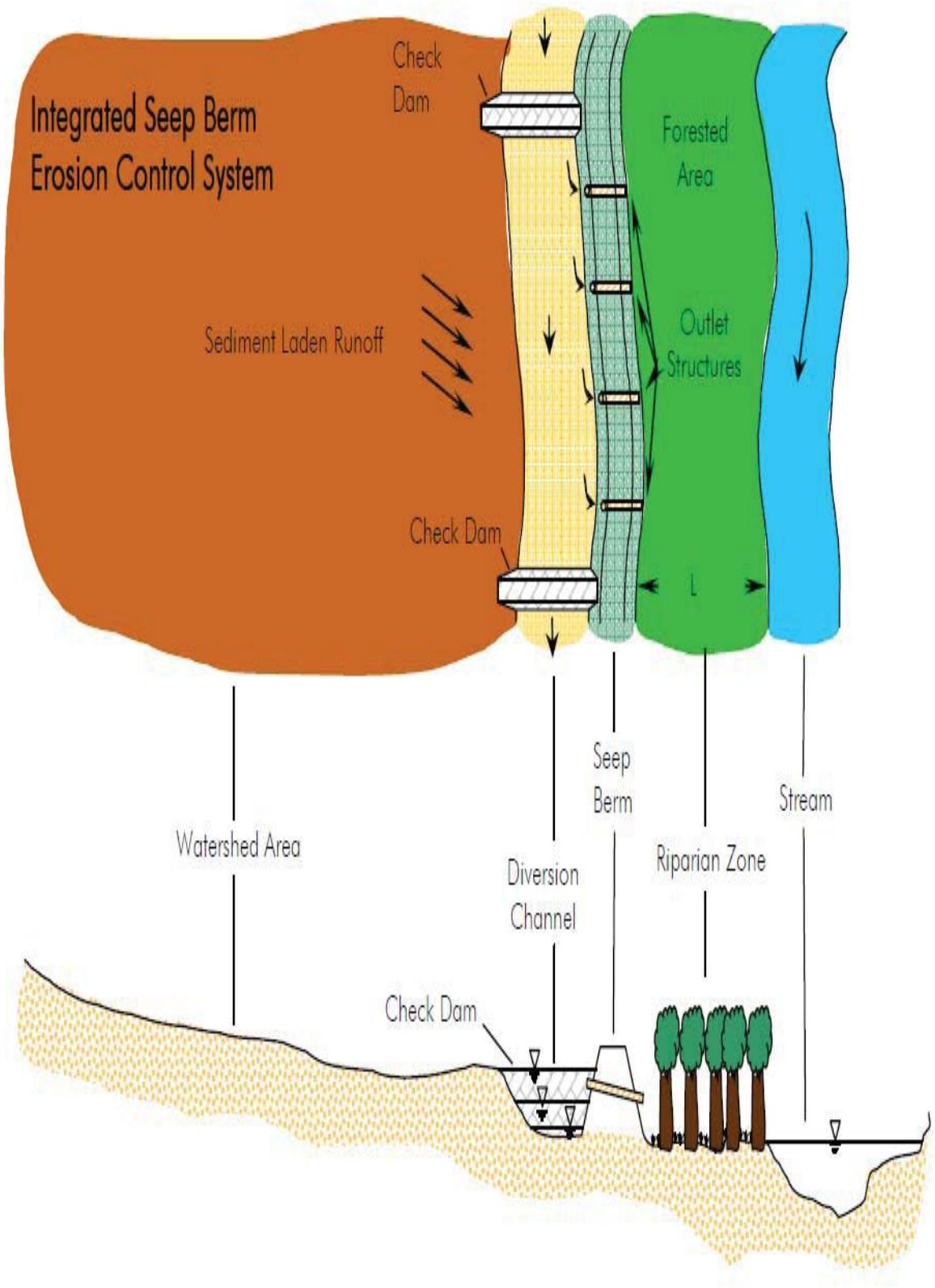
2. After the entire berm has been constructed, excavation at the location of the seeps can be conducted, seeps placed in the trench and back-filled, and the berm compacted above the seeps.

3. Completely build the earthen berm with proper compaction and then using a steel pipe with a conical end insert pipes through the berm.

Maintenance

Inspect the drain from the seep and supporting berm after every half inch rainfall event or greater or weekly depending on environmental conditions. Promptly make necessary repairs. The seep berms shall have the sediment removed when sediment accumulates to one-third the height of the intermediate dike or before. If the area is to be mowed then may be removed. Otherwise intermediate dikes may remain in place permanently. When the berms remain in place they may be utilized as a walking trail, etc.

To Be Re-drawn



References

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Strun, T.W., Warner, R.C., Torrealba,S., and Hamade,F. (2008). Demonstration of a Performanced-Based System of Storm Water and Erosion Controls on Small Residential/Commercial Sites in the Georgia Piedmont. Final Report submitted to Georgia EPD, Project751-40101.

Warner,R., Schwab,P.J., and Marshall, D.J. (1998). SEDCAD 4 Design Manual and User's Guide. Civil Software Design.

Breedlove,M.W., Breedlove Land Planning Inc. Seep Berm Installation. Personal Interview April, 2013.

Warner,R.C., Strum,T.W., Torrealba,S. (2007). Seep Berm Design Manual. Final Report submitted to Georgia EPD and U.S. Environmental Protection Agency, Atlanta, GA

TO BE SHOWN ON THE EROSION, SEDIMENT AND POLLUTION CONTROL PLAN

A. Top of Berm Elevation _____ft

B. Bottom of Berm Elevation _____ft

C. Top of Berm Width _____ft

D. Height of the Berm_____ft

E. Seep Hole Diameter _____ft

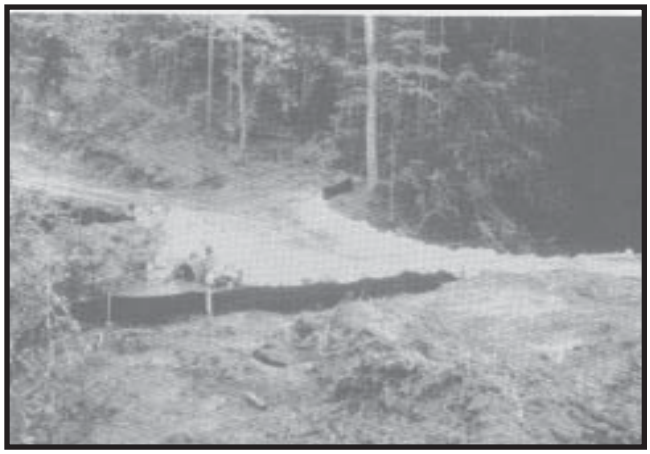
F. Distance from the the Top of the Seep to be Placed in Accordance with the 2yr-24hr storm _____ft

G. Type of Seep (circle one)
PVC Metal Other(specify)_____

H. Spacing of Seep Along the Berm_____ft

Temporary Stream Crossing

Sr



DEFINITION

A *temporary* structure installed across a flowing stream or watercourse for use by construction equipment.

PURPOSE

This standard provides a means for construction vehicles to cross streams or watercourses without moving sediment into streams, damaging the streambed or channel, or causing flooding.

CONDITIONS

Temporary stream crossings ~~shall~~ should not be used on streams with drainage areas greater than one square mile, unless specifically designed to accommodate the additional drainage area by the design professional. A certification statement and signature shall accompany the design.

Structures may include bridges, round pipes or pipe arches.

Temporary stream crossings should be in place for less than one year and should not be used by the general public.

DESIGN CRITERIA

Size

The structure shall be large enough to convey the full bank flow of the stream, typically flows produced by a 2-year, 24-hour frequency storm, without appreciably altering the stream flow characteristic.

Location

The temporary stream crossing shall be perpendicular to the stream. Where approach conditions dictate, the crossing may vary 15% from the perpendicular.

Overflow Protection

Structures shall be protected from washout during periods of peak discharges by diverting water around the structures. Methods to be considered for washout protection may include elevation of bridges above adjacent flood plain lands, crowning of fills over pipes, or by the use of diversions, dikes or island type structures. Two types of stream crossings that may be used are bridges and culverts. Frequency and intended use, stream channel conditions, overflow areas, potential flood damage, and surface runoff control should be considered when selecting the type of temporary stream crossing to be used.

Temporary Bridge Crossing

Sr-B

A temporary access bridge causes the least erosion of the stream channel crossing when the bridge is installed and removed. It also provides the least obstruction to flow and fish migration. Provided that the bridge is properly designed and appropriate materials are used, a temporary access bridge will be long-lasting and will require little maintenance. However, it is generally the most expensive crossing to design and construct; creating the greatest safety hazard if not adequately designed, installed and maintained.

Table 6-23.1. Corrugated Metal Pipe (CMP) Diameters For Temporary Stream Crossings [a]

Drainage Area	Average Slope of Watershed			
(Acres)	1%	4%	8%	16%
1-25	24	24	30	30
26-50	24	30	36	36
51-100	30	36	42	48
101-150	30	42	48	48
151-200	36	42	48	54
201-250	36	48	54	54
251-300	36	48	54	60
301-350	42	48	60	60
351-400	42	54	60	60
401-450	42	54	60	72
451-500	42	54	60	72
501-550	48	60	60	72
551-600	48	60	60	72
601-640	48	60	72	72

[a] Assumptions for determining the table: USDA-NRCS Peak Discharge Method; CN = 65; Rainfall depth (average for Georgia) = 3.7" for 2-year frequency. Pipe diameters shown in the table are in inches.

Temporary Culvert Crossing (Sr-C)

A temporary access culvert can control erosion effectively, but can cause erosion when it is installed and removed. It is the most common stream crossing. A temporary culvert can be easily constructed and enables heavy equipment loads to be used. However, culverts create the greatest obstruction to flood flows and are subject to blockage and washout.

Table 6-23.1 shall be used to determine the culvert size necessary to safely convey streamflow. *Please note that the required pipe size is based on cross-sectional area of the pipe; e.g. if a 24 inch pipe is prescribed by Table 23.1, two 12 inch pipes could not be substituted because less flow area is provided.*

CONSTRUCTION SPECIFICATIONS

All Crossings

1. Clearing of the stream bed and banks shall be kept to a minimum.
2. All surface water from the construction site shall be diverted onto undisturbed areas adjoining the stream. Line unstable stream banks with riprap or otherwise appropriately stabilize them.
3. The structure shall be removed as soon as it is no longer necessary for project construction.
4. Upon removal of the structure, the stream shall immediately be restored to its original cross-section and properly stabilized.

Temporary Bridge Crossing (Sr-B)

1. The temporary bridge shall be constructed at or above bank elevation to prevent the entrapment of floating materials and debris.
2. Abutments shall be placed parallel to and on stable banks.
3. Bridges shall be constructed to span the entire channel. If the channel width exceeds eight feet (as measured from the tops of the banks), a footing, pier or bridge support may be constructed within the waterway.
4. Bridges shall be securely anchored at only one end using steel cable or chain. This will prevent channel obstruction in the event that floodwaters float the bridge. Large trees, large boulders, or driven steel anchors can serve as anchors.

Temporary Culvert Crossing (Sr-C)

1. The invert elevation of the culvert shall be installed on the natural streambed grade.
2. The culvert(s) shall extend a minimum of one foot beyond the upstream and downstream toe of the aggregate placed around the culvert. In no case shall the culvert exceed 40 feet in length.
3. The culvert(s) shall be covered with

a minimum of one foot of aggregate. If multiple culverts are used, they shall be separated by a minimum of 12 inches of compacted aggregate fill.

