

Storm Water Field Inspector's Guide



Storm Water Field Inspector's Guide



**Texas Department of Transportation
Environmental Affairs Division
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Austin, Texas 78704**

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INTRODUCTION

INTRODUCTION

Construction activities can be a major cause of water pollution. Polluted storm water from construction sites is often conveyed via storm sewer systems into rivers and streams. Anywhere soil-disturbing activities occur, erosion and sedimentation are potential problems. Soil-disturbing activities increase the potential for storm water runoff pollution, which can cause downstream impacts to receiving waters. Sediment from construction sites has been shown to exceed that from agricultural land by 10 to 20 times, and by 1,000 to 2,000 times for forested land. In addition to soil-disturbing activities, poor construction management practices, including waste and spill control, can impact receiving waters. As part of an ongoing effort to minimize and/or eliminate pollution to receiving waters, the Texas Department of Transportation (TxDOT) continually evaluates and implements procedures and practices related to storm water runoff pollution. TxDOT's goal is to prevent the pollution of storm water runoff from highway projects, particularly construction-related activities.

To facilitate this objective of reducing storm water pollution, TxDOT has created this *Storm Water Field Inspector's Guide*. The purpose of this guide is to assist TxDOT field inspectors in ensuring compliance with the Texas Commission on Environmental Quality (TCEQ) and Environmental Protection Agency (EPA) Construction General Permit (CGP) conditions for construction projects. This guide also is designed to compliment TxDOT's *Storm Water Management Guidelines for Construction Activities* document. Unless otherwise noted, all figures within this guide are from the *Storm Water Management Guidelines for Construction Activities* document.

For construction activities, TxDOT implements best management practices (BMPs) for compliance with applicable regulations. BMPs are required for construction areas at which final soil stabilization is not established. For each implemented BMP, an inspection and maintenance program is required to ensure that the BMP is functioning as designed. This inspection guide provides a listing of BMPs and the associated inspection and maintenance activities, as summarized below. **TxDOT specifications take precedent over this guidance document.**

Types of Best Management Practices

BMPs are procedures, devices, and practices that are implemented to minimize and/or eliminate erosion, sedimentation, and the introduction of other pollutants to storm water. TxDOT, the EPA, and the TCEQ have developed BMPs based on previous efforts that are approved for use at highway construction sites. Erosion control BMPs are implemented to reduce erosion of the surface cover, including limiting disturbance to native vegetation. By reducing erosion, sediment transport is minimized. Once sediment becomes mobile, sediment-control BMPs are required to reduce the volume of sediment being transported off-site. TxDOT's goal is to prevent all silt and sediment from entering creeks, rivers, and marshes. The most common sediment-control BMPs slow down storm water flow, letting the dirt settle out. Other BMPs actually catch the dirt, like the oil filter in your truck.

While sediment- and erosion-derived pollutants are the most common at construction sites, other pollutants can have an impact on storm water. Other pollutants are caused by poor housekeeping procedures, poor waste management practices, and other management activities.

Following this introduction, this document addresses erosion, sediment, and other pollutant categories of management practices. Within each section, specific, approved BMPs are detailed and the installation and maintenance requirements are provided.

Inspection and Maintenance Guidelines

For each BMP described in this document, a description of the activity and inspection and maintenance guidelines are provided. The inspection subsection is intended to provide detailed inspection procedures for activities that occur during the construction phase of the project. The BMP maintenance subsection provides maintenance procedures for activities conducted after construction is complete but for which permanent erosion and sediment controls have not yet been established.

Many of the BMP activities associated with construction inspection are also required during the maintenance phase of the project. The maintenance subsection summarizes maintenance activities that are detailed in the construction inspection subsection.

Introduction

**STORM WATER
POLLUTION PREVENTION PLAN
REQUIREMENTS**

STORM WATER POLLUTION PREVENTION PLAN REQUIREMENTS

A Storm Water Pollution Prevention Plan (SW3P) is prepared to provide planning and design for environmental protection controls and to ensure minimal environmental impact during highway construction projects. The following sections outline the contents of the SW3P. A checklist of the information required in the SW3P is shown in Figure 1.

The SW3P should be developed jointly by the District Hydraulic Engineer, the TPD Environmental Coordinator, and the District Environmental Quality Control (DEQC). Controls developed in the SW3P should work at the site; if they do not work, the controls and the SW3P must be fixed. The key sections of the SW3P are as follows.

Site Description

A general description of the type of construction activity.

A description of potential pollutants and sources.

A description of the sequence of major activities that will disturb soil at major portions of the site (e.g., grubbing, excavation, grading, joint-bid utilities, and infrastructure installation).

Estimates of the total area of the site. The contract defines all TxDOT sites within the project, whether at one location (typical linear roadway construction project) or multiple locations (off-system bridges at multiple locations). Estimates of the total area of the site to be disturbed by excavation, grading, or other activities, including off-site borrow and fill areas. For a project involving multiple locations and SW3Ps, add the total disturbed area shown on each SW3P to determine the project's total disturbed area.

An estimate of the site runoff coefficient before and after construction.

Data describing the soil or the quality of any discharges from the site.

A general location map (e.g., a portion of a city or county map).

SW3P Requirements

Site map with the following:

- Drainage patterns and slopes expected after major grading activities
- Areas where soil is and is not disturbed
- Locations of major control measures identified in the SW3P
- Locations where stabilization practices will occur
- Locations of off-site material, waste, borrow, or equipment storage areas
- Locations of off-site surface waters (including wetlands)
- Locations where storm water discharges to surface waters

Location and description of any discharge associated with industrial activity, other than the construction, covered under the site permit. This could include storm water discharges from dedicated asphalt plants and dedicated concrete plants.

The name of the receiving water(s) and the extent and description of wetland or other special aquatic sites at or near the construction site that will be disturbed or that will receive discharges from the disturbed areas of the project.

A copy of the permit requirements. A copy of the Texas Pollutant Discharge Elimination System (TPDES) CGP is acceptable, if applicable.

Information on whether or not endangered or threatened species or critical habitat are found near the construction activities and whether or not the species may be affected by the storm water discharges or related activities.

Information on whether or not the storm water discharges or related activities would have an effect on a property that is listed or eligible for listing on the National Register of Historic Places and any applicable requirements to reduce adverse effects.

SW3P Description of Control Measures

Measures will be implemented as part of construction activities to control pollutants in storm water discharges. The SW3P will provide information on these control measures, which will include the following:

- A description of the control measures
- A description of each major activity that disturbs soil at major portions of the site (e.g., grubbing, excavation, grading, joint-bid utilities, and infrastructure installation)
- The general timing/sequence the control measure will be implemented during the construction process

Short- and Long-Term Goals and Criteria for Erosion and Sediment Control Measures are as follows:

- Controls should be designed to keep sediment on-site to the maximum extent possible.
- Control measures must be properly selected, installed, and maintained.
- If periodic inspections or other information indicates that a control has been used inappropriately or incorrectly, the control must be replaced or modified for site situations.
- If sediment escapes the construction site, off-site buildup of sediment must be removed often enough to minimize off-site impacts. Timing of buildup removal must ensure that sediment in the street is not washed into storm sewers by the next rain event and/or does not pose a safety hazard to users of public streets.
- Sediment must be removed from sediment controls when capacity has been reduced by 50%. For example, sediment should be removed from a silt fence when the silt has reached 50% of the fence height.

- Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from polluting storm water discharges. For example, outfall can be screened and trash can be picked up daily.
- Off-site material storage areas (including dirt overburden and stockpiles, borrow areas, etc.) used solely by the project are to be addressed in the SW3P.

SW3P Stabilization Practices

A description of temporary and permanent stabilization practices for the site, including a schedule of when the practices will be implemented.

Site plans should ensure that existing vegetation is not disturbed, if possible, and that disturbed portions of the site are stabilized.

SW3P Structural Practices

A description of structural practices to reroute flow from exposed soil, store flow, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site.

SW3P Post-Construction Storm Water Management

The CGP requires that the SW3P contain a description of any measures installed during the construction process to control storm water discharges after construction operations have been completed.

The SW3P must include an explanation of the technical reasons for selecting practices to control pollution where flows are greater than pre-development levels. The CGP also requires that velocity-reducing devices be placed at discharge locations and along the length of any outfall channel to provide a flow velocity that prevents erosion from the structure to a watercourse.

Other Controls

The CGP requires that no solid materials, including building materials, be discharged to receiving waters unless specially authorized. The SW3P must contain a description of measures to minimize off-site vehicle tracking of sediments and dust generation. See the Other Best Management Practices section of this document for further information.

The SW3P must be consistent with applicable state, Tribal, and/or local waste disposal, sanitary sewer, or septic system regulations to the extent that these are located within the permitted area.

The SW3P must include a description of construction and waste materials expected to be stored on-site, with updates as appropriate. The SW3P must also include a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to storm water and spill prevention and response. See the Other Best Management Practices section of this document for further information.

The SW3P must be updated to remain consistent with any changes applicable to protecting surface water resources. This may relate to updating the sediment- and erosion-control site plans or site permits, storm water management site plans, or site permits approved by state, Tribal, or local officials as requested by written notice.

Permit Requirement to Keep SW3P Current

The TxDOT construction inspector and the contractor superintendent must work together to identify any changes in the SW3P. The TxDOT construction inspector must provide the project engineer and Area Engineer (AE) with constant feedback if the SW3P is current.

The SW3P must be amended whenever:

- There is ***any change in design, construction, operation, or maintenance*** that has an effect on the discharge of pollutants to receiving waters that was not addressed in the SW3P.

- **Inspections** by site operations, local, state, or federal officials **indicate that the SW3P is ineffective** in eliminating or significantly minimizing pollutants from the construction site or otherwise is not achieving the general objectives of controlling pollutants in storm water discharges.
- The CGP requires TxDOT to **modify the SW3P within 14 calendar days of a spill or release**. The modification must include a description of the release, the circumstances leading to the release, and the date of release. The plan must be reviewed to identify measures to prevent the event of such a release, and the plan must be modified where appropriate.

SW3P Signatory Requirements

The SW3P must be signed by the District Engineer (DE), AE, or, if delegated, the authorized representative. DE- or AE-delegated signature authority, or the delegated authorization, must be kept with the SW3P.

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STORM WATER POLLUTION PREVENTION PLAN (SW3P) CHECKLIST

SW3P Site Description Section <i>(Part IV.D.1.a-j) (Page 36502-36503)</i> ¹	
	A general description of the nature of the construction activity.
	A description of the intended sequence of the major activities that will disturb soils for major portions of the site (e.g. grubbing, excavation, grading, joint-bid utilities and infrastructure installation).
	Estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading or other activities including off-site borrow and fill areas.
	An estimate of the runoff coefficient of the site for both the pre-construction and post-construction conditions and data describing the soil or the quality of any discharge from the site.
	A general location map (e.g. a portion of a city or county map).
	A site map that indicates the following:
	Drainage patterns and approximate slopes anticipated after major grading activities;
	Areas of soil disturbance (and areas which will not to be disturbed);
	Locations of major structural and nonstructural control measures identified in the SW3P;
	Location and description of industrial activity discharges other than storm water discharges;
	Locations where stabilization practices are to occur;
	Location of off-site material, waste, borrow or equipment storage areas;
	Locations of off-site surface waters (including wetlands);
	Locations where storm water discharges to surface waters.
	Location and description of any discharge associated with industrial activity, other than the construction, which are covered by this permit. This could include storm water discharges from dedicated asphalt plants and dedicated concrete plants.
	The name of the receiving water(s) and the areal extent and description of wetland or other special aquatic sites at or near the construction site that will be disturbed or which will receive discharges from the disturbed areas of the project.
	A copy of the permit requirements. (A copy of the actual EPA NPDES CGP is acceptable);
	Information on whether listed endangered or threatened species or critical habitat are found in proximity to the construction activity and whether such species may be affected by the storm water discharges or storm water discharge related activities.
	Information on whether the storm water discharges or storm water discharge related activities would have an effect on a property that is listed or eligible for listing on the National Register of Historic Places and any requirements that may be applicable related to mitigation of any adverse effects.
SW3P Description of Control Measures <i>(Part IV.D.2) (Page 36503-36504)</i>	
	A description of the control measures that will be implemented as part of the construction activity to control pollutants in storm water discharges.
	A description of each major activity that disturbs soils for major portions of the site (e.g. grubbing, excavation, grading, joint-bid utilities and infrastructure installation). The control measure(s) to be used and the general timing (or sequence) that the measure will be implemented during the construction process.
	The Short and Long Term Goals and Criteria for Erosion and Sediment Control Measures are as follows <i>(Part IV.D.2.a (1)(a)-(f)) (Page 36503)</i> The construction phase erosion and sediment controls should be designed to retain sediment on site to the extent practicable. All control measures must be properly selected, installed, and maintained in accordance with the manufacturer specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately, or incorrectly, the permittee must replace or modify the control for site situations. ² If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize off-site impacts (to ensure that fugitive sediment in the street is not

Figure 1. SW3P Checklist

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	<p>washed into storm sewers by the next rain event and/or pose a safety hazard to users of public streets).²</p> <p>Sediment must be removed from sediment traps or sedimentation ponds when design capacity has been reduced by 50%.²</p> <p>Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, trash picked up daily).²</p> <p>Offsite material storage areas (also including overburden and stockpiles of dirt, borrow areas etc.) used solely by the permitted project are considered a part of the project and are to be addressed in the SW3P.³</p>
SW3P Stabilization Practices (Part IV.D.2.a(2)) (Page 36503)	
	A description of interim and permanent stabilization practices for the site, including a schedule of when the practices will be implemented. Site plans should ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized.
SW3P Structural Practices (Part IV.D.2.a(3)) (Page 36503-36504)	
	A description of structural practices to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site.
SW3P Post-Construction Storm Water Management (Part IV.D.2.b (1)-(2)) (Page 36504)	
	The CGP requires that the SW3P contain a description of any measures installed during the construction process to control storm water discharges after construction operations have been completed
	The SW3P must include an explanation of the technical basis used to select the practices to control pollution where flows exceed pre-development levels. The CGP also requires that velocity dissipation devices must be placed at discharge locations and along the length of any outfall channel to provide a non-erosive flow velocity from the structure to a watercourse.
Other Controls (Part IV.D.2.c(1)-(6)) (Page 36504)	
	The CGP requires that no solid materials, including building materials, be discharged to waters of the United States, except as authorized by a separate permit issued under Section 404 of the CWA.
	The SW3P must contain a description of measures that will be used to minimize off-site vehicle tracking of sediments and dust generation.
	The SW3P must be consistent with applicable State, Tribal and/or local waste disposal, sanitary sewer or septic system regulations to the extent these are located within the permitted area.
	The SW3P must include a description of construction and waste materials expected to be stored on-site with updates as appropriate. The SW3P must also include a description of controls to reduce pollutants from these materials including storage practices to minimize exposure of the materials to storm water, and spill prevention and response.
	The SW3P must include a description of construction and waste materials expected to be stored on-site with updates as appropriate. The SW3P must also include a description of controls to reduce pollutants from these materials including storage practices to minimize exposure of the materials to storm water, and spill prevention and response.
	The SW3P must be updated as necessary to remain consistent with any changes applicable to protecting surface water resources. This may relate to updating the sediment and erosion control site plans or site permits, or storm water management site plans or site permits approved by State, Tribal or local officials for which the permittee receives written notice. ²
Permit Requirement to Keep SW3P Current (Part IV.C) (Page 36502)	
	<p>The SW3P must be amended whenever:</p> <p>There is a change in design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to the waters of the United States that was not addresses in the SW3P.⁴</p> <p>Inspections or investigations by site operations, local, state or federal officials indicate that the SW3P is proving ineffective in eliminating or significantly minimizing pollutants from the construction site or otherwise is not achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity.⁴</p> <p>The CGP requires TxDOT to modify the SW3P within 14 calendar days of knowledge of a spill or</p>

Figure 1. SW3P Checklist (cont.)

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	<p>release. The modification must include a description of the release; the circumstances leading to the release; and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such a release, and the plan must be modified where appropriate (Also see Section 2.4 Discharges of Hazardous substances).⁴</p> <p>Revisions to the SW3P must be completed within 7 calendar days following the inspection. If existing BMPs need to be modified or if additional BMPs are necessary, implementation must be completed before the next anticipated storm event. If implementation before the next anticipated storm event is impracticable, they must be implemented as soon as practicable.⁴</p>
SW3P Signatory Requirements <i>(Part IV.B.1) (Page 36502)</i>	
	The SW3P must be signed by the District Engineer (DE), Area Engineer (AE) or, if delegated, by the authorized representative. DE or AE delegated signature authority, or the delegated authorization must be kept with the SW3P.

- Note: ¹ Shaded portions are references to the July 6, 1998 Federal Register Notice of the NPDES Construction General Permit (CGP).
² Items that should be included as a General Note in the Construction Plans.
³ Areas where TxDOT has day-to-day operational controls need to be included in SW3P. The SW3P should also include a list of activities that are under the direct day-to-day operational control of the contractor. Contractor needs to be made aware of the obligations to ensure compliance with the NPDES permit. This should be documented and placed in the NPDES file.
⁴ TxDOT Inspector in charge of SW3P inspections needs to be made aware of these items.

Figure 1. SW3P Checklist (cont.)

**INSPECTION FREQUENCY
AND PROCEDURES**

INSPECTION FREQUENCY AND PROCEDURES

Frequency

Qualified personnel should inspect the construction site on a regular inspection cycle. Inspection cycles include at least once every 14 calendar days and within 24 hours of the end of a rainfall that is 1/2-inch or greater or once every 7 days. Where sites have been finally stabilized, or during seasonal arid periods in arid (with an average annual rainfall of 0 to 10 inches) and semiarid (with an average annual rainfall of 10 to 20 inches) areas, inspections shall be conducted at least monthly. The inspection cycle is located on the project's SW3P sheet. The default option is at least once every 14 calendar days and within 24 hours of the end of a rainfall that is 1/2 inch or greater. The inspection shall include an evaluation of the BMP condition, maintenance requirements, and an indication of whether or not the device is functioning properly. If the inspection determines that modifications to the SW3P are needed, changes will be completed within 7 calendar days of the inspection.

Record Keeping and General Procedures

A report summarizing the inspection shall be completed that includes the following:

- Name(s) and qualifications of personnel making the inspection
- The date(s) of the inspection
- Major observations relating to the implementation of the SW3P and actions taken.

The inspection form to be used—Form 2118—is presented in Figure 2.

Note: The Engineer must approve additional BMPs identified as needed in an inspection that is not shown on the SWP3.

If any *issues* are listed that are potentially **not in compliance**, **forward the report immediately** to your supervisor. **Corrective actions must be taken** immediately when the contractor or cleanup procedure is not in compliance with BMPs.

The inspection form certification can be signed by the DE, Division Director, or their immediate staff; AEs; Assistant AEs; Maintenance Supervisors; Project Architects or Engineers; or Project Inspectors with overall responsibility for the project.

Records of all inspections shall be retained on-site.

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Form 2118 **CONSTRUCTION STORM WATER POLLUTION PREVENTION PLAN**
11-07-2003 **FIELD INSPECTION AND MAINTENANCE REPORT**

Project Information:					
Controlling CSJ: <u>0054-04-093</u>	<input checked="" type="checkbox"/> 1. At least every 14 calendar days or within 24 hours after 0.5 inches or more of rainfall.	Inspection Date: <u>1/20/04</u>			
Controlling Project: <u>NG 2003 (671)</u>	<input type="checkbox"/> 2. At least every 7 calendar days.	TCEQ Authorization Number: (If Applicable) _____			
Controlling Highway: <u>US 84</u>	<input type="checkbox"/> 3. At least monthly [Engineer approved revision to SWP3 required.]	Date of Last Rainfall: <u>1/18/04</u>			
Controlling County: <u>COLEMAN</u>		Amount of Last Rainfall: <u>0.2 Inch</u>			
Areas Inspected:					
Area	Inspected? (Y/NA)	Area	Inspected? (Y/NA)	Area	Inspected? (Y/NA)
Disturbed Soil Areas	Y	Structural Controls	Y	Entrance(s) & Exit(s)	Y
Material Storage Areas	NA	Sediment & Erosion Controls	Y	Other _____	NA
Describe how the inspection was conducted: <u>Walked through project area inspecting the disturbed areas and controls with the Contractor's superintendent.</u>					
Best Management Practices (BMPs) Inspected:					
Except those listed below, all BMPs have been inspected and found to be in functioning as intended and do not require maintenance, upgrading or additional controls? (If multiple highways or project locations are involved, identify the highway or project location for the BMP requiring maintenance or improvement.)					
BMP Type	Approximate Station		Lt or Rt of Centerline	BMP Required Maintenance or Improvement (Describe required corrective actions needed and taken or directions given to the contractor.)	
	From	To			
7	346+00	347+00	Lt	Silt Fence not buried 6". Contractor directed to bury edges 6" towards flow.	
28	368+30	368+60	Rt	"Single layer downstream" per plans not installed. Contractor directed to install per plans.	
Additional BMPs Needed (Any BMPs not shown on the SWP3 must be approved by the Engineer. If multiple highways or project locations are involved, identify the highway or project location for the additional BMP.):					
Approximate Station		Lt or Rt of Centerline	BMP to be Installed (Describe required corrective actions needed and taken or directions given to the contractor.)		
From	To				

Figure 2. Form 2118

Storm Water Field Inspector's Guide

Temporarily or Permanently Ceased Construction Activities: Where construction activities (grading, excavating, embankment, or other land disturbing activities) have temporarily or permanently ceased, describe why stabilization measures were not initiated within 14 days of when the construction activities ceased or if additional construction activities will not occur within 21 days of when construction activities were temporarily ceased. (Include the general location of the area involved if it is only part of the site.)			
Actions to be taken as a result of this inspection.			
Furnish a copy of this inspection report to the contractor so necessary maintenance or improvement actions can be taken. Document all changes to the SWP3 after the Engineer has approved them.			
Contractor's Representative Name: Joseph Smith	Title: Superintendent	Date: 1/21/2004	
Compliance Certification (Check only one):			
<input checked="" type="checkbox"/> With the maintenance and Improvements actions noted, the site is in compliance with the SWP3 and the C.GP regulations.			
<input type="checkbox"/> The site is in potential non-compliance with the SWP3 or the CGP regulations. Complete the following "Potential Non-Compliance Issues" section of this inspection report.			
TxDOT's Representative Name: William Young	Title: Construction Inspector	Date: 1/21/2004	
TxDOT's Representative Signature: _____ (Signed)			
Potential Non-Compliance Issues:			
Describe potential non-compliance issues (repeated failure of a BMP, failure to install a required BMP, off-site discharges [silt, gravel, sand, oily water, other pollutant], potential off-site discharges, etc.)		Location on-site where discharge occurred	
Forward this inspection report to your Supervisor immediately if any potential non-compliance issues are listed.			
Inspection Certification:			
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.			
TxDOT's Certifying Representative Name: William Tyler, P.E.	Title: Asst AE	Date: 1/22/2004	
Signature: _____ (Signed)			
1. Temporary Seeding	8. Hay Bales	15. Rock Bed at Construction Exit	22. Curbs and gutters
2. Permanent Plant, Sod or Seed	9. Rock Berm	16. Timber Mat at Construction Exit	23. Storm Sewers
3. Mulch	10. Diversion Dike	17. Channel Liner	24. Velocity Control Devices
4. Soil Retention Blanket	11. Diversion Swale	18. Sediment Trap	25. Excess Dirt removed from Road Daily
5. Buffer Zone	12. Diversion Dike/Swale	19. Sediment Basin	26. Haul Roads Dampened for Dust Control
6. Preserve Natural Resource	13. Pipe Slope Drain	20. Storm Inlet Sediment Trap	27. Cleanup of Possible Contaminants
7. Silt Fence	14. Paved Flume	21. Stone Outlet Structure	28. _____

Figure 2. Form 2118 (cont.)

**BEST MANAGEMENT PRACTICES—
EROSION CONTROL**

Temporary and Permanent Vegetation

Mulch

Blankets and Mattings

Sodding

Interceptor and Perimeter Swales

Diversion, Interceptor, and Perimeter Dikes

Stone Outlet Structures

Pipe Slope Drain

TEMPORARY AND PERMANENT VEGETATION

Description

Vegetation is utilized to establish a temporary vegetative cover over areas disturbed by construction but not yet covered by pavement, buildings, permanent vegetation, or other structures. Temporary vegetation protects the soil from erosion until permanent structural installation or final soil stabilization is complete. Permanent vegetation provides final soil stabilization after soil-disturbing activities are complete. Figure 3 shows the proper placement of vegetative cover.

Inspection and Installation Guidelines

Complete grading activities prior to applying seed mixture.

Apply compost-manufactured topsoil if required.

Apply the seed mixture uniformly to the disturbed areas as required.

Verify that applied seeds are well pulverized, loose, and uniform.

Apply fertilizer, if necessary, at the appropriate rate.

Irrigate vegetation initially and as dry conditions require.

Determine if weeds and/or pests are hindering vegetative growth.

Determine if erosion-control measures (mulching, blankets, erosion-control compost, mattings, etc.) are required to assist vegetation growth on steep slopes.

Maintenance Guidelines

Seed areas that have less than 70% vegetative cover established.

Fertilize and irrigate sod vegetation as needed.

Implement a weed and pest management plan if necessary.

Implement the erosion control measures, including dikes, diversion, and slope regrading, for steep slopes where vegetation is not established due to erosion of seed.