MAINTENANCE

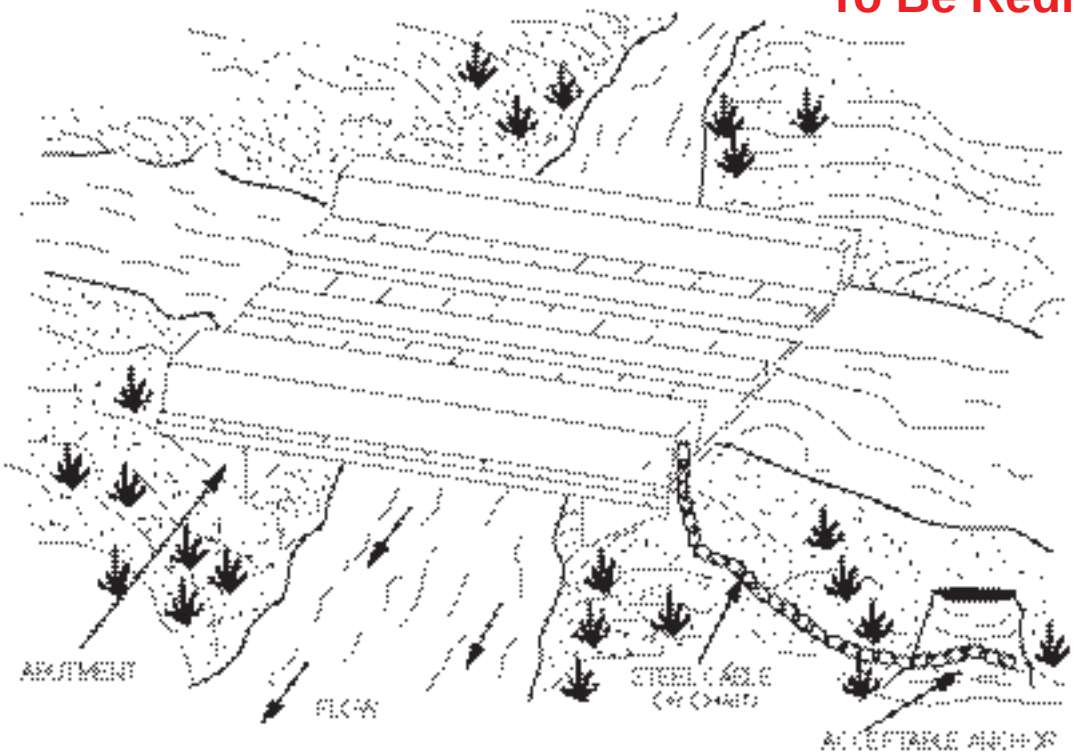
The structure shall be inspected after every rainfall and at least once a week, whether it has rained or not, and all damages repaired immediately. The structure shall be removed immediately after construction is finished, and the streambed and banks must be stabilized. Refer to specification **Bf - Buffer Zone**.

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. Drainage area (ac), average slope of watershed (%), and stream flow rate at bankfull flow (cfs).
2. Detailed dimensions of components for the type of crossing to be used.

TEMPORARY BRIDGE CROSSING

To Be Redrawn



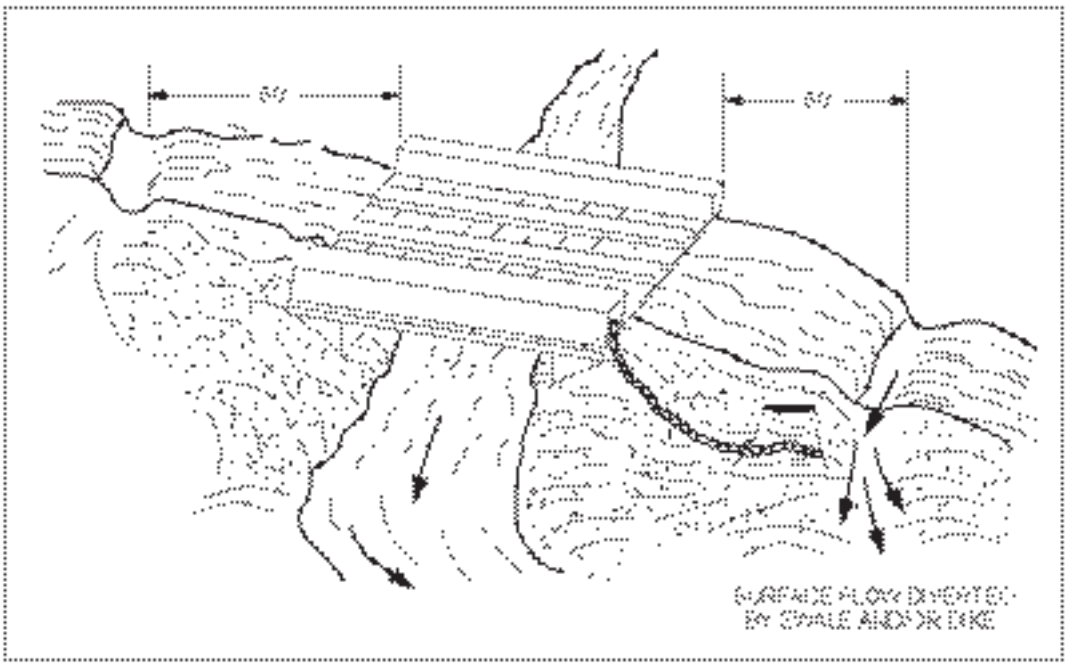
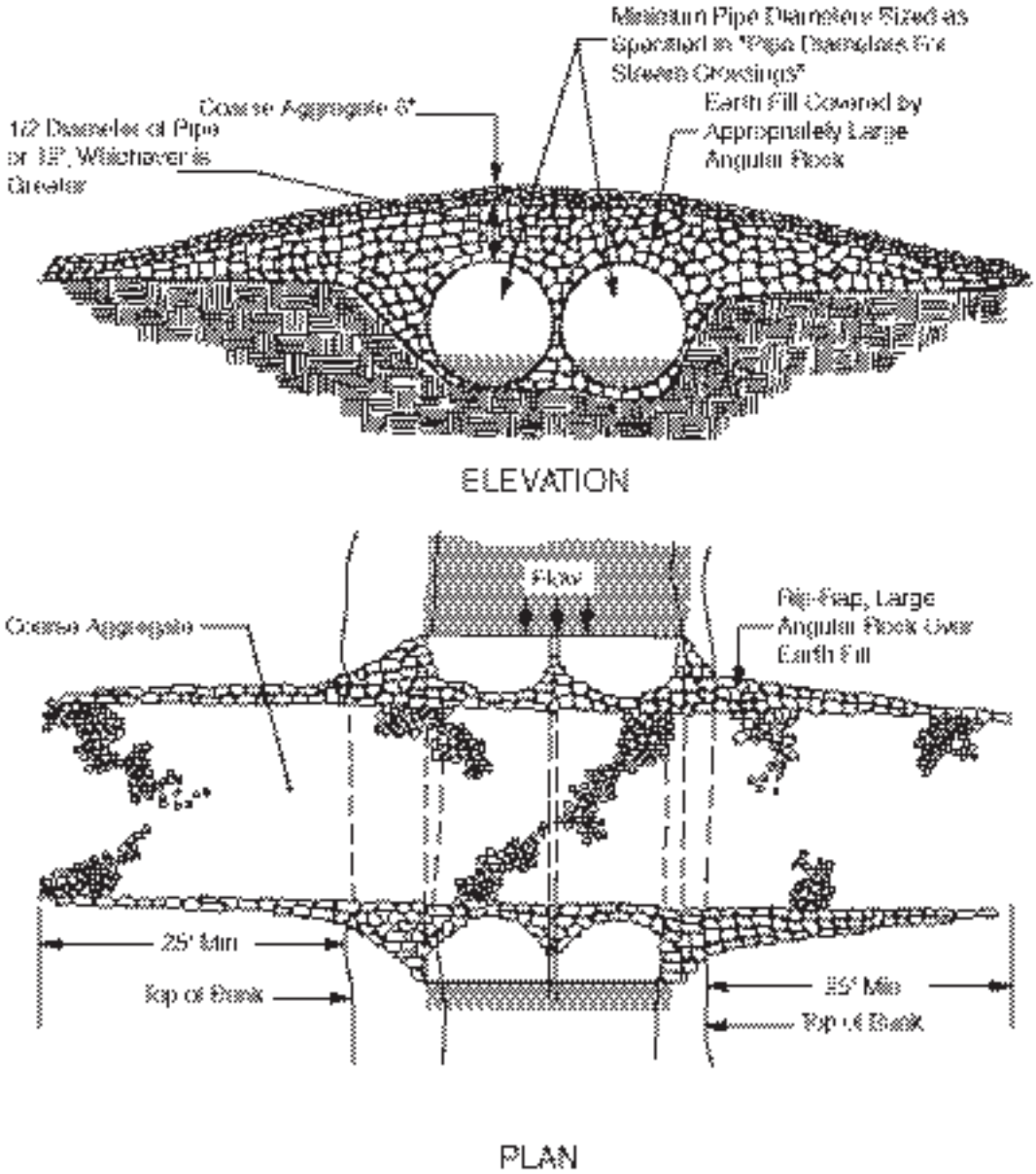


Figure 6-23.1

To Be Redrawn



GENERAL NOTES

1. Not to scale.
2. This type of crossing can be installed in both wet or dry weather streams and ditches where the drainage area exceeds 10 acres.
3. Remove debris and drainage.

Figure 6-23.2

To Be Redrawn

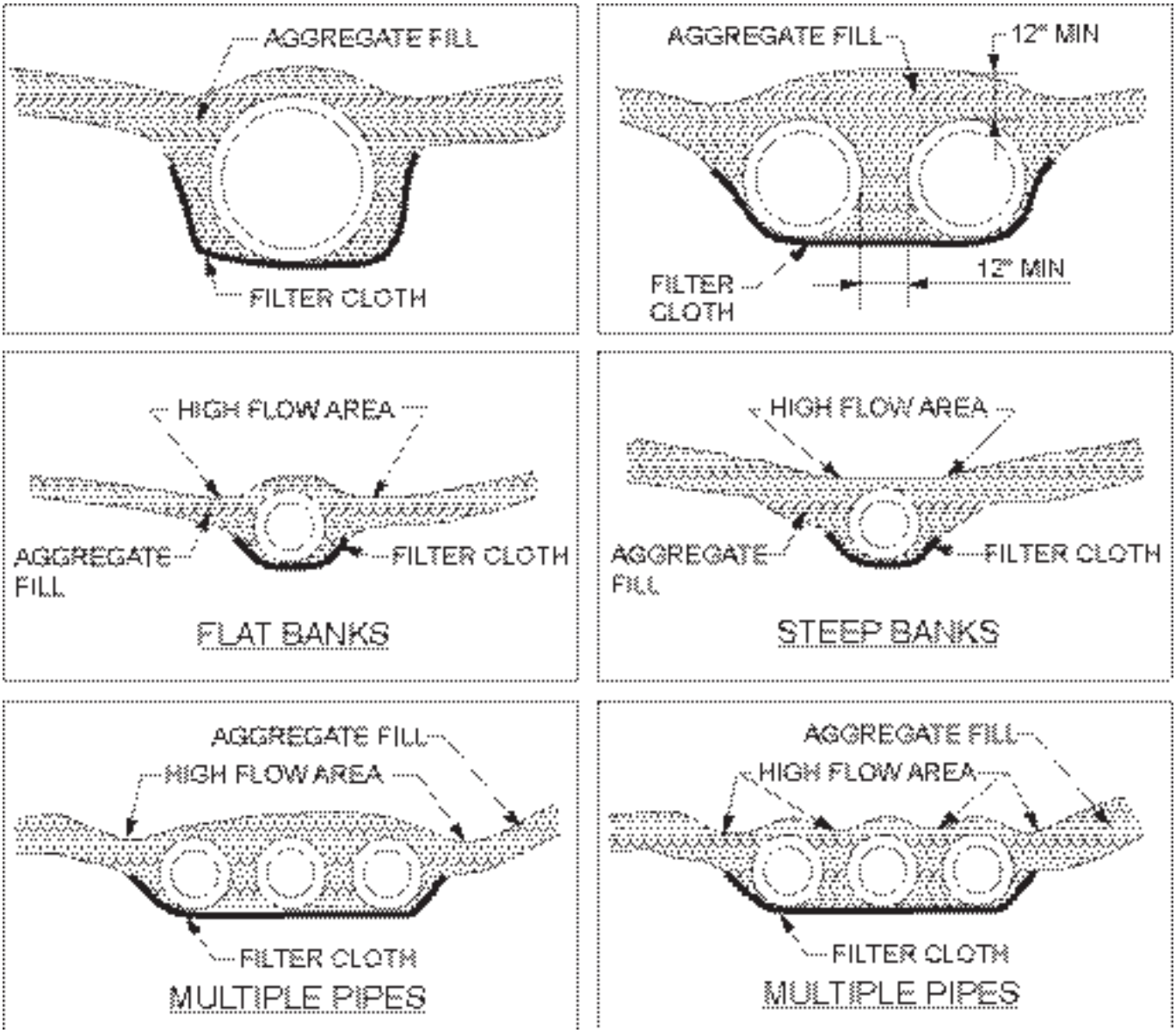


Figure 6-23.3 - Configuration of Temporary Culvert Crossing

Storm Drain Outlet Protection

St

DEFINITION

Paved and/or riprapped channel sections, placed below storm drain outlets.