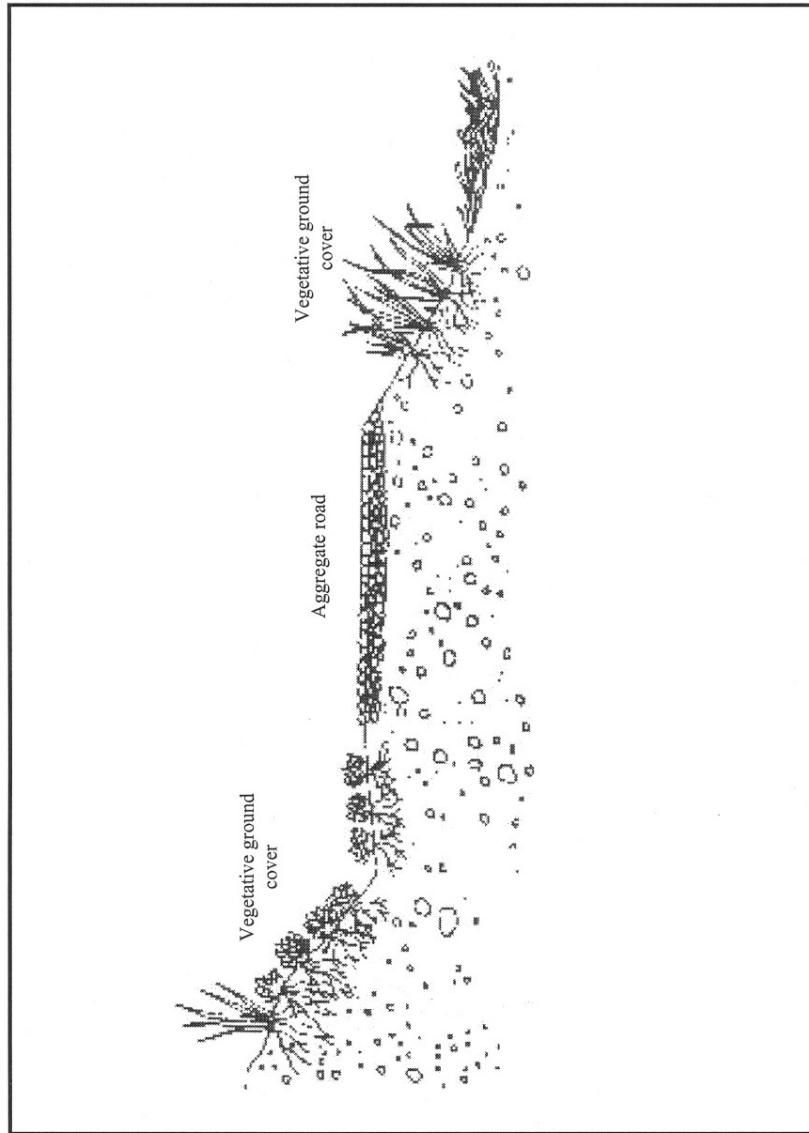


Figure 3. Temporary and Permanent Vegetative Cover
(Modified from Keller and Sherar [2003])

MULCH

Description

Mulching is the process of applying straw, hay, wood chips, compost, shredded bark, chemical binders, or other TxDOT-approved materials to the surface of disturbed soil that has been seeded. The mulch protects the seeded soil from erosive forces and conserves moisture until vegetation becomes established. Table 1 provides information on the mulch types and rates of application.

Inspection and Installation Guidelines

Complete grading activities prior to seeding and mulching.

Select mulch that is free of weeds and pests; otherwise, vegetation could be hindered.

Apply the mulch immediately after seeding activities.

Apply the mulch at the appropriate rate/thickness (material, application rate, etc.).

Verify that mulch covers 80% to 100% of the disturbed soil area.

Anchor the mulch immediately after placement.

Use netting, binding chemicals, or other anchoring mechanisms when installing mulch on slopes steeper than 3:1.

Maintenance Guidelines

Seed areas that exhibit inadequate vegetative growth followed by mulching.

Seal or anchor any loose areas of the mulch cover.

Replace any areas of missing mulch cover.

Table 1. Mulch Types

Mulches	Rates	Notes
Straw	1.5 to 2.0 tons/acre	Free from weeds and coarse matter Anchored with tracking, netting, or liquid tackifiers
Hay	1.5 to 2.0 tons/acre	
Cellulose Fiber	1.0 to 1.5 tons/acre	Apply as slurry (effective in quick vegetative cover)
Chemical Binders	Manufacturers specification	Asphalt, emulsions, synthetic binders (e.g., vinyl, acrylic)
Organic Tackifiers	Manufacturer's specification	
Compost	As specified in Item 161	

Source: *Storm Water Management Guidelines for Construction Activities* (TxDOT 2003)

BLANKETS AND MATTINGS

Description

Blankets and mattings refer to sheets of erosion-control materials (straw, jute, wood fiber, coconut fiber, plastic netting, erosion-control compost, or other TxDOT-approved materials) placed on the surface of disturbed soil. The blankets and mattings protect the soil from erosion until vegetation becomes established. Figure 4 shows the proper anchoring of blankets and matting.

Inspection and Installation Guidelines

Complete grading, fertilization, and seeding activities prior to installing a blanket or matting unless noted otherwise in the specifications.

Install the blanket or matting in accordance with the manufacturer's recommendations and/or the specifications.

Anchor the blanket or matting to the soil surface using staples, trenches, or other TxDOT-approved anchoring methods.

Install anchor staples flush with the soil surface.

Secure blanket or matting joints (Note: Specifications typically require a minimum amount of overlap).

Identify areas where the blanket or matting is loose, damaged, or missing.

Maintenance Guidelines

Seed areas that exhibit inadequate vegetative growth followed by anchoring or replacement of the blanket or matting.

Anchor any loose areas of the blanket or matting.

Replace any damaged or missing areas of the blanket or matting.

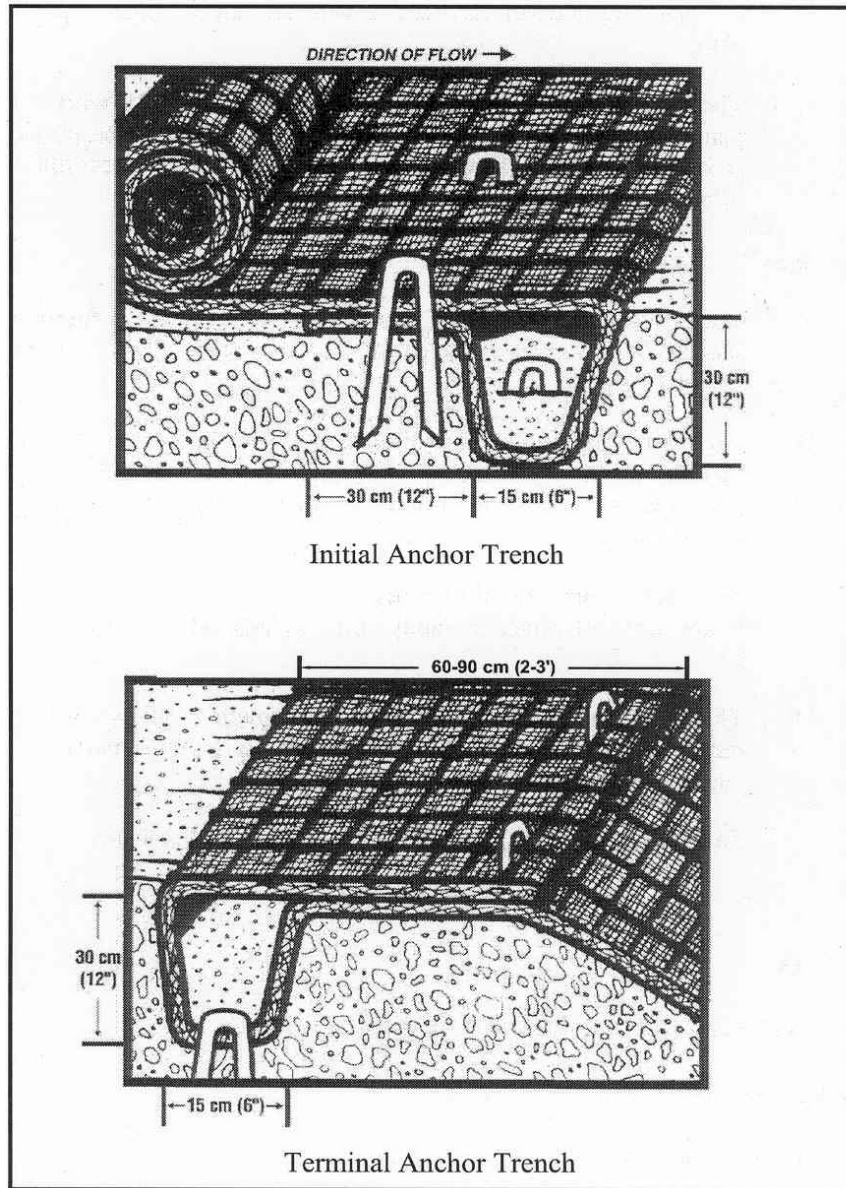


Figure 4. Anchoring of Blankets and Mattings

SODDING

Description

Sod is composed of living vegetation and is placed on disturbed soil that requires an immediate and permanent vegetative cover. Figure 5 shows the proper installation techniques for sod.

Inspection and Installation Guidelines

Complete grading activities prior to sod installation.

Apply compost-manufactured topsoil if required.

Apply fertilizer, if necessary, at the appropriate rate.

Verify that sod is being harvested, delivered, and installed within a period of 36 hours.

Avoid torn or uneven sod pads during installation.

Install the sod in a staggered pattern with the long side perpendicular to the slope (see Figure 5).

Anchor the sod to the ground when installing sod on slopes steeper than 3:1.

Determine if weeds and/or pests are hindering vegetative growth.

Irrigate vegetation initially and as dry conditions require.

Perform the first mowing event only after the sod is firmly rooted.

Maintenance Guidelines

Replace sod pads that exhibit inadequate vegetative growth.

Fertilize and irrigate sod vegetation as needed.

Implement a weed and pest management plan if necessary.

Mow vegetation to a height at which 1/3 of the grass leaf remains.

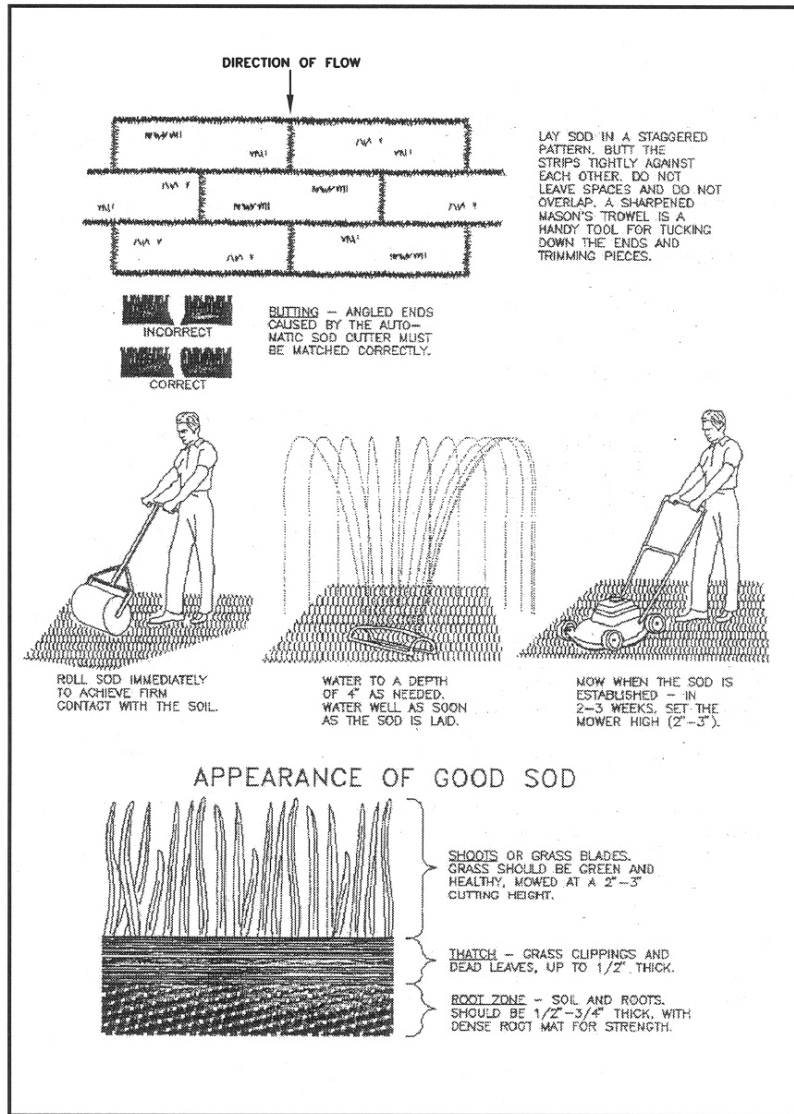


Figure 5. Sod Installation Techniques
 (Adapted from Virginia Department of Conservation and Recreation [1992])

INTERCEPTOR AND PERIMETER SWALES

Description

Interceptor and perimeter swales are channels that have been excavated across disturbed soil areas or along the perimeter of a construction site. The swales prevent off-site storm water runoff from entering the disturbed area and/or prevent the runoff from leaving the construction site or disturbed area. The runoff from the swale is directed to a sediment trap, sediment basin, or other outlet structure built for handling the sediment-laden runoff. Figure 6 shows the proper placement of interceptor and perimeter swales.

Inspection and Installation Guidelines

Check that the depth of the swale is at least 1 foot or more.

Check that the side slopes of the swale are 2:1 or flatter.

Check for proper drainage along the swale by verifying that ponding is not occurring.

Check that runoff is draining to the outlet structure.

Remove trash or debris along the swale to prevent ponding or other drainage problems.

Stabilize the bottom and side slopes of the swale as well as the outlet structure with vegetation, rip-rap, blankets, matting, or other erosion control measures if runoff velocities are high enough to erode soil along the swale.

Stabilize vehicle crossing points across swales.

Maintenance Guidelines

Re-grade swale to ensure proper drainage.

Remove trash and debris.

Stabilize swale, vehicle crossing points, and outlet structures as necessary to control erosion.

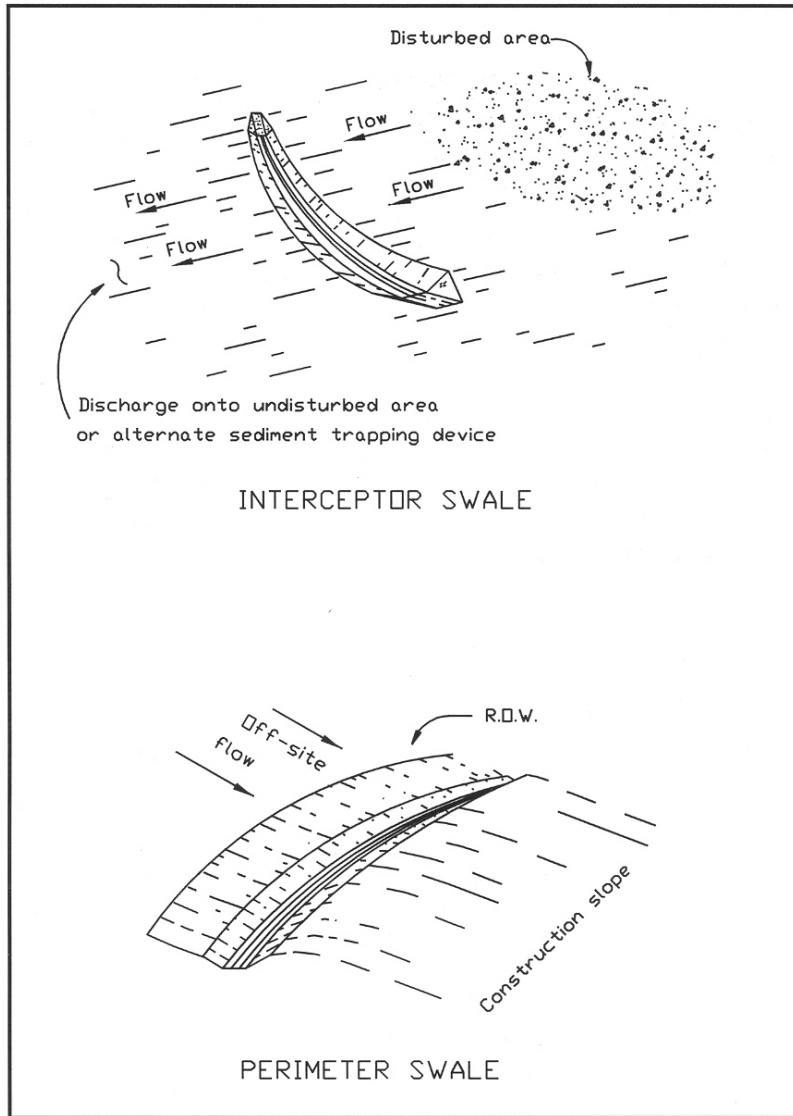


Figure 6. Interceptor and Perimeter Swales
(See TxDOT Specifications and Drawings section for TxDOT
Standard EC(5)-93)

DIVERSION, INTERCEPTOR, AND PERIMETER DIKES

Description

Diversion, interceptor, and perimeter dikes are used to prevent off-site storm water runoff from entering the disturbed area and/or to prevent the runoff from leaving the construction site or disturbed area. The runoff from the dike is directed to a sediment trap, sediment basin, or other outlet structure built for handling the sediment-laden runoff. Figure 7 shows the proper installation of diversion, interceptor, and perimeter dikes.

Inspection Guidelines

Ensure that the top of the dike is at least 18 inches or more above the soil surface.

Check that the side slopes of the dikes are 2:1 or flatter.

Check for proper drainage along the toe of the dike by verifying that ponding is not occurring and that runoff is draining to the outlet structure.

Remove trash or debris along the dike to prevent ponding or other drainage problems.

Stabilize the side slopes and toe of the dike as well as the outlet structure with vegetation, rip-rap, blankets, matting, or other erosion-control measures if runoff velocities are high enough to erode soil along the dike.

Maintenance Guidelines

Repair or modify the dike (height, slopes, etc.).

Remove trash and debris.

Stabilize the dike and outlet structure as necessary to control erosion and maintain integrity.

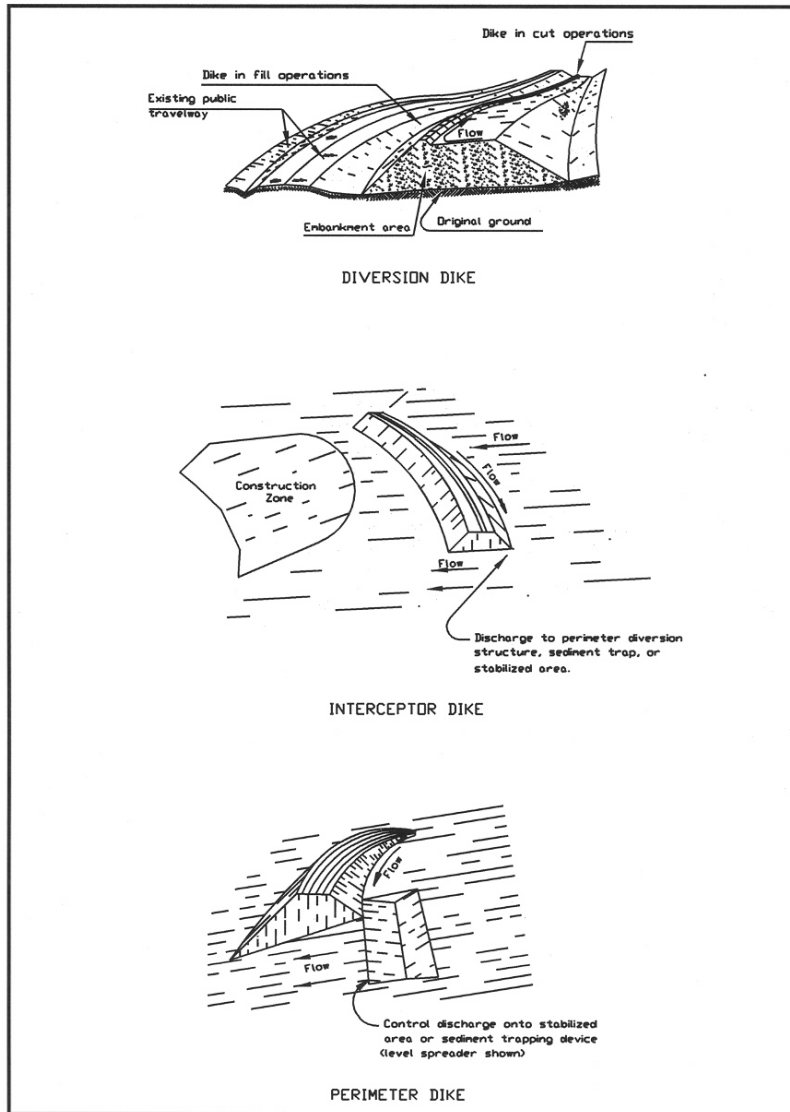


Figure 7. Diversion, Interceptor, and Perimeter Dikes
(See TxDOT Specifications and Drawings section for TxDOT
Standard EC(4)-93)

STONE OUTLET STRUCTURES

Description

A stone outlet structure is a temporary, crushed-stone filter dam typically installed in conjunction with and as part of a diversion dike, interceptor dike, perimeter dike, pipe slope drain, or sediment trap or basin. A stone outlet structure assists in reducing storm water runoff velocities as well as in trapping sediments in the runoff. Figure 8 shows the proper installation of stone outlet structures with a sediment trap.

Inspection and Installation Guidelines

Ensure that the top of the stone filter dam is at least 6 inches below the top of the adjacent earthen dikes.

Verify that the crushed stone used for the dam meets size requirements.

If used at the center of the rock filter dam, ensure that the geotextile fabric is completely covered by the crushed stone.

Remove trash and debris accumulating at the upstream side of the stone filter dam.

Remove accumulated sediment that has reached a height equal to 1/3 of the structure or 1 foot, whichever is less.

Place removed sediment in an area that is protected from erosion.

Maintenance Guidelines

Repair or modify stone filter dam.

Remove trash and debris.

Remove accumulated sediment regularly.

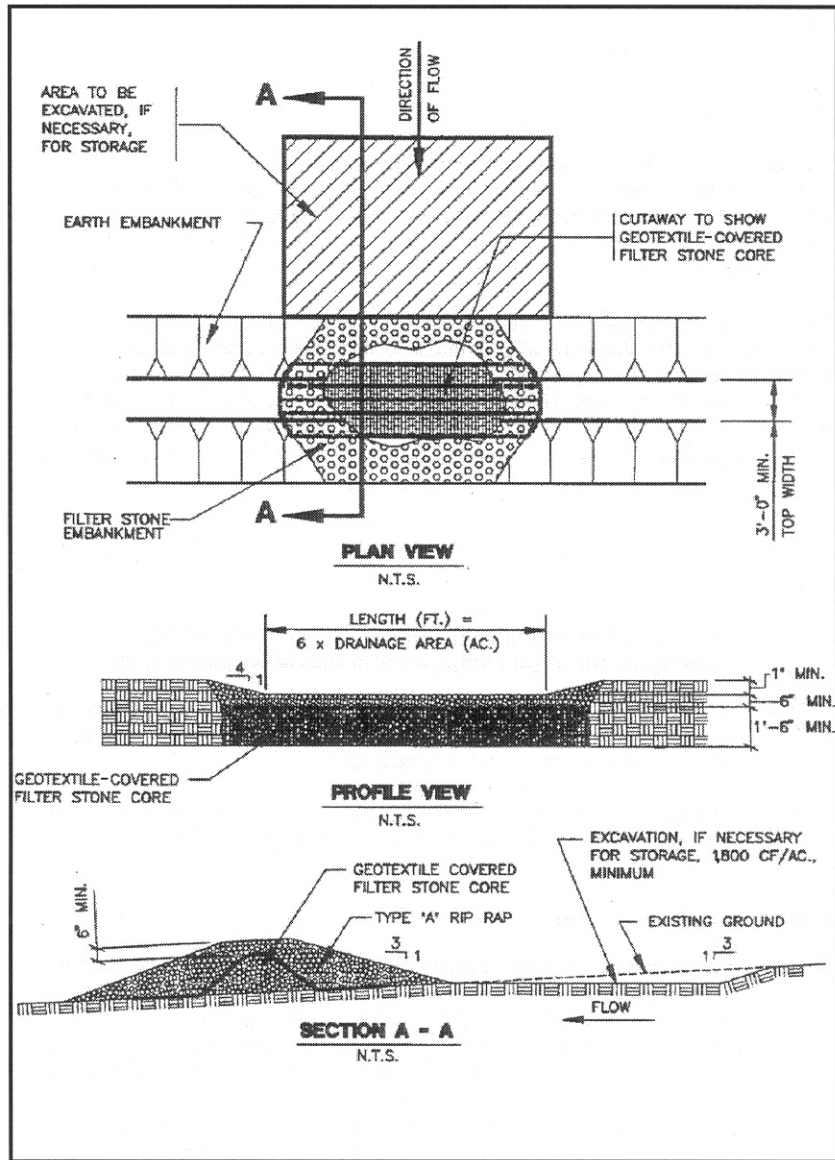


Figure 8. Stone Outlet Structures Installed with a Sediment Trap

PIPE SLOPE DRAIN

Description

A pipe slope drain is an erosion-control device that combines an earthen embankment and a rigid or flexible pipe to transport water runoff over an exposed slope without causing erosion. Figure 9 shows the proper installation of a pipe slope drain.

Inspection and Installation Guidelines

Secure the drainpipe to the ground surface.

Verify that the drainpipe is free of leaks.

Check that the dike height at the top of the slope is at least 1 foot higher than the top of the drainpipe to prevent water from flowing over the dike.

Remove trash and debris accumulating at the top and bottom of the slope and within the pipe.

Stabilize the area around the inlet and outlet of the drainpipe with rip-rap, blankets, rock berm, or other erosion-control measures if runoff velocities are high enough to erode soil.

Maintenance Guidelines

Repair or modify the pipe slope drain.

Remove trash and debris.

Stabilize the drainpipe's inlet and outlet as necessary to control erosion.