PURPOSE

To reduce velocity of flow before entering receiving channels below storm drain outlets.

CONDITIONS

This standard applies to all storm drain outlets, road culverts, paved channel outlets, etc., discharging into natural or constructed channels. Analysis and/or treatment will extend from the end of the conduit, channel or structure to the point of entry into an existing stream or publicly maintained drainage system.

DESIGN CRITERIA

Structurally lined aprons at the outlets of pipes and paved channel sections shall be designed according to the following criteria:

Capacity

Peak stormflow from the 25-year, 24-hour frequency storm or the storm specified in Title 12-7-1 of the Official Code of Georgia Annotated or the design discharge of the water conveyance structure, whichever is greater.

Tailwater Depth

The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. Manning's Equation may be used to determine tailwater depth. If the tailwater depth is less than half the diameter of the outlet pipe, it shall be classified as a Minimum Tailwater Condition. If the tailwater depth is greater than half the pipe diameter, it shall be classified as a Maximum Tailwater Condition. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition.

Apron Length and Thickness

The apron length and d_{50}, stone median size, shall be determined from the curves according to tailwater conditions:

Minimum Tailwater- Use Figure 6-24.1

Maximum Tailwater- Use Figure 6-24.2

Maximum Stone Size = 1.5 x d50

Apron Thickness = 1.5 x dmax

Apron Width

If the pipe discharges directly into a well-defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank (whichever is less). If the pipe discharges onto a flat area with no defined channel, the width of the apron shall be determined as follows:

a. The upstream end of the apron, adjacent to the pipe, shall have a width three times the diameter of the outlet pipe.

b. For a Minimum Tailwater Condition, the downstream end of the apron shall have a width equal to the pipe diameter plus the length of the apron. Refer to Figure 6-24.1.

c. For a Maximum Tailwater Condition, the

down stream end shall have a width equal to the pipe diameter plus 0.4 times the length of the apron. Refer to Figure 6-24.2.

Bottom Grade

The apron shall be constructed with no slope along its length (0.0% grade). The invert elevation of the downstream end of the apron shall be equal to the elevation of the invert of the receiving channel. There shall be no overfall at the end of the apron.

Side Slope

If the pipe discharges into a well-defined channel, the side slopes of the channel shall not be steeper than 2:1.

Alignment

The apron shall be located so that there are no bends in the horizontal alignment.

Geotextile

Geotextiles should be used as a separator between the graded stone, the soil base, and the abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be specified in accordance with AASHTO M288-96 Section 7.5, *Permanent Erosion Control Recommendations.* The geotextile should be placed immediately adjacent to the subgrade without any voids.

Materials

The apron may be lined with riprap, grouted riprap, or concrete. The median sized stone for riprap, d_{50}, shall be determined from the curves, Figures 6-24.1 and 6-24.2, according to the tailwater condition. The gradation, quality and placement of riprap shall conform to Appendix C.

Refer to Figure 6-24.4, for alternative structures to achieving energy dissipation at an outlet. For information regarding the selection and design of these alternative energy dissipators, refer to:

FHWA Standard (REF. Hydraulic Design of Energy Dissipators for Culverts and Channels; HEC No. 14, FHWA, Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CONSTRUCTION SPECIFICATIONS

1. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.

2. The riprap and gravel filter must conform to the specified grading limits shown on the plans.

3. Geotextile must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter fabric over the damaged area. All connecting joints should overlap a minimum of 1 ft. If the damage is extensive, replace the entire filter fabric.

4. Riprap may be placed by equipment, but take care to avoid damaging the filter.

5. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.

6. Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.

7. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.

8. Immediately after construction, stabilize all disturbed areas with vegetation.

9. Stone quality - Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly weather-resistant. The specific gravity of the individual stones should be at least 2.5.

10. Filter - Install a filter to prevent soil movement through the openings in the riprap. The filter should consist of a graded gravel layer or a synthetic filter cloth. See Appendix C; p. C-1.

MAINTENANCE

Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. The flow characteristics of the pipe at full flow including pipe diameter, flow rate (cfs), velocity (fps), and tailwater condition.

2. The dimensions of the apron including length (La), width at the headwall (W_1), downstream width (W_2), average stone diameter (d50), and stone depth (D) designed in accordance with Figures 6-24.1 and 6-24.2.

To Be Redrawn

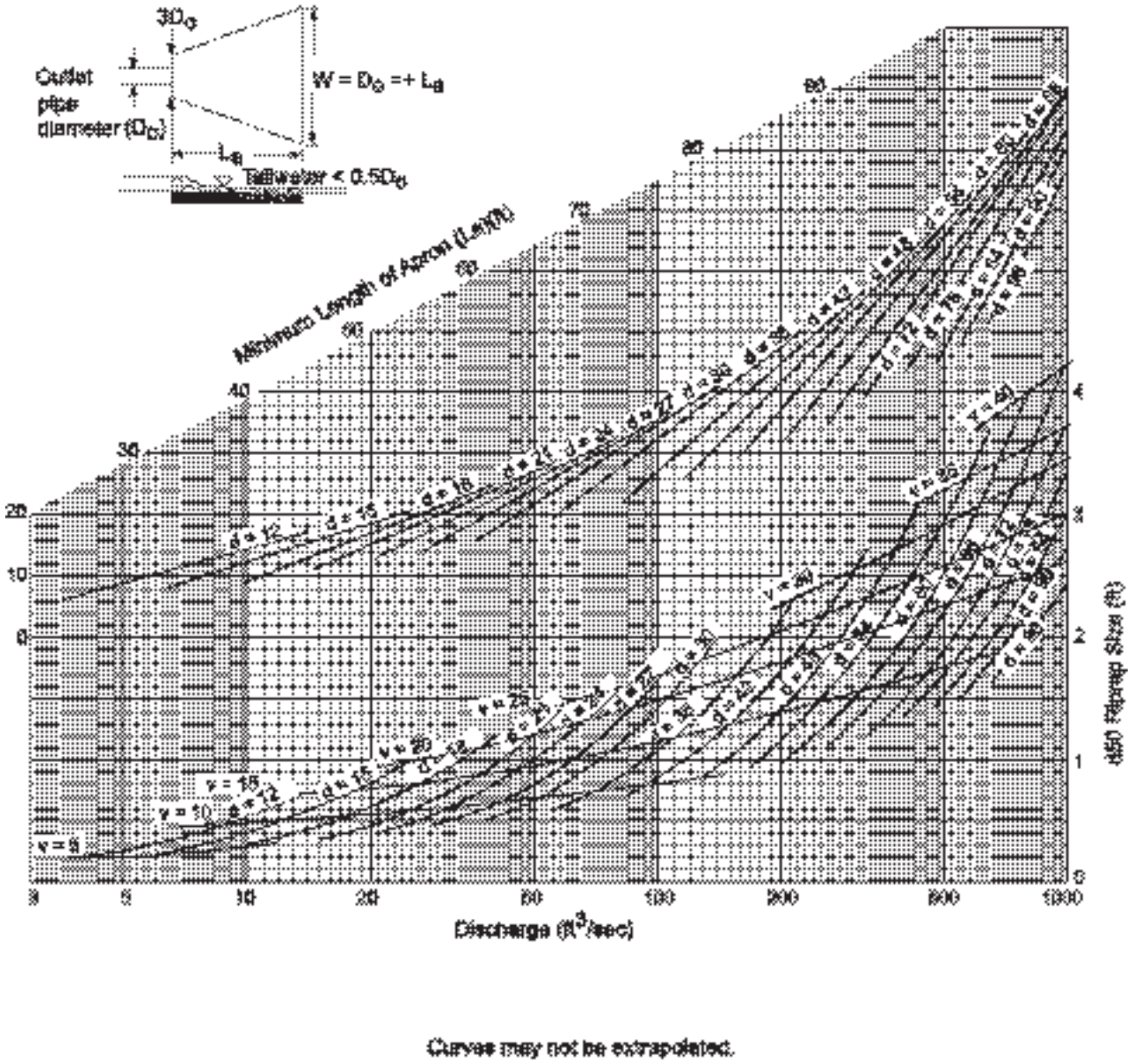


Figure 6-24.1 - Design of Outlet Protection From a Round Pipe Flowing Full, Minimum Tailwater Condition (Tw < 0.5 Diameter)