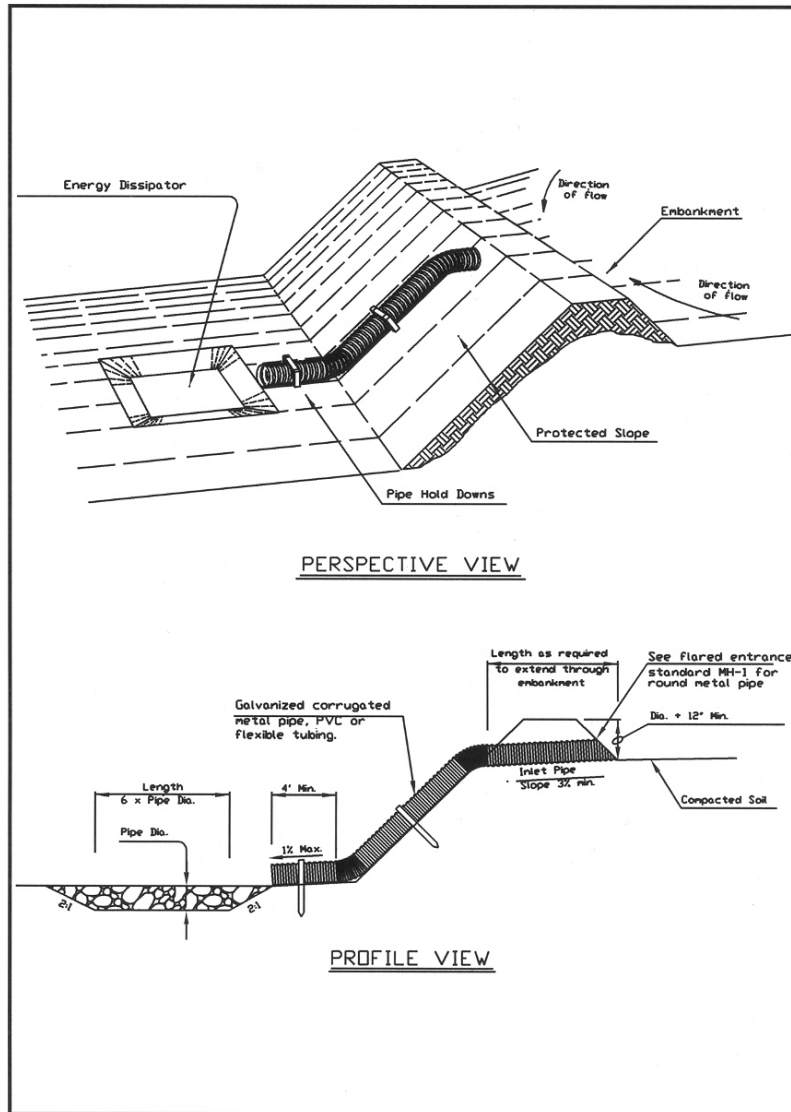


Figure 9. Pipe Slope Drain Installation
 (See TxDOT Specifications and Drawings section for TxDOT Standard EC(7)-93)

**BEST MANAGEMENT PRACTICES—
TEMPORARY SEDIMENT CONTROLS**

Sandbag Berm

Silt Fence

Temporary Erosion Control Device

Triangular Filter Dike

Rock Berm

Hay Bale Dike

Stabilized Construction Exit

Brush Berm

Sediment Trap

Sediment Basin

SANDBAG BERM

Description

A sandbag berm consists of sandbags stacked over one another to create a berm that intercepts storm water runoff, creates ponding conditions, and retains sediments. The sandbag berm can trap sediments when used in channels or form a diversion channel. Figure 10 shows the proper installation of a sandbag berm.

Inspection and Installation Guidelines

Ensure that the berm is installed perpendicular to the direction of runoff flow.

Shape the sandbag berm to ensure that no storm water gets past the berm (other than over the tops of the sandbags and through the drainage pipes).

Seal sandbags where any holes exist in seams.

Stack sandbags properly in a staggered arrangement.

Ensure that ponding associated with the sandbag berm does not create problems (flooded roads, schedule delays, etc.) with the construction area immediately upgradient of the sandbag berm.

Remove accumulated sediment.

Remove sandbags in poor condition.

Check that the design height of the berm is maintained.

Maintenance Guidelines

Reshape and stack the berm as needed.

Remove sediment and sandbags in poor condition.

Seal sandbags.

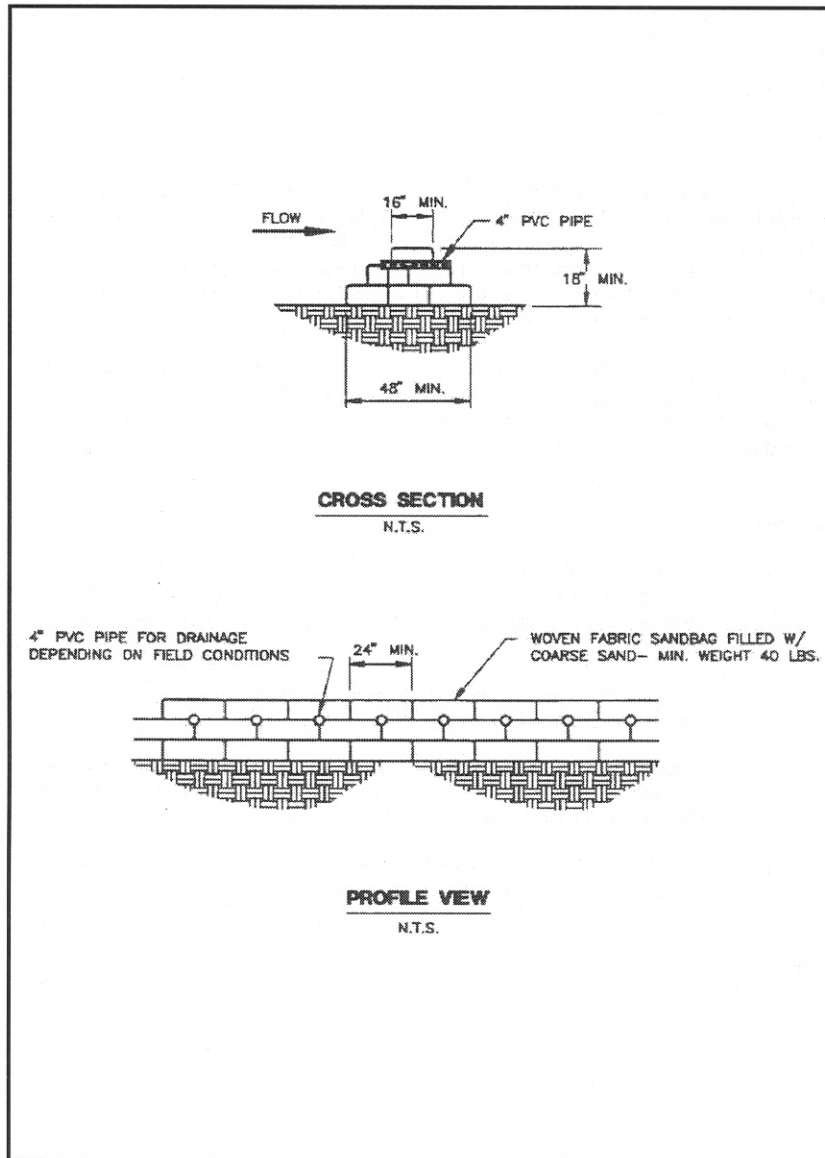


Figure 10. Sandbag Berm Installation (NCTCOG 1993)

SILT FENCE

Description

A silt fence consists of geotextile fabric supported by metal posts and wire mesh that prevents soil and sediment from leaving areas disturbed by construction. Figure 11 shows the proper installation of a silt fence.

Inspection and Installation Guidelines

Ensure that the silt fence is installed perpendicular to the direction of runoff flow.

Securely fasten the geotextile fabric to metal posts or wire mesh.

Face the geotextile fabric towards the construction area (the steel posts and wire mesh behind the fabric should face away from the construction area).

Securely anchor the geotextile fabric to the ground so that storm water runoff does not pass beneath the fence.

Embed the steel posts a minimum of 1 foot deep and no more than 8 feet apart, or 6 feet apart where water is concentrated.

Ensure that there is a 3-foot overlap where the ends of the geotextile fabric meet.

Remove accumulated sediment when buildup reaches 1/3 the height of the fence.

Re-install the silt fence at the end of the day if it was temporarily moved (such as for vehicular access).

Repair torn or missing sections of the geotextile fabric.

Maintenance Guidelines

Repair and replace the silt fence as needed.

Remove sediment.

Securely fasten and anchor the silt fence.

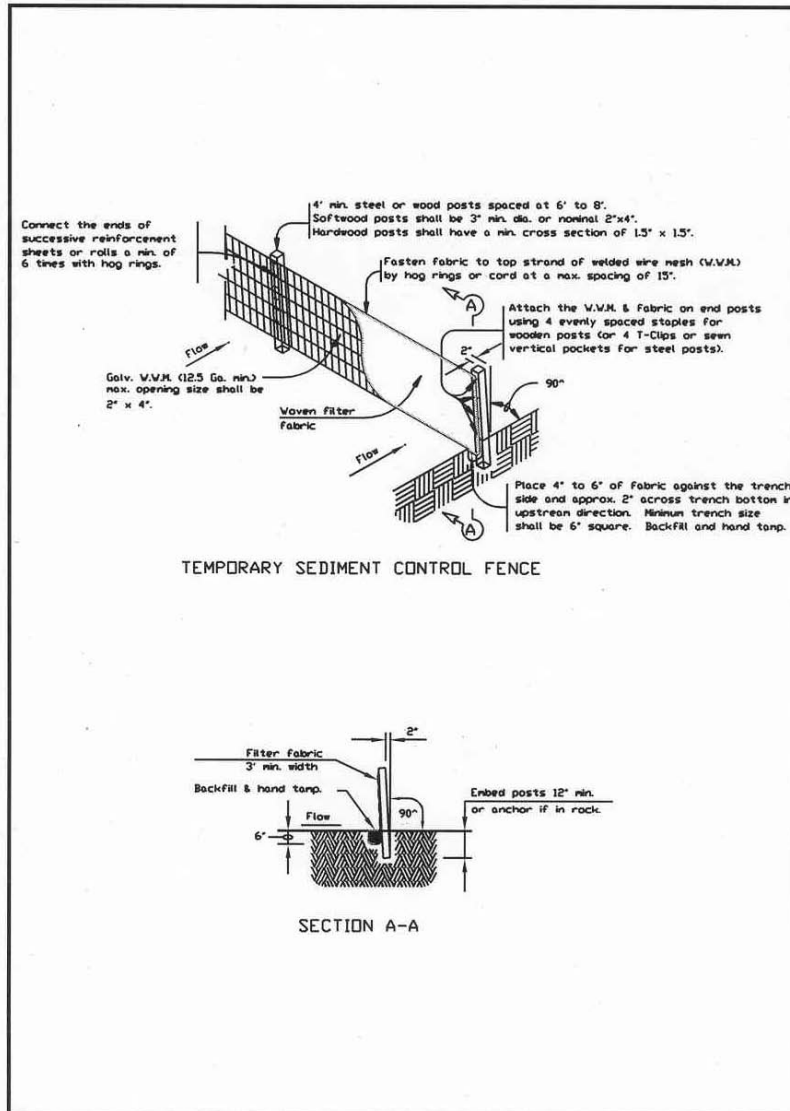


Figure 11. Silt Fence Installation
 (See TxDOT Specifications and Drawings section for TxDOT Standard EC(1)-93)

TEMPORARY EROSION CONTROL DEVICE

Description

A temporary erosion-control device consists of a containment mesh material filled with compost and or wood-based mulch that prevents soil and sediment from leaving areas disturbed by construction. Figures 12, 13, 14, and 15 show the proper installation of filter logs, back of curbing, edge of right-of-way, and check dam temporary erosion-control devices, respectively. Figure 16 shows a picture of a temporary erosion control device.

Inspection and Installation Guidelines

Ensure that the temporary erosion-control device is installed perpendicular to the direction of runoff flow.

Securely fasten the ends of the containment mesh.

Secure the temporary erosion-control device in a method adequate to prevent displacement as a result of normal rain events and in such a manner that storm water flow is not passed under the devices.

Install a cradle of erosion-control compost to ensure that storm water flow does not pass under the devices.

Drive in stakes used for anchoring from the upstream angle.

Remove accumulated sediment when it reaches a depth of 6 inches.

Replace the temporary erosion-control device at the end of the day if it was temporarily moved (such as for vehicular access).

Repair torn sections of the containment mesh with plastic lock ties.

Maintenance Guidelines

Repair and replace temporary erosion-control devices as needed.

Remove sediment.

Securely anchor the temporary erosion control device.

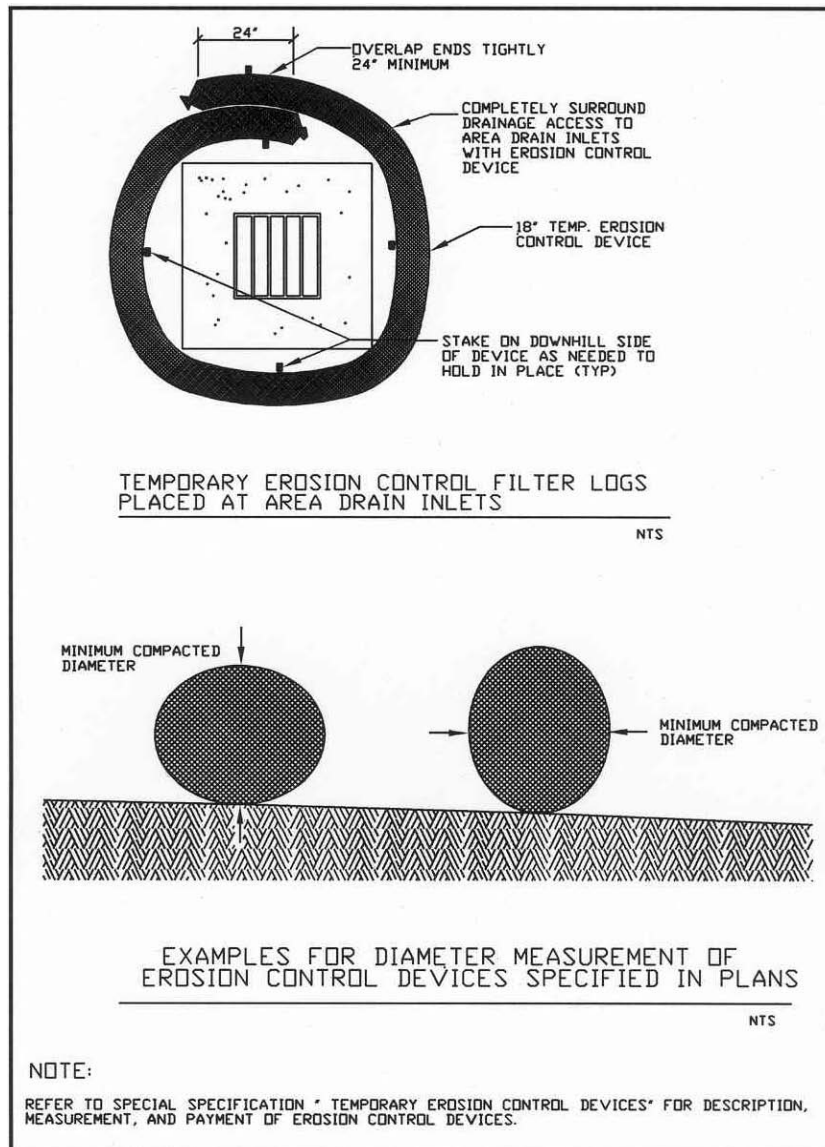


Figure 12. Temporary Erosion-Control Device—
Filter Logs and Diameters

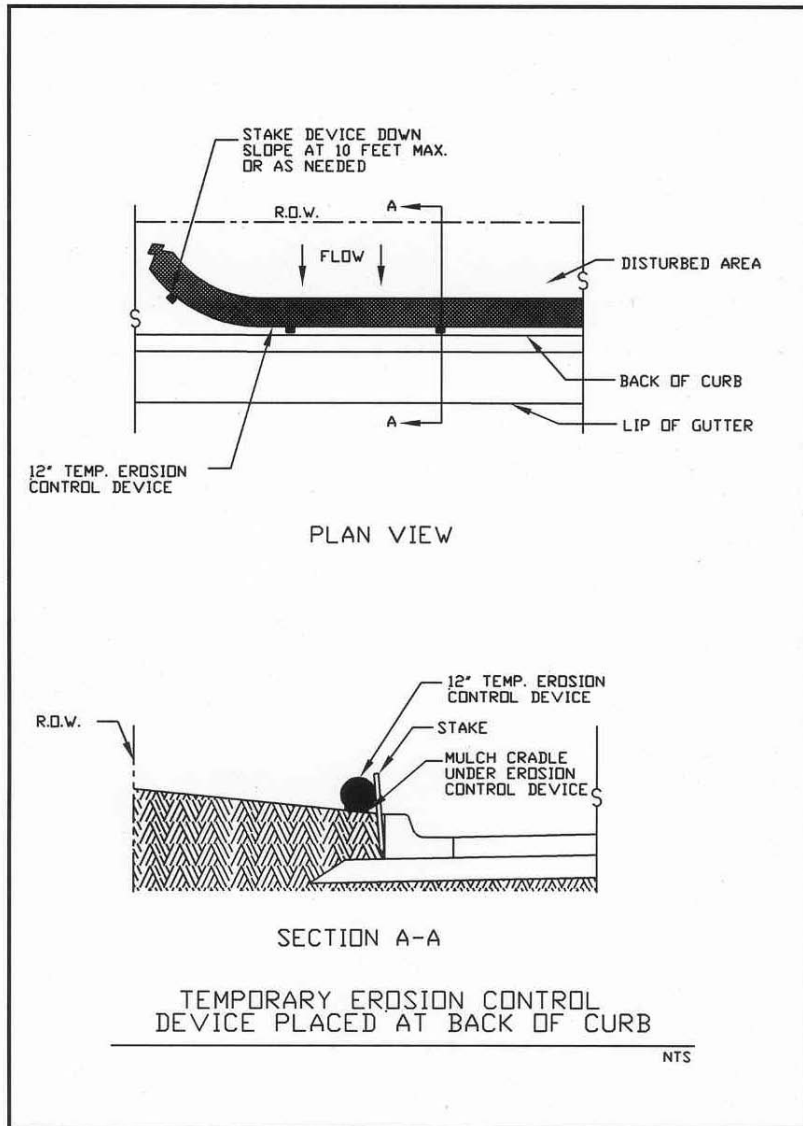


Figure 13. Temporary Erosion-Control Device—
Back of Curb

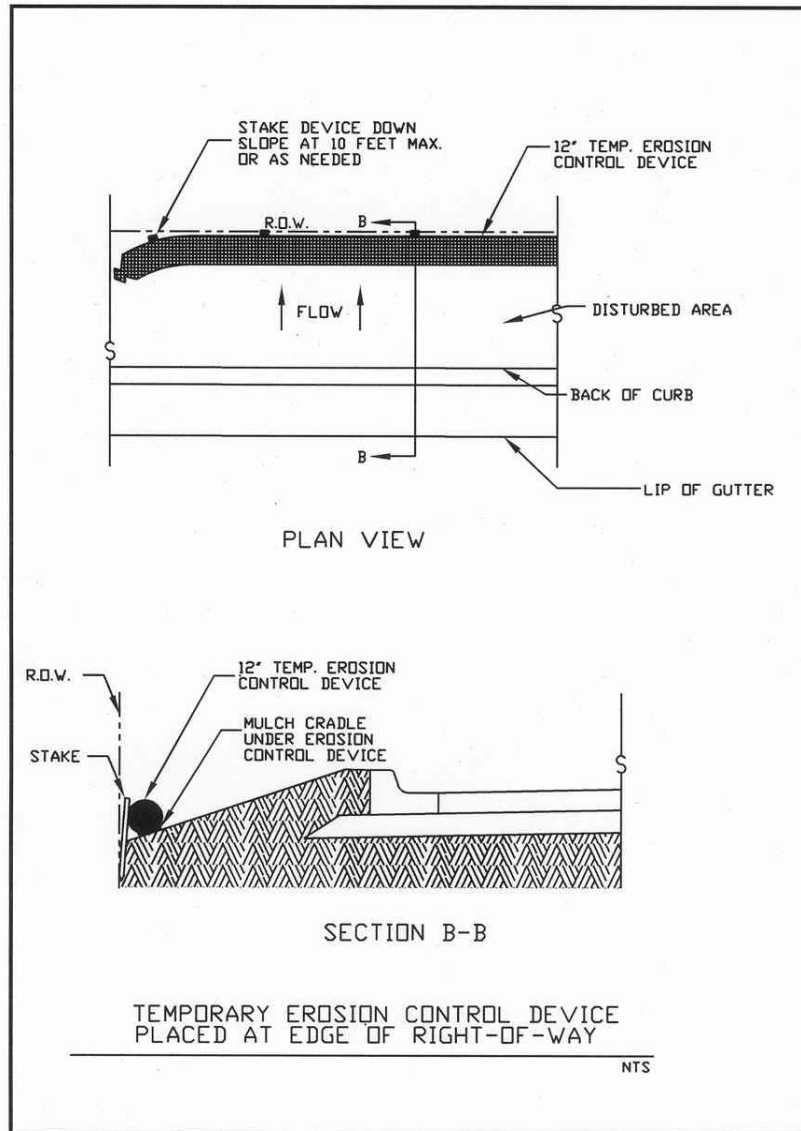


Figure 14. Temporary Erosion-Control Device—
Edge of Right-of-Way

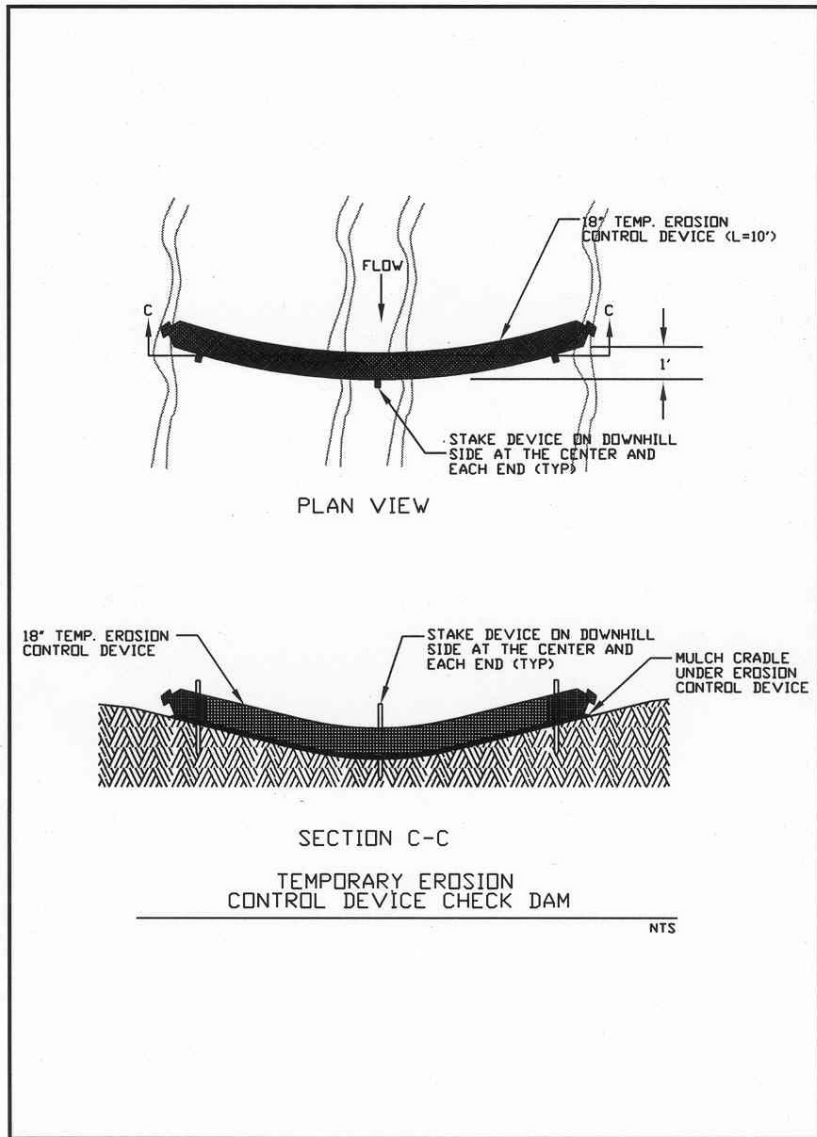


Figure 15. Temporary Erosion-Control Device—
Check Dam



Figure 16. Temporary Erosion-Control Devices

TRIANGULAR FILTER DIKE

Description

A triangular filter dike consists of geotextile fabric wrapped around a triangle-shaped, wire-mesh frame. A triangular filter dike intercepts storm water runoff and retains sediment. Figure 17 shows the proper installation of a triangular filter dike.

Inspection and Installation Guidelines

Ensure that the dike is installed perpendicular to the direction of runoff flow.

Repair torn or missing sections of geotextile fabric along the dike.

Repair damaged sections of the wire mesh frame.

Securely anchor the dike to the ground by embedding, staples, nails, or other TxDOT-approved methods.

Securely attach adjacent dikes so that no gap exists at dike junctions.

Re-install dikes at the end of the day if they are temporarily moved (such as for vehicular access).

Remove accumulated sediment.

Maintenance Guidelines

Repair and replace triangular dikes.

Securely anchor and attach dikes.

Remove sediment.

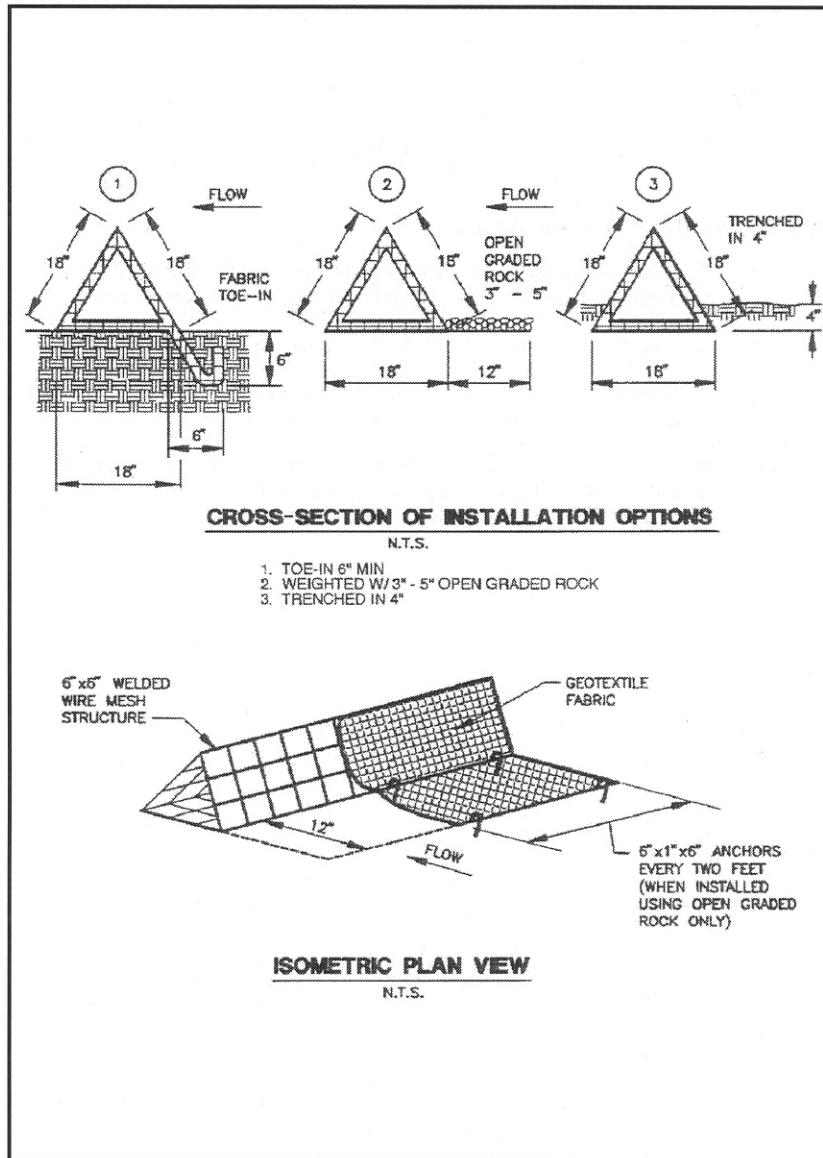


Figure 17. Triangular Filter Dike Installation
(NCTCOG 1993)

ROCK BERM

Description

A rock berm consists of a dike constructed of rock wrapped in wire mesh (Type 1 rock berms do not use wire mesh). A rock berm intercepts and slows storm water runoff and retains sediment. Figure 18 shows the proper installation of a rock berm at the toe of a slope.