To Be Redrawn

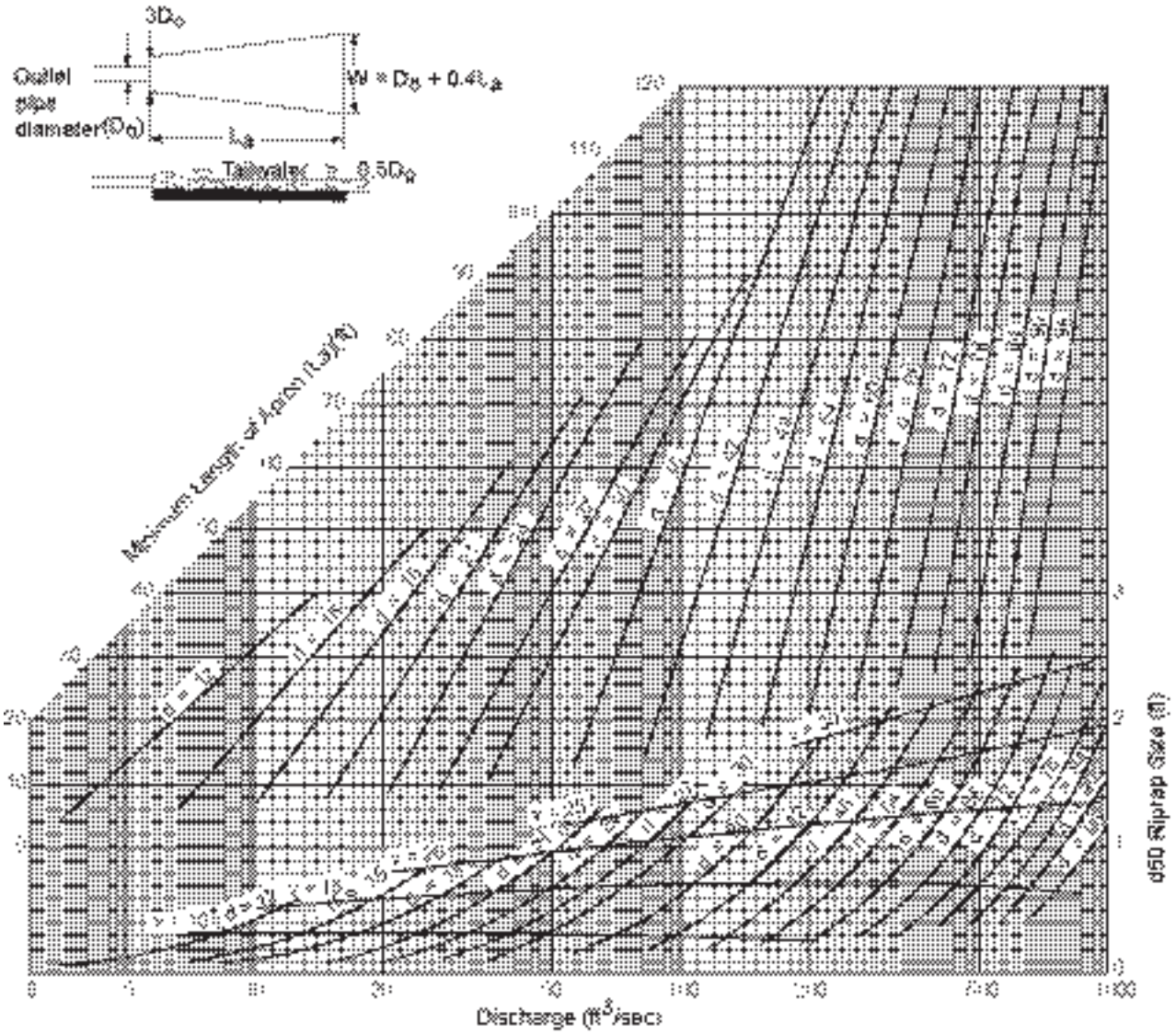
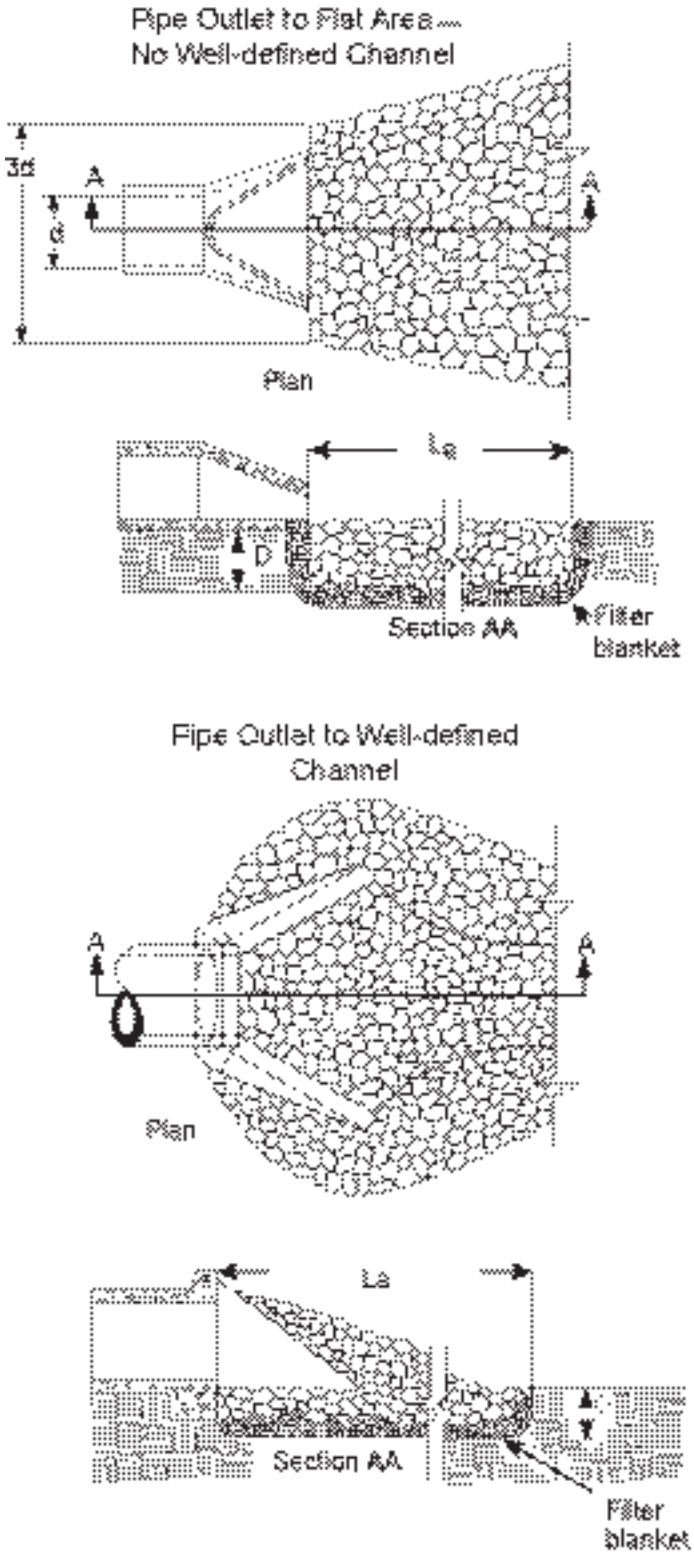


Figure 6-24.2 - Design of Outlet Protection From a Round Pipe Flowing Full, Maximum Tailwater Condition (Tw > 0.5 Diameter)

To Be Redrawn



Notes

1. L_a is the length of the riprap apron.
2. d = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Figure 6-24.3 - Riprap Outlet Protection (Modified From Va SWCC)

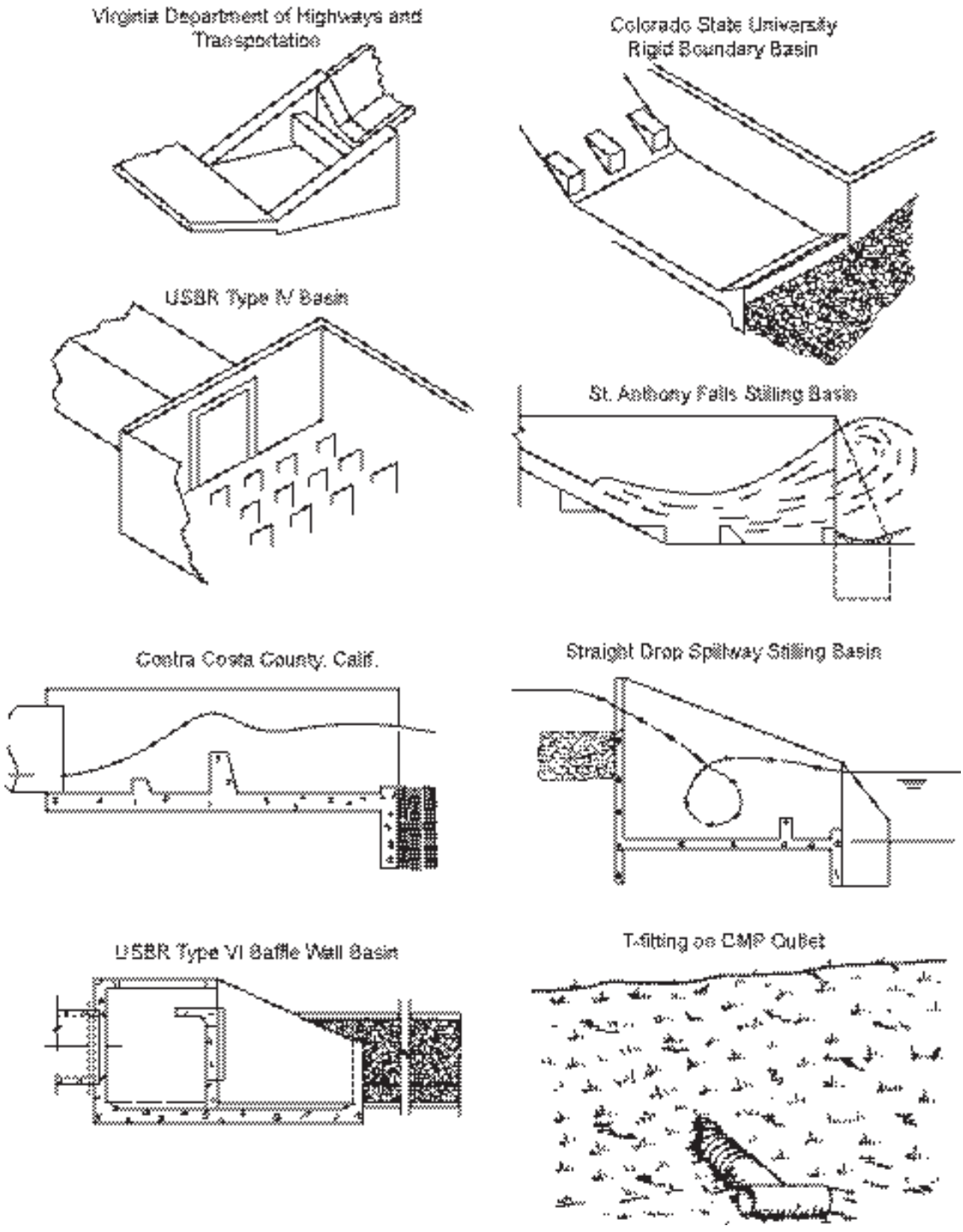


Figure 6-24.4 - Alternative Structures For Energy Dissipation at an Outlet (Modified From Goldman, Jackson, and Bursztynsky)

To Be Redrawn

Surface Roughening (Su)

DEFINITION

Providing a rough soil surface with horizontal depressions created by operating a tillage or other suitable implement on the contour, or by leaving slopes in a roughened condition by not fine-grading them.

PURPOSE

The purposes of surface roughening are to aid in establishment of vegetative cover with seed, to reduce runoff velocity and increase infiltration and to reduce erosion and provide for sediment trapping.

CONDITIONS

All slopes steeper than 3:1 require surface roughening, either stair-step grading, grooving, furrowing, or tracking if they are to be stabilized with vegetation. However, if the slope is to be stabilized with erosion control blankets or soil reinforcement matting, the soil surface should not be roughened.

Areas with grades less steep than 3:1 should have the soil surface lightly roughened and loosened to a depth of 2 to 4 inches prior to seeding. Areas which have been graded and will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place. Slopes with a stable rock face do not require roughening or stabilization.

DESIGN CRITERIA

Graded areas with smooth, hard surfaces give a false impression of “finished grading” and a job well done. It is difficult to establish vegetation on such surfaces due to reduced water infiltration and the potential for erosion. Rough slope surfaces with uneven soil and rocks left in place may appear unattractive or unfinished at first, but encourage water infiltration, speed the establishment of vegetation, and decrease runoff velocity. Rough, loose soil surfaces give lime, fertilizer and seed some natural coverage. Niches in the surface provide microclimates which generally provide a cooler and more favorable moisture level than hard flat surfaces. This aids seed germination.

There are different methods of achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, and tracking. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

1. Disturbed areas which will not require mowing maybe stair-step graded, grooved, or left rough after filling.

2. Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each “step” catches material which sloughs from above, and provides a level site where vegetation can become established.

3. Areas which will be mowed (these areas should have slopes less steep than 3:1) may have small furrows left by discing, harrowing, raking, or seed planting machinery operated on the contour.

4. It is important to avoid excessive compacting of the soil surface when scarifying. Tracking with bulldozer treads is preferable to

not roughening at all, but is not as effective as other forms of roughening, as the soil surface is severely compacted and runoff is increased.

CONSTRUCTION SPECIFICATIONS

Cut Slopes Steeper than 3:1

Cut slopes with a gradient steeper than 3:1 should not be mowed. They shall be stair-step graded or grooved (see Figure 6-25.1).

1. Stair-step grading may be carried out on any material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.

   The ratio of the vertical cut distance to the horizontal distance shall be less than 1:1 and the horizontal portion of the "step" shall slope toward the vertical wall.