Inspection and Installation Guidelines

Install the berm perpendicular to the direction of runoff flow.

Embed the berm a minimum of 4 inches into the ground.

When placed in a channel, tie the ends of the berm to the existing side slopes.

Wrap rocks with wire mesh (wire mesh is not used for Type 1 berms).

Overlap wire mesh a minimum of 2 inches at ends and at joints (wire mesh is not used for Type 1 berms).

Repair any wire mesh damaged by traffic (wire mesh is not used for Type 1 berms).

Remove accumulated sediment.

Maintenance Guidelines

Repair wire mesh (wire mesh is not used for Type 1 berms).

Remove sediment.

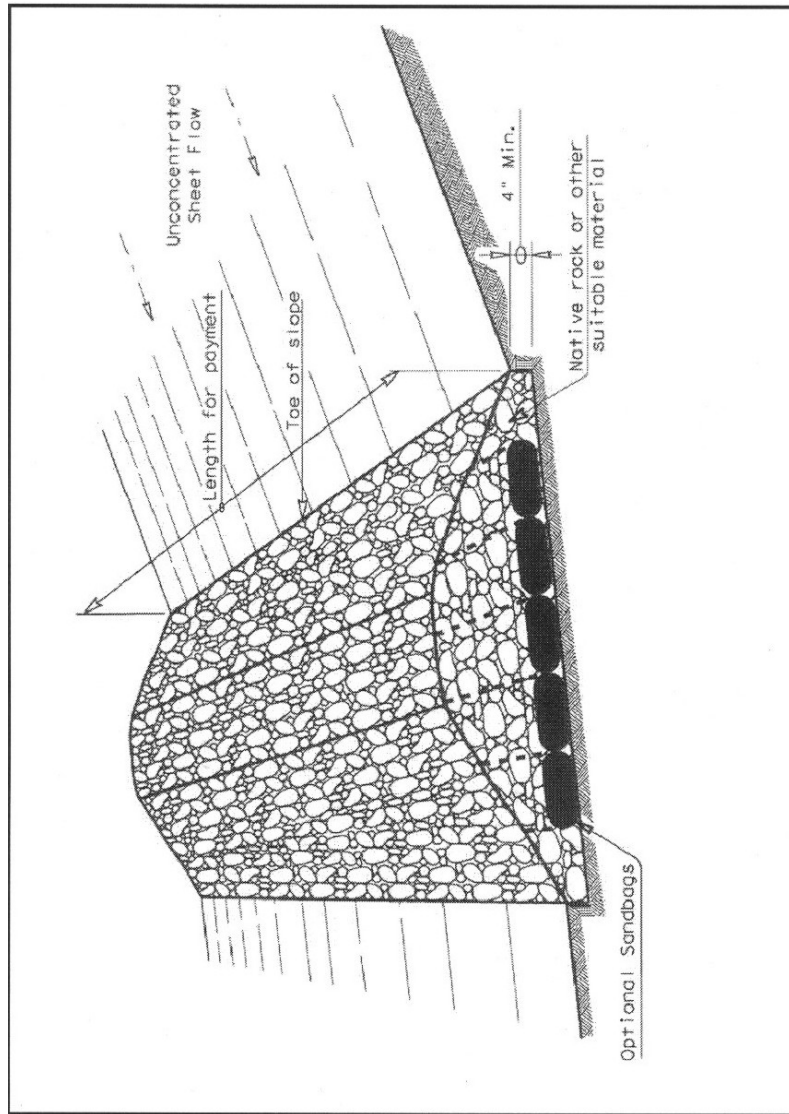


Figure 18. Rock Berm Installation at the Toe of a Slope
(See TxDOT Specifications and Drawings section for TxDOT Standard EC(2)-93)

HAY BALE DIKE

Description

A hay bale dike is a temporary berm constructed of hay or straw bales. The dike intercepts storm water runoff and retains sediments. Hay bale dikes require frequent maintenance and are only used when no other erosion control measure is an option. Figure 19 shows the proper installation of a hay bale dike.

Inspection and Installation Guidelines

Install the dike perpendicular to the direction of runoff flow.

Embed bales a minimum of 4 inches into the ground.

Anchor bales to the ground using wooden stakes or metal rebar driven a minimum of 6 inches into the ground.

Angle the first stake in each bale toward the previously laid bale to force the bales together.

Remove accumulated sediment.

Replace bales every 2 months or sooner.

Maintenance Guidelines

Repair and replace hay bales.

Remove sediment.

Anchor and embed the bales properly.

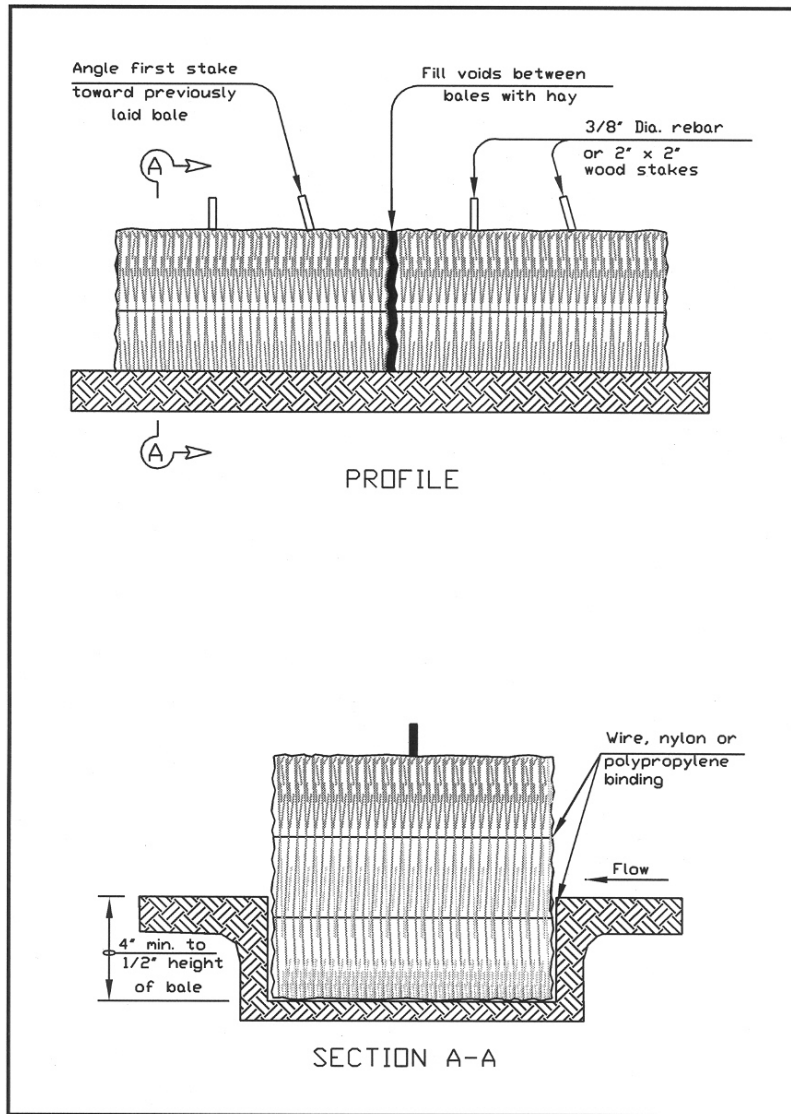


Figure 19. Hay Bale Dike Installation
(See TxDOT Specifications and Drawings section for TxDOT Standard EC(1)-93)

STABILIZED CONSTRUCTION EXIT

Description

A stabilized construction exit is a pad of crushed stone, timber, or other TxDOT-approved material located at any point at which traffic will be leaving the construction site to or from a public right-of-way, street, sidewalk, or parking area. A stabilized construction exit minimizes or eliminates the transport of sediment onto public rights-of-way. Figure 20 shows the plan and profile of a stabilized construction exit.

Inspection and Installation Guidelines

Ensure that the construction pad is flush with the connecting road so that no damage occurs to the road edge.

Ensure that the pad foundation is stable enough to handle traffic and that it exhibits minimal settling.

Re-grade the slope of the pad as necessary to improve drainage.

Remove any sediment that is spilled, dropped, washed, or tracked onto public rights-of-way immediately.

Wash wheels if off-site sediment tracking is occurring.

Capture and drain wash water to an approved sediment-control structure, such as a sediment trap or basin.

Maintenance Guidelines

None. Construction exit should be removed after construction activities.

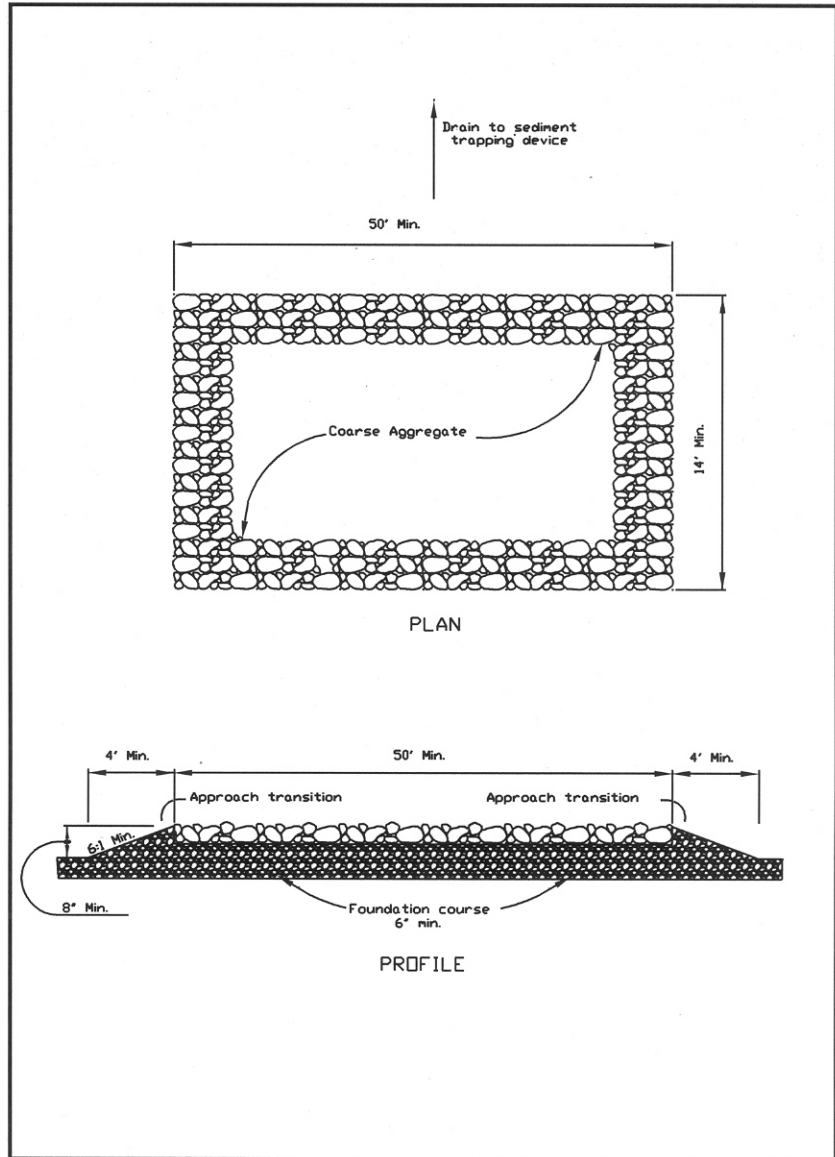


Figure 20. Stabilized Construction Exit—Plan and Profile

BRUSH BERM

Description

A brush berm is a temporary berm constructed of hand-placed brush from woody plants and installed at the toe of a slope or the perimeter of a construction site. Anchor ropes are used to secure the brush to the ground. A brush berm intercepts and slows the surface water runoff and retains sediment. Figure 21 shows the proper installation of a brush berm.

Inspection and Installation Guidelines

Securely anchor the brush to the ground with stakes.

Ensure that filter fabric is fully anchored in the uphill trench.

Replace any brush berm that exhibits signs of deterioration or instability.

Inspect filter fabric anchor for tears and replace damaged sections properly.

Remove trash or debris accumulating along the brush berm.

Remove accumulated sediment that has reached a height equal to 1/3 of the berm height or 1 foot, whichever is less.

Maintenance Guidelines

Remove trash, debris, and sediment.

Secure anchor ropes.