   Individual vertical cuts shall not be more than 30 inches on soft soil material and not more than 40 inches in rocky materials.

2. *Grooving* consists of using machinery to create a series of ridges and depressions which run perpendicular to the slope (on the contour).

Grooves may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction. Suggested implements include discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Such grooves shall not be less than 3 inches deep nor further than 15 inches apart.

Fill Slopes Steeper than 3:1

Fill slopes with a gradient steeper than 3:1 should not be mowed. They shall be grooved or allowed to remain rough as they are constructed. Method (1) or (2) below may be used.

1. Groove according to #2 of "Cut Slopes Steeper than 3:1".

2. As lifts of the fill are constructed, soil and rock material may be allowed to fall naturally onto the slope surface (see Figure 6-25.1).

Colluvial materials (soil deposits at the base of slopes or from old stream beds) shall not be used in fills as they flow when saturated.

Cuts, Fills, and Graded Areas Which Will Be Mowed (less than 3:1)

Mowed slopes should not be steeper than 3:1. Excessive roughness is undesirable where mowing is planned.

These areas may be roughened with shallow grooves such as remain after tilling, discing, harrowing, raking, or use of a multipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).

Grooves formed by such implements shall be not less than one inch deep and not further than 12 inches apart.

Fill slopes which are left rough as constructed may be smoothed with a dragline or pickchain to facilitate mowing.

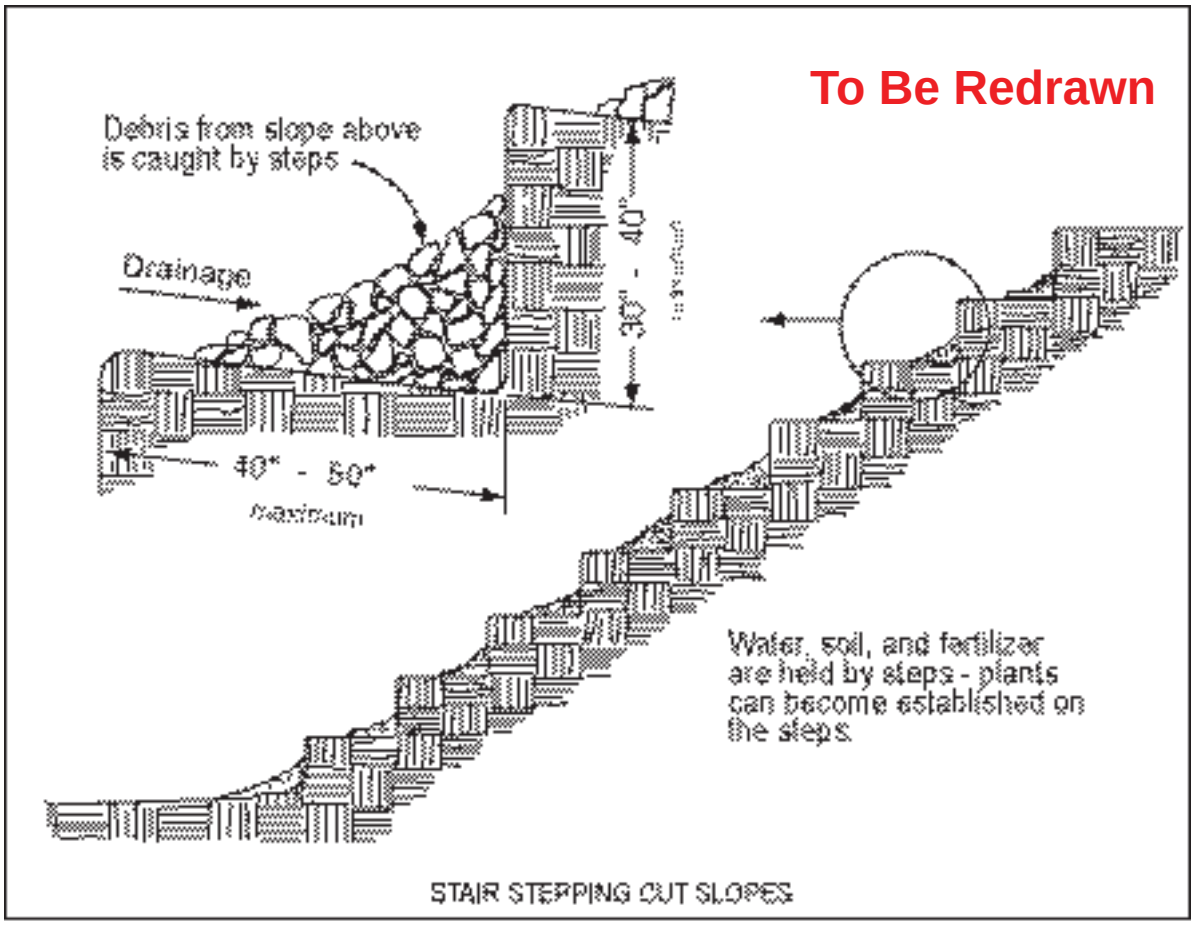
Roughening With Tracked Machinery

Roughening with tracked machinery on clayed soils is not recommended unless no alternatives are available. Undue compaction of surface soil results from this practice. Sandy soils do not compact severely and may be tracked. In no case is tracking as effective as the other roughening methods described.

When tracking is the chosen surface roughening technique, it shall be done by operating tracked machinery up and down the slope to leave horizontal depressions in the soil. As few passes of the machinery as possible should be made to minimize compaction.

Seeding

Roughened areas shall be seeded and mulched as soon as possible to obtain optimum seed germination and seeding growth. Refer to specifications **Ds1, Ds2, Ds3, and Ds4 - Disturbed Area Stabilization (With Mulching Only, Temporary Seeding, Permanent Vegetation, and Sodding),** respectively.


To Be Redrawn
Debris from slope above is caught by steps
Drainage
30" - 40"
40" - 50"
maximum
Water, soil, and fertilizer are held by steps - plants can become established on the steps.
STAIR STEPPING CUT SLOPES

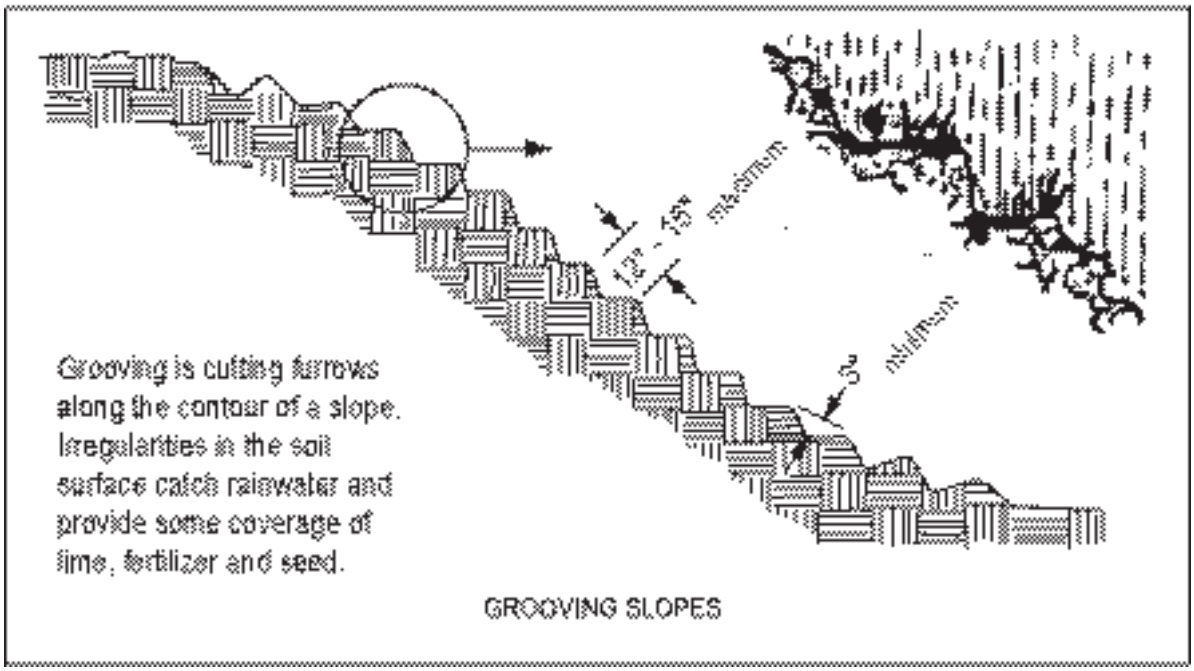
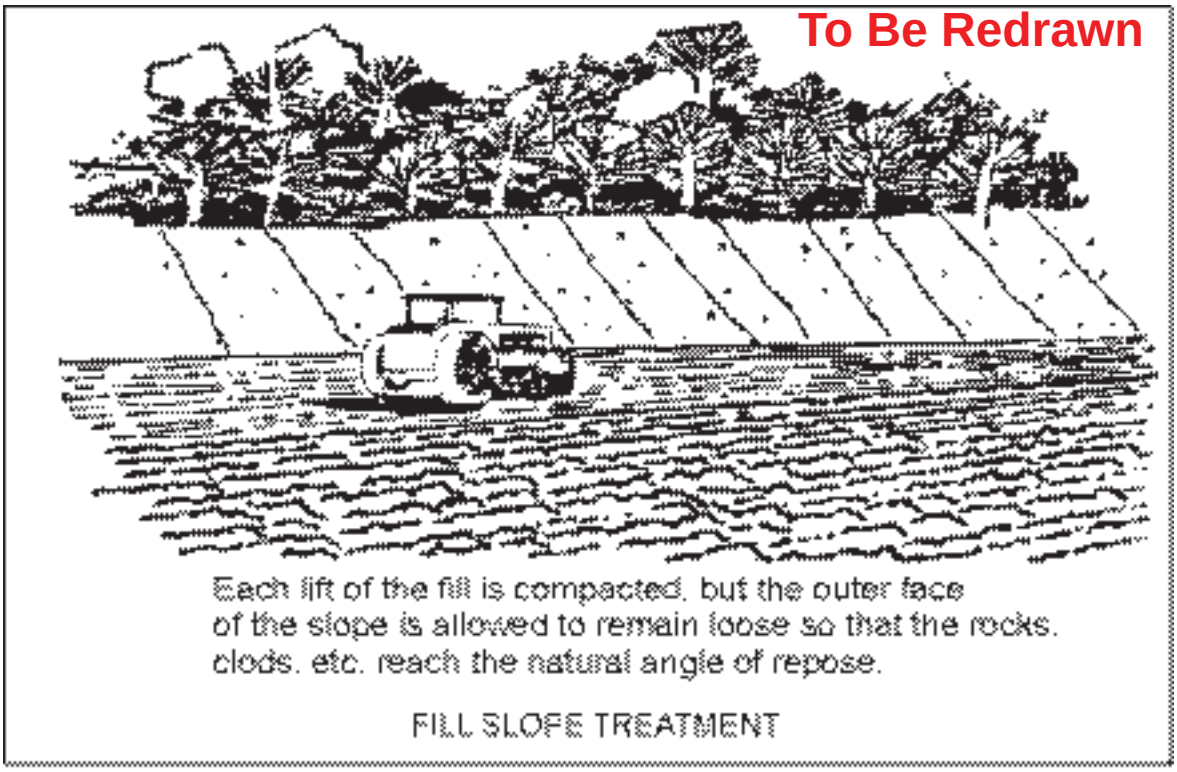

12" - 15"
maximum
3"
minimum
Grooving is cutting furrows along the contour of a slope. Irregularities in the soil surface catch rainwater and provide some coverage of lime, fertilizer and seed.
GROOVING SLOPES

Figure 6-25.1


To Be Redrawn
Each lift of the fill is compacted, but the outer face of the slope is allowed to remain loose so that the rocks, clods, etc. reach the natural angle of repose.
FILL SLOPE TREATMENT

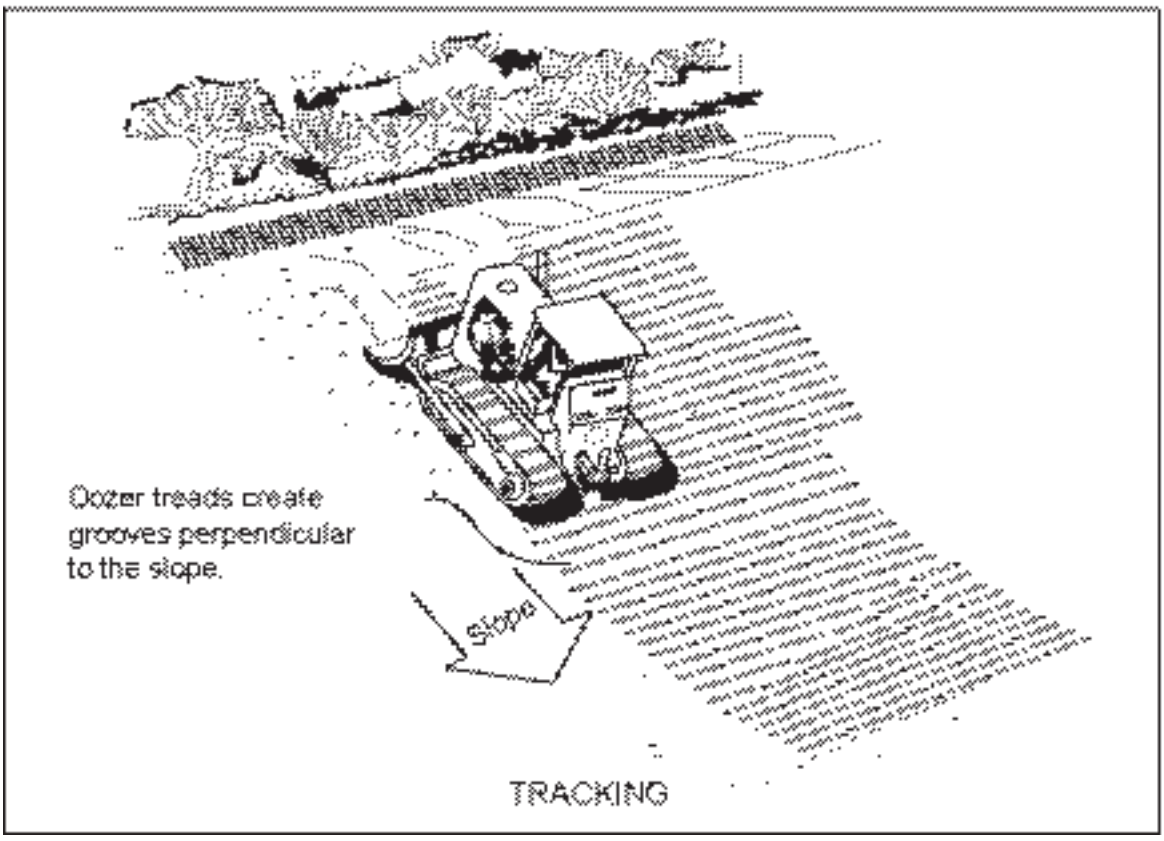

Dozer treads create grooves perpendicular to the slope.
Slope
TRACKING

Figure 6-25.2

Topsoiling

Tp

DEFINITION

Stripping off the more fertile top soil, storing it, then spreading it over the disturbed area after completion of construction activities.

PURPOSE

To provide a suitable soil medium for vegetative growth on areas where other measures will not produce or maintain a desirable stand.

CONDITIONS

This practice is recommended for sites of 2:1 or flatter slopes where:

1. The texture of the exposed subsoil or parent material is not suitable to produce adequate vegetative growth.

2. The soil material is so shallow that the rooting zone is not deep enough to support plants with continuing supplies of moisture and food.

3. The soil to be vegetated contains material toxic to plant growth.

CONSTRUCTION SPECIFICATIONS

Materials

Topsoil should be friable and loamy, free of debris, objectionable weeds and stones and contain no toxic substance that may be harmful to plant growth. A pH range of 5.0-7.5 is acceptable. Soluble salts should not exceed 500 ppm.

Testing

Field exploration should be made to determine whether the quantity and quality of surface soil justifies stripping.

Stripping

Stripping should be confined to the immediate construction area.

A 4 to 6 inch stripping depth is common, but may vary depending on the particular soil.

Topsoil pH

If pH value is less than 6.0, lime shall be applied and incorporated with the topsoil to adjust the pH to 6.5 or higher. Topsoils containing soluble salts greater than 500 parts per million shall not be used.

Stockpiles

The location of topsoil stockpiles should not obstruct natural drainage or cause off-site environmental damage.

Stabilization

Stockpiles shall be contained by sediment barriers to prevent sedimentation on adjacent areas. Stockpiles shall be stabilized in accordance with specifications Ds1 and Ds2 - Disturbed Area Stabilization (With Mulching) and (With Temporary Grassing), respectively, or Pm - Polyacrylamide or Tb - Tackifiers and Binders.

Site Preparation (Where topsoil is to be added)

Topsoiling - When topsoiling, maintain

needed erosion control practices such as diversions, grade stabilization structures, berms, dikes, level spreaders, waterways, sediment basins, etc.

Grading - Grades on the areas to be topsoiled which have been previously established shall be maintained.

Liming - Soil tests should be used to determine the pH of the soil. Where the pH of the subsoil is 5.0 or less or composed of heavy clays, agricultural limestone shall be spread at the rate of 100 pounds per 1,000 square feet. Lime shall be distributed uniformly over designated areas and worked into the soil in conjunction with tillage operations as described in the following procedure.

Bonding - Use one of the following methods to insure bonding of topsoil and subsoil:

1. Tilling. After the areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by discing or scarifying to a depth of at least 3 inches to permit bonding of the topsoil to the subsoil.

2. Tracking. Passing a bulldozer over the entire surface area of the slope to leave horizontal depressions.

Applying Topsoil

1. Topsoil should be handled only when it is dry enough to work without damaging soil structure.

2. A uniform application of 5 inches (unsettled) is recommended, but may be adjusted at the discretion of the engineer or landscape architect.

Table 6-26.1. Cubic Yards Of Topsoil Required For Application To Various Depths

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

Turbidity Curtain

Tc

Photo To Be Added

DEFINITION
A floating or staked barrier installed within the water. (It may also be referred to as a floating boom, silt barrier or silt curtain).

PURPOSE
Turbidity Curtains are installed to minimize turbidity and silt migration from work occurring within the water or as a supplement to perimeter control BMPs at the water's edge. Silt or turbidity is confined to the area within the boundary created by the installation, such that suspended particles drop out of the water column over time.

CONDITIONS
By its nature, a turbidity curtain encourages a controlled deposition of silt or sediment. A Turbidity Curtain is only allowed as a primary device when required permitting has been obtained for the site that approves the filling of State or U.S. waters. The unauthorized storing of sediment in waters of the State is strictly prohibited.

The installation of a Turbidity Curtain as a supplemental BMP that in no way represents perimeter control is allowed provided the stream, river or "water" substrate or bottom will not be altered in any manner by the installation.

The Owner, Operator and Designer are cautioned that State or LIA Water buffer and variance requirements may apply to bank and shoreline installations.

PLANNING CONSIDERATIONS
Careful assessment of the depth, flow or current of water and nature of construction is needed in order to determine if floating or staked installations are warranted.

DESIGN CRITERIA
Formal design is not required but the following guidelines have been established:

Depending upon the installation conditions (see Construction Specifications) Curtain material may be comprised of suitable impermeable materials such as heavy polyethylene film or suitable permeable materials such as canvas duck or those materials meeting the requirements of Sd1-C.

Floating Turbidity Curtains Tc-f

Tc-f

Typical installations include large bodies of water such as rivers and lakes.

Staked Turbidity Curtains Tc-s

Tc-s

Typical installations include shallow inundations where construction is required. It may be used to protect a small stream while it is being realigned or restored. In this case the barrier should extend to the bottom of the streambed. The height should be limited to 5 feet whenever possible and extend 2 foot above the normal water elevation.

CONSTRUCTION SPECIFICATIONS
Whenever possible, place barrier approximately 25 feet outside of the affected construction area for large water bodies. Installations less than 25 feet from the work are allowed however narrower confinements promote proportionate sedimentation. Curtain depth should reach a depth within 5 feet

of the bottom for floating installations. If the body of water has significant velocity or current, place the barrier parallel to the flow and ensure the curtain is permeable.

In smaller streams the barrier should be placed close to the construction area.

Installation dimensions and methods shall be fitted to the conditions, permitted activity and construction methods. **IN no instance shall the silt dispersion exceed the allowances the filling permit has authorized.** The permittee is reminded to be a good steward of our resources by minimizing the migration and sedimentation regardless of permits obtained.

Barriers shall be either staked or floating depending upon current, tides, water depth and other variables. When staked barriers are used in stream relocations or widening, the curtain shall be permeable, weighted at the bottom and not be trenched in.

MAINTENANCE

For installations that permit the placement of fill within the water body, maintenance consists of removing the Turbidity Curtain when it is no longer required. If the deposition exceeds the allowances of the filling permit, careful removal of the sediment is required and shall be performed in a manner that is consistent with all other applicable permits.

If the installation is made as a supplemental BMP, the Turbidity Curtain should be removed after final stabilization of the contributing drainage area and perimeter control removal has occurred.

Vegetated Waterway or Stormwater Conveyance Channel

Wt

DEFINITION

A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.

PURPOSE

To dispose of runoff without causing damage either by erosion or by flooding.

CONDITIONS

This standard applies to all sites where added channel capacity and/or stabilization is required to control erosion resulting from concentrated runoff and where such control can be achieved by this practice alone or in combination with others.

DESIGN CRITERIA

Capacity

The minimum capacity shall be that required to convey the peak runoff expected from a 25-year, 24-hour storm or the storm specified in Title 12-7-1 of the Official Code of Georgia Annotated. Peak runoff values used in determining the capacity requirements shall be as outlined in Appendix A or by other accepted methods.

The design of a waterway is based on the determination of channel dimensions that will carry the estimated flow without damage to the channel or its lining. Vegetative linings vary in their protective ability according to type and density. Therefore, safe velocities under various conditions are a matter for careful consideration.

Velocity

In designing grassed waterways, care must be taken to ensure that the design velocity is well within the limits of permissible velocities given in Table 6-27.1. These values apply to uniform good stands of each type of cover.

Cross Section

The minimum design capacity of a waterway receiving water from developing areas, diversions, or other tributary channels shall be that depth required to keep the design water surface elevation in the channel to prevent overflow.

The bottom width of waterways or outlets shall not exceed 50 feet unless multiple or divided waterways or other means are provided to control meandering of low flows within this limit. See Figure 6-27.1.

Drainage

Tile or other suitable subsurface drainage measures shall be provided for sites having high water tables or seepage problems. Where there is base flow, a stone center or lined channel will be required. See Appendix C for rock riprap specifications.

Stone Center

Stone center waterways shall be constructed as shown in Figure 6-27.2 and Table 6-27.2 and stabilized with riprap according to the specification Riprap - Appendix C.

Geotextiles should be used as an erosion control measure beneath the riprap center. The geotextile shall be specified in accordance with

AASHTO M288-96 Section 7.5, Permanent Erosion Control Requirements.

Vegetative Retardance Factor

The design of a vegetated waterway is more complicated than for a bare channel since the value for "n" varies where grass linings are used. Tests show that vegetation tends to bend and oscillate under the influence of velocity and depth of flow. Thus the retardance to flow varies as these factors change.

Five general retardance curves designated as A, B, C, D, and E have been developed for various cover conditions. The vegetated conditions under which the various retardance values apply in Georgia are shown in Table 6-27.1. These cover classifications are based on tests in experimental channels when the covers were green and generally uniform.

"The Stormwater Conveyance Channel Design Sheets" shall be used to design grass-lined channels. These design sheets include the cross-sectional detail that shall be included on the erosion and sediment control plan.

If a stone center waterway is selected, it shall be designed according to Tables 6-27.2 and 6-27.3. Cross-sectional details on the erosion and sediment control plan shall include all information noted in Figure 6-27.2, including the maximum stone size of the rock to be used.

An example of how to design a grass-lined channel with a parabolic cross-section is provided on p. 6-198.

CONSTRUCTION SPECIFICATIONS

1. All trees, brush, stumps, obstructions, and other objectionable material shall be removed and disposed of so as not to interfere with the proper functioning of the waterway.

2. The waterway or outlet shall be excavated or shaped to line, grade, and cross section as required to meet the criteria specified herein. It will be free of bank projections or other irregularities which will impede normal flow. If the channel must have erosion protection other than vegetation, the lining shall not compromise the capacity of the emergency spillway, i.e. the channel shall be over-excavated so that the lining will be flush with the slope surface.

3. Fills shall be compacted as needed to prevent unequal settlement that would cause damage in the completed waterway.

4. All earth removed and not needed in construction shall be spread or disposed of so that it will not interfere with waterway functioning.

5. Stabilization

Applicable vegetative standards shall be followed for time of seeding, sprigging or sodding, liming and fertilizing, and site and seedbed preparation.

Erosion control blankets or matting or sod shall be used to aid in the establishment of vegetation. Installation methods should follow manufacturer recommendations. Refer to specification Ds4 - Disturbed Area Stabilization (With Sodding) and Mb - Erosion Control Matting and Blankets.

Mulching shall be a requirement for all seeded or sprigged channels.

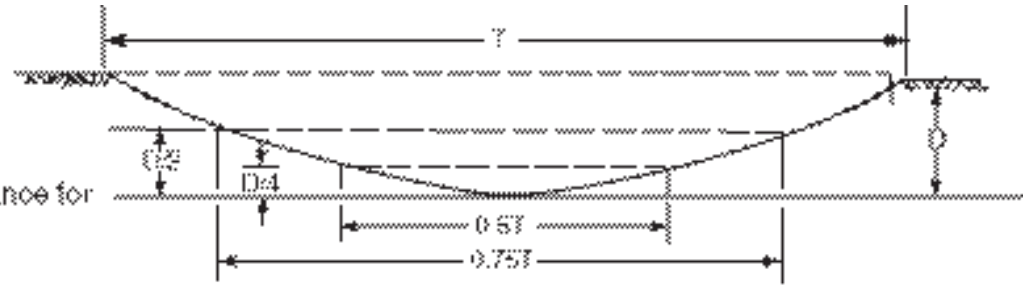
Temporary protection during establishment should be provided when conditions permit through temporary diversions or other means to dispose of water.

Table 6-27.1. Permissible Velocities and Retardances for Vegetated and Rock-Lined Waterways					
VEGETATIVE COVER TYPE	**GOOD STAND**				**MAXIMUM PERMISSIBLE VELOCITY, V_1 FEET PER SECOND**
	FOR CAPACITY AND V_2		**FOR STABILITY AND V_1**		
	RETARDANCE	PLANT HT. NOT MOWED	RETARDANCE	PLANT HT. NOT MOWED	
BERMUDAGRASS	B	12”	D	2-6”	**5**
BAHIA	C	6-12”	D	2-6”	4
TALL FESCUE GRASS MIX-TURES[1]	B	18”	D	6”	4
SERICEA LESPEDEZA WEEPING LOVEGRASS	B	19”	D	2-6”	3
STONE CENTER	RIPRAP STONE SIZE CAN BE DETERMINED IN APPENDIX C.				

[1] Mixtures of Tall Fescue, Bahia, and or Bremuda.

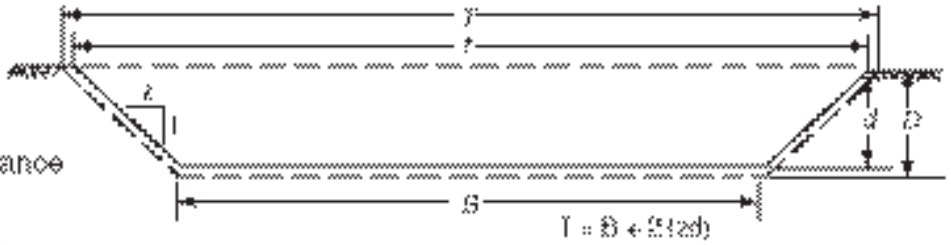
NOTE: For planting instructions refer to Disturbed Area Stablization (with Permanent Vegetation) Ds3.

T = design top width
D = design depth
Both values include allowance for the vegetative lining.



PARABOLIC CROSS SECTION

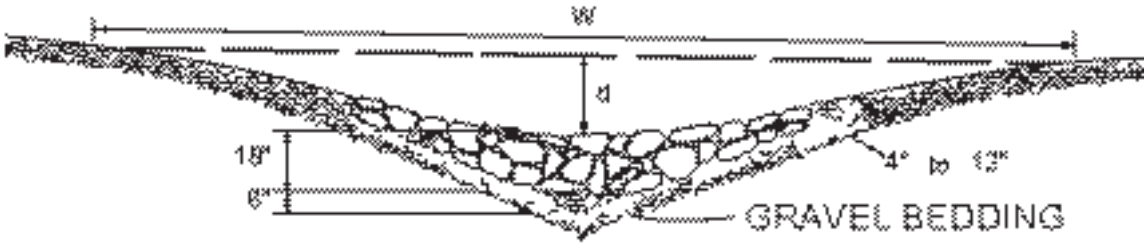
B = design bottom width
d = design depth
D = design depth plus allowance for vegetative lining
t = design top width
T = design top width plus allowance for vegetative lining
z = side slope ratio



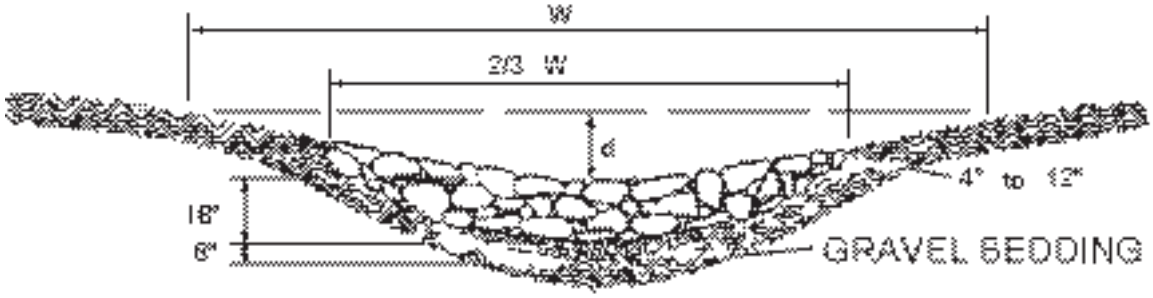
TRAPEZOIDAL CROSS SECTION

Figure 6-27.1 - Typical Waterway Cross Section

STONE CENTER WATERWAYS



Waterway with stone center drain
V section shaped by motor patrol

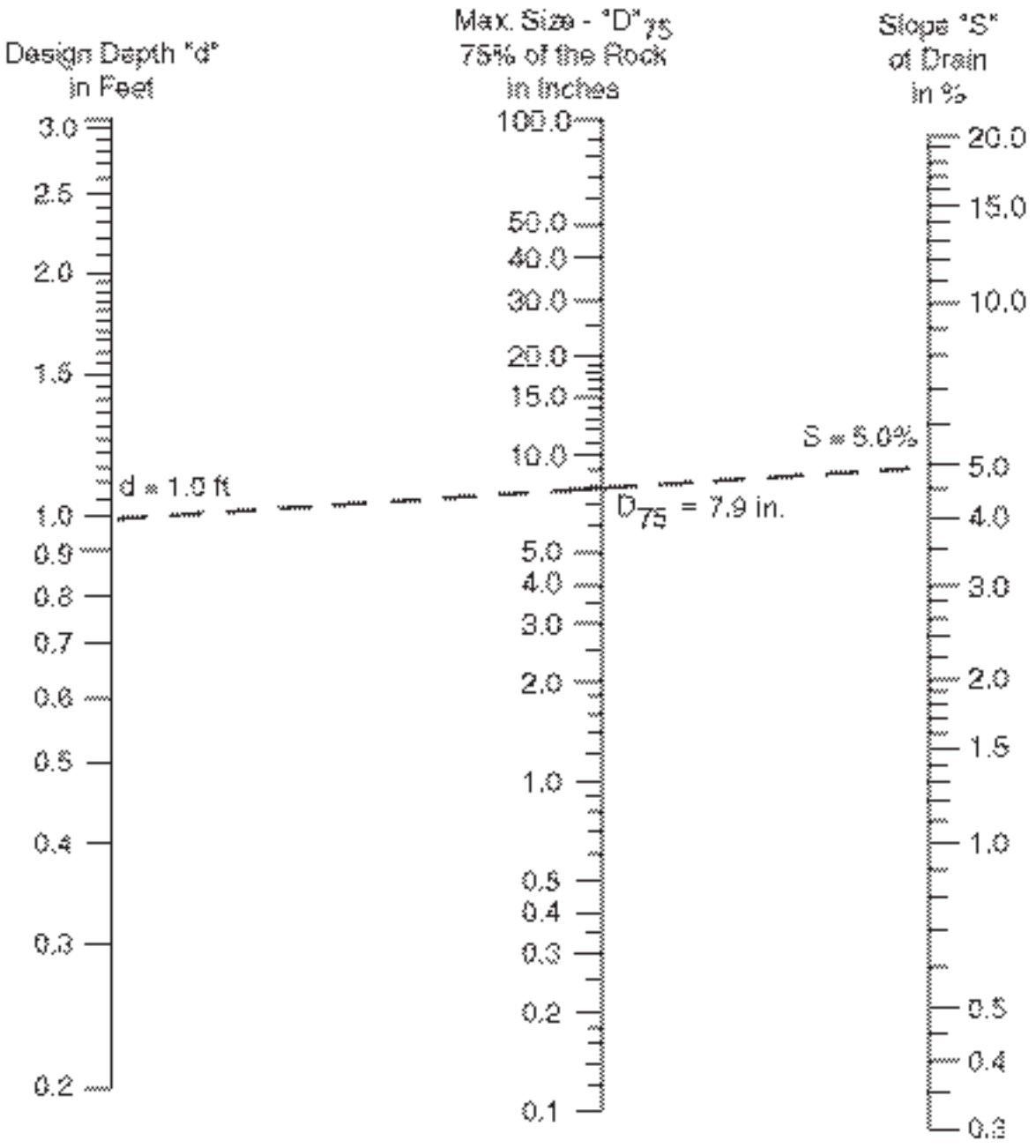


Waterway with stone center drain
Rounded section shaped by bulldozer

Figure 6-27.2 - Waterway With Stone Center

Figure 6-27.2 - Velocity, Top Width and Depth for Parabolic Stone Center Waterways

Grade	6 Percent		8 Percent		10 Percent		12 Percent		15 Percent	
V	8.0	10	8.0	10	8.0	10.0	8.0	10.0	8.0	10.0
D	1.3	1.6	1.1	1.3	1.0	1.2	0.9	1.1	0.8	0.9
Q	Top Widths									
20							5		5	
25					5		6		6	4
30			5		6		7		7	5
35			6		7		8	5	8	6
40	6		7		8	5	9	6	10	7
45	7		8		9	6	10	6	11	7
50	7		9	6	10	7	11	7	12	8
55	8		9	6	11	7	12	8	13	9
60	9		10	7	12	8	13	8	14	9
65	9		11	7	12	9	14	9	16	11
70	10	7	12	8	13	9	15	10	17	11
75	11	7	13	9	14	10	16	10	18	12
80	12	8	14	9	15	10	18	11	19	13
90	13	9	15	10	17	12	20	13	21	15
100	14	10	17	11	19	13	22	14	24	16
110	16	11	19	13	21	14	24	15	26	18
120	17	11	21	14	23	16	26	17	29	20
130	19	12	22	15	25	17	29	18	31	21
140	20	13	24	16	27	18	31	19	33	23
150	22	14	26	17	29	20	33	21	36	24
160	23	15	27	18	31	21	35	22	38	26
170	25	16	29	19	33	22	37	24	40	28
180	26	17	31	20	34	23	39	25	43	29
190	27	18	32	22	36	25	42	26	45	31
200	29	19	34	23	38	26	44	28	47	33
220	32	21	38	25	42	29	48	31	52	38
240	35	23	41	27	46	31	53	33	57	39
280	38	25	44	30	50	34	57	36	62	42
280	40	27	48	32	54	36	61	39	67	45
300	43	29	51	34	57	39	66	42	71	49



EXAMPLE: "d" = 1.0 Feet "S" = 5%

Place straight edge at "d" value in Design Depth column and at "S" value in Slope column. Read rock size in middle column 7.9 inches. Say 8 inches.

FOR DESIGN:

25% of the rock by volumes should be in sizes of 8 inches or slightly larger. The remaining 75% or less should be of well graded material, smaller than 8 inches, including sufficient sands and gravels to fill the voids between the larger rock.

Figure 6-27.3 - Determination of Rock Size For Stone Center Waterway

STORMWATER CONVEYANCE CHANNEL DESIGN SHEET

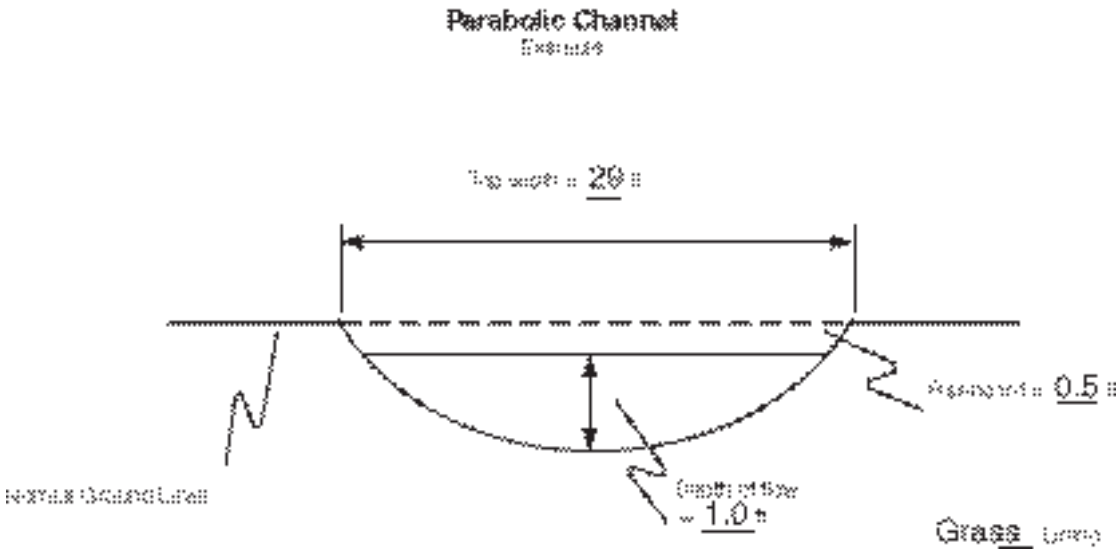
Vegetated Parabolic Channel

EXAMPLE

Computed by_____ Date _____
Checked by_____ Date _____

Project Name_____

1. Compute peak rate of runoff for 25-year, 24-hour storm.
   Q_{25} = 55 cfs
2. Determine grade of channel.
   Grade = 6%
3. Determine which vegetative cover will be used. Refer to Ds3 - Disturbed Area Stabilization (Using Permanent Vegetation).
   Vegetative cover = Bermudagrass
4. Determine retardances and permissible velocities for channel using Table 6-27.1.
   The retardance class for capacity (unmowed vegetation) is B.
   The retardance class for stability (mowed vegetation) is D.
   Maximum permissible velocity, V_1, is 5 fps.
5. Determine dimensions of the parabolic channel. Use Table 6-28.1, for retardances “D” and “B”.
   For a grade of 6% and a Q_{25} of 55 cfs,
   Top width, T = 29.1 ft (includes allowance for vegetative lining)
   Depth, D = 1.0 ft (includes allowance for vegetative lining)
   Velocity for unmowed vegetation, V_2 = 2.8 fps.



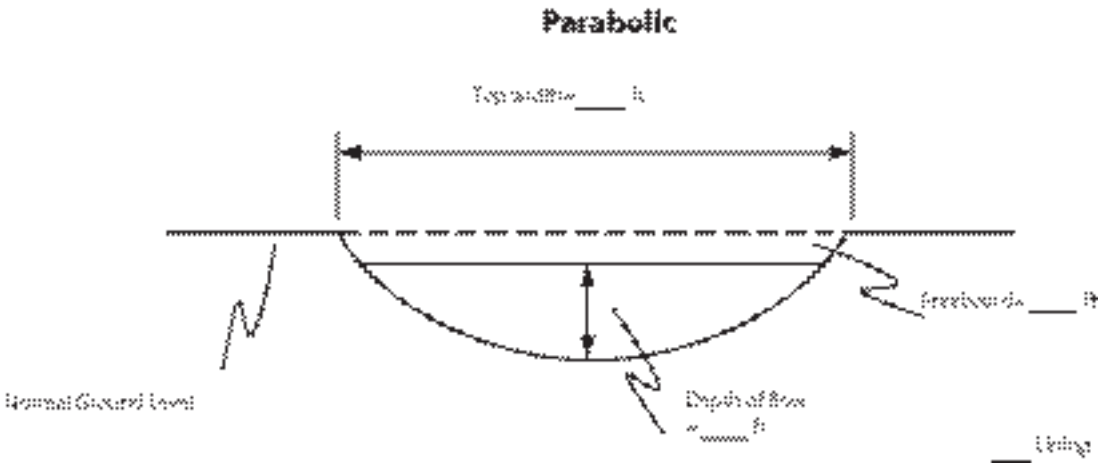
STORMWATER CONVEYANCE CHANNEL DESIGN SHEET

Vegetated Parabolic Channel

Computed by_____ Date _____
Checked by_____ Date _____

Project Name_____

1. Compute peak rate of runoff for 25-year, 24-hour storm.
   Q_{25} = _____ cfs
2. Determine grade of channel.
   Grade = _____ %
3. Determine which vegetative cover will be used. Refer to Ds3 - Disturbed Area Stabilization (Using Permanent Vegetation).
   Vegetative cover = _____
4. Determine retardances and permissible velocities for channel using Table 6-27.1.
   The retardance class for capacity (unmowed vegetation) is _____.
   The retardance class for stability (mowed vegetation) is _____.
   Maximum permissible velocity, V_1, is _____ fps.
5. Determine dimensions of the parabolic channel. Use Table 6-28.1 for retardances “D” and “B”. Use Table 6-28.2 for retardance “D” and “C”.
   For a grade of _____ % and a Q_{25} of _____ cfs,
   Top width, T = _____ ft (includes allowance for vegetative lining)
   Depth, D = _____ ft (includes allowance for vegetative lining)
   Velocity for unmowed vegetation, V_2 = _____ fps.



STORMWATER CONVEYANCE CHANNEL DESIGN SHEET

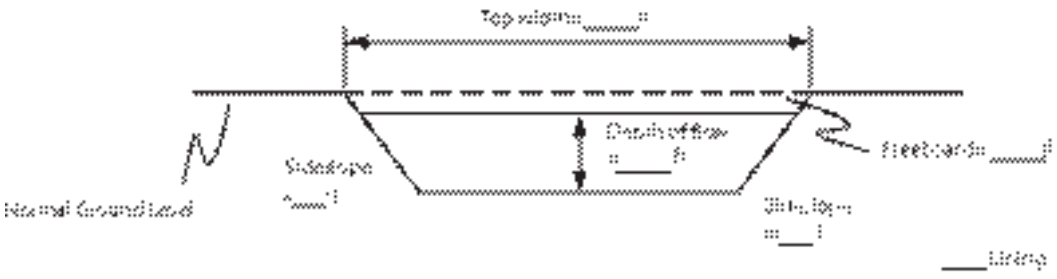
Vegetated Trapezoidal or Triangular Channel

Computed by_____ Date _____
Checked by_____ Date _____

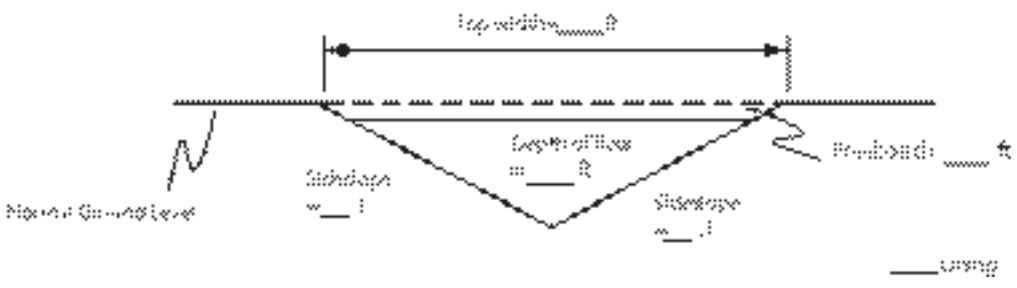
Project Name_____

1. Compute peak rate of runoff for 25-year, 24-hour storm.
   Q_{25} = _____ cfs
2. Determine grade of channel.
   Grade = _____ %
3. Determine which vegetative cover will be used. Refer to Ds3 - Disturbed Area Stabilization (Using Permanent Vegetation).
   Vegetative cover = _____
4. Determine retardances and permissible velocities for channel using Table 6-27.1.
   The retardance class for capacity is _____ and the unmowed plant height is _____ in.
   The retardance class for stability is _____ and the mowed plant height is _____ in.
   Maximum permissible velocity, V_1, is _____ fps.
5. Determine dimensions of the channel. Use Table 6-28.3 for retardance "D". Use Table 6-28.4 for retardance "C".
   For a grade of _____ % and Q_{25} of _____ cfs,
   Side slopes (z:1) = _____
   Bottom width, B = _____ ft (0 for triangular channel)
   Design depth, d = _____ ft
   Area of channel, A = _____ sf.
6. Calculate the constructed depth of the channel.
   Constructed depth, D = Design depth, d + Unmowed plant height
   Constructed depth, D = _____ ft + _____ ft
   Constructed depth, D = _____ ft
7. Calculate the top width of the channel.
   Top width, T = Bottom width + 2(Side slope * design depth)
   Top width, T = B + 2(z*d)
   Top width, T = _____ ft + 2(_____*_____ft)
   Top width, T = _____ ft

Trapezoidal



Triangular



TO BE SUBMITTED WITH/ON
THE EROSION AND SEDIMENT CONTROL PLAN

GRASS-LINED CHANNEL

1. Stormwater Conveyance Channel Design Sheet for the appropriate channel shape.

2. Cross-sectional detail of the channel (include with Design Sheet and show on E&SC plan).

STONE CENTER CHANNEL

1. Cross-sectional detail of the channel on the E&SC plan.

SECTION IV: TABLES FOR DESIGN OF STORMWATER CONVEYANCE PRACTICES

NO CHANGE