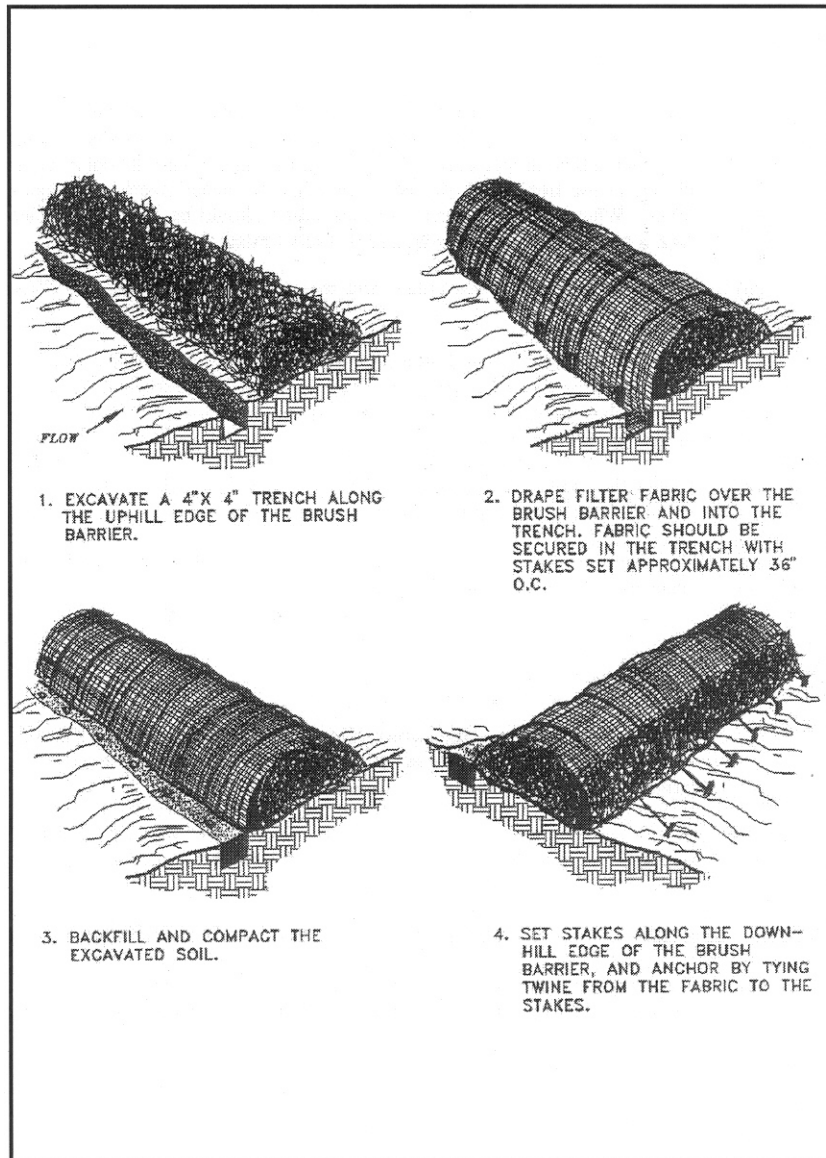


Figure 21. Brush Berm Installation (VDCR 1992)

SEDIMENT TRAP

Description

A sediment trap is a small, temporary basin that catches and retains storm water runoff and allows sediments to settle out. Figure 22 shows the proper installation of a sediment trap.

Inspection and Installation Guidelines

Verify that drainage area to trap is less than 10 acres.

Check that the slopes of the trap are 2:1 or flatter.

Ensure that embankments/surrounding edges do not exhibit water leakage or seepage.

Ensure that sufficient barriers and/or warnings exist to discourage unauthorized entrance into the sediment trap.

Ensure that areas of erosion are not present at storm water runoff entry and exit points, embankments, and spillways.

Remove accumulated sediment that has reached a depth equal to 1/2 of the design depth or 1 foot, whichever is less.

Ensure that any sediment removed from sediment traps is being stockpiled or redistributed to an area that is protected from erosion.

Remove trash or debris accumulating in the sediment trap.

Maintenance Guidelines

Reseed the vegetative cover.

Remove trash, debris, and sediment.

Repair and replace earthen components.

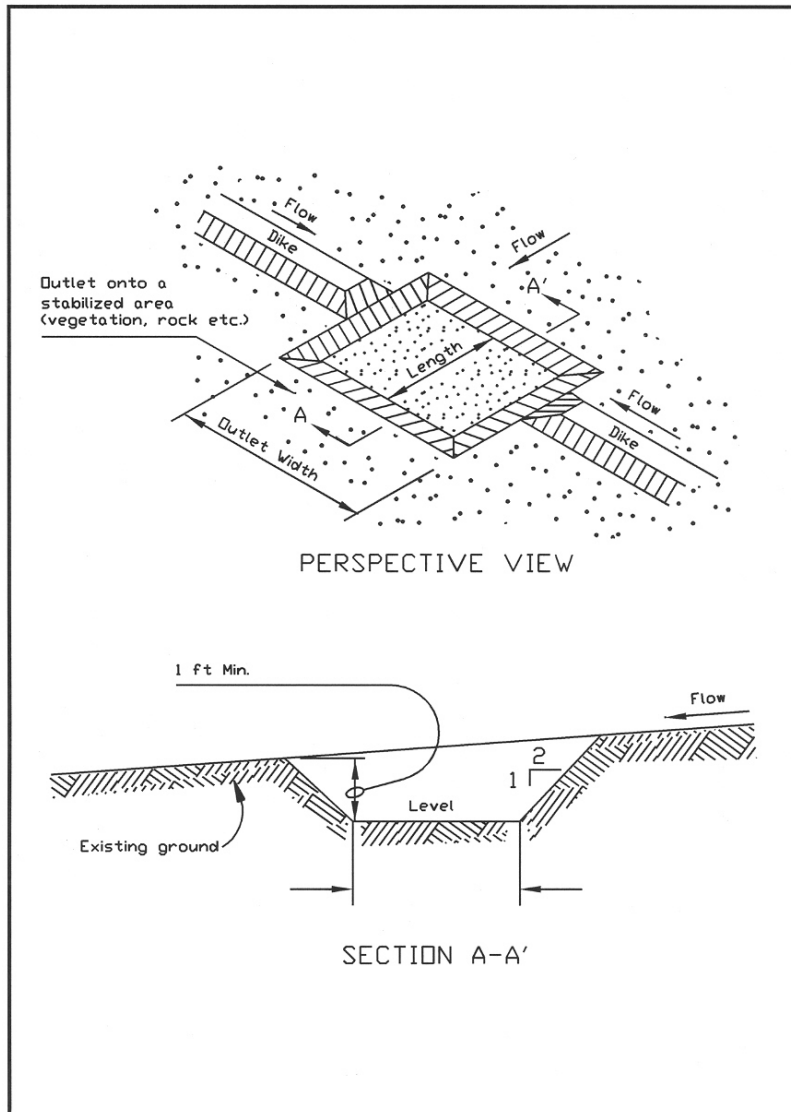


Figure 22. Sediment Trap Installation
(See TxDOT Specifications and Drawings section for TxDOT
Standard EC(6)-93)

SEDIMENT BASIN

Description

A sediment basin is a settling pond that intercepts and retains storm water runoff and allows suspended sediments to settle out. A sediment basin is a larger version of a sediment trap. Figure 23 shows the proper installation of a sediment basin.

Inspection and Installation Guidelines

Verify that drainage area to basin is less than 100 acres.

Ensure that the minimum top width of the embankment is 3 feet.

Check that the side slopes are 3:1 or flatter.

Ensure that areas of erosion are not present at storm water runoff entry and exit points, embankments, spillways, and outlet pipe.

Remove accumulated sediment when the volume equals 1/2 of the design volume.

Ensure that any sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Remove trash or debris accumulating in the sediment basin.

Ensure that embankments/surrounding edges do not exhibit water leakage or seepage.

Repair pipes that exhibit any signs of deterioration.

Ensure that sufficient barriers and/or warnings exist to discourage unauthorized entrance into the sediment basin.

Maintenance Guidelines

Remove trash, debris, and sediment.

Repair and replace earthen and structural components.

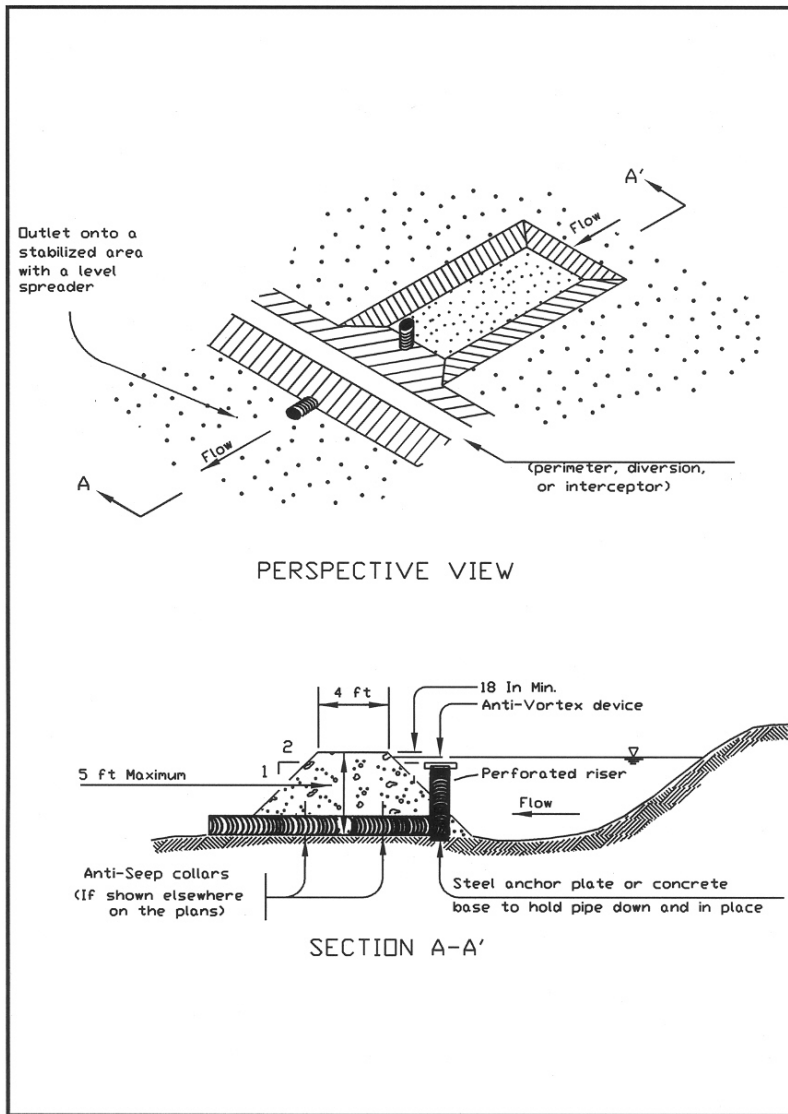


Figure 23. Sediment Basin Installation
(See TxDOT Specifications and Drawings section for TxDOT Standard EC(6)-93)

**BEST MANAGEMENT PRACTICES—
PERMANENT SEDIMENT CONTROL**

Grassy Swales

Retention/Irrigation Systems

Vegetative Filter Strips

Extended Detention Basin

Constructed Wetland

Wet Basin

Sand Filter

GRASSY SWALES

Description

Grassy swales are vegetated channels that transport storm water runoff as well as remove sediments and pollutants by filtration through grass and infiltration through soil.

Inspection and Installation Guidelines

Ensure that the swale is graded properly so that storm water runoff drains along the swale and does not pond at specific locations.

Ensure that sufficient freeboard (the height needed to contain storm water runoff) exists along the swale.

Apply fertilizer, if necessary, at the appropriate rate.

Remove trash or debris accumulating in the swale.

Determine if areas of erosion or inadequate vegetative growth are present along the swale.

Irrigate vegetation initially and as dry conditions require.

Determine if sediment is accumulating at inlet or outlet structures as well as along the channel.

Determine if weeds and/or pests are hindering vegetative growth.

Mow vegetation to a height of 4 to 6 inches.

Maintenance Guidelines

Remove trash, debris, and sediment.

Reseed, mow, and irrigate vegetation.

Remove weeds and pests from vegetation.

Re-grade the swale.

RETENTION/IRRIGATION SYSTEMS

Description

A retention/irrigation system captures and stores storm water runoff in a basin. Captured water is used to irrigate appropriate landscape areas.

Inspection and Installation Guidelines

Implement a nuisance (odors, weeds, insects, etc.) management system if necessary.

Remove trash or debris accumulating in the basin.

Determine if vegetation above the water line requires mowing.

Determine if any areas of erosion or inadequate vegetative growth are present on the side slopes and embankment.

Check to see that pipes, spray heads, pumps, and other structural and mechanical components of the retention/irrigation system are functioning properly.

Ensure that sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Irrigate vegetation initially and as dry conditions require above the water line.

Maintenance Guidelines

Reseed, mow, and irrigate vegetation.

Remove trash, debris, and sediment.

Control nuisance conditions.

Repair structural and mechanical components.

VEGETATIVE FILTER STRIPS

Description

Vegetative filter strips are strips of dense vegetation that remove sediments and pollutants in storm water runoff through settling and filtration processes. Figure 24 shows the proper placement of a vegetative filter strip.

Inspection and Installation Guidelines

Ensure that area is free of gullies that can concentrate flow.

Remove trash or debris accumulating along the vegetative filter strip.

Determine if areas of erosion or inadequate vegetative growth are present along the vegetative filter strip.

Determine if weeds and/or pests are hindering vegetative growth.

Irrigate vegetation initially and as dry conditions require.

Remove sediment accumulating along the upgradient side of the vegetative filter strip.

Implement a pest management system if necessary.

Maintenance Guidelines

Remove trash, debris, and sediment.

Reseed, mow, and irrigate vegetation.

Implement pest management.

Remove accumulated sediment by hand, with a flat-bottomed shovel, or by similar means.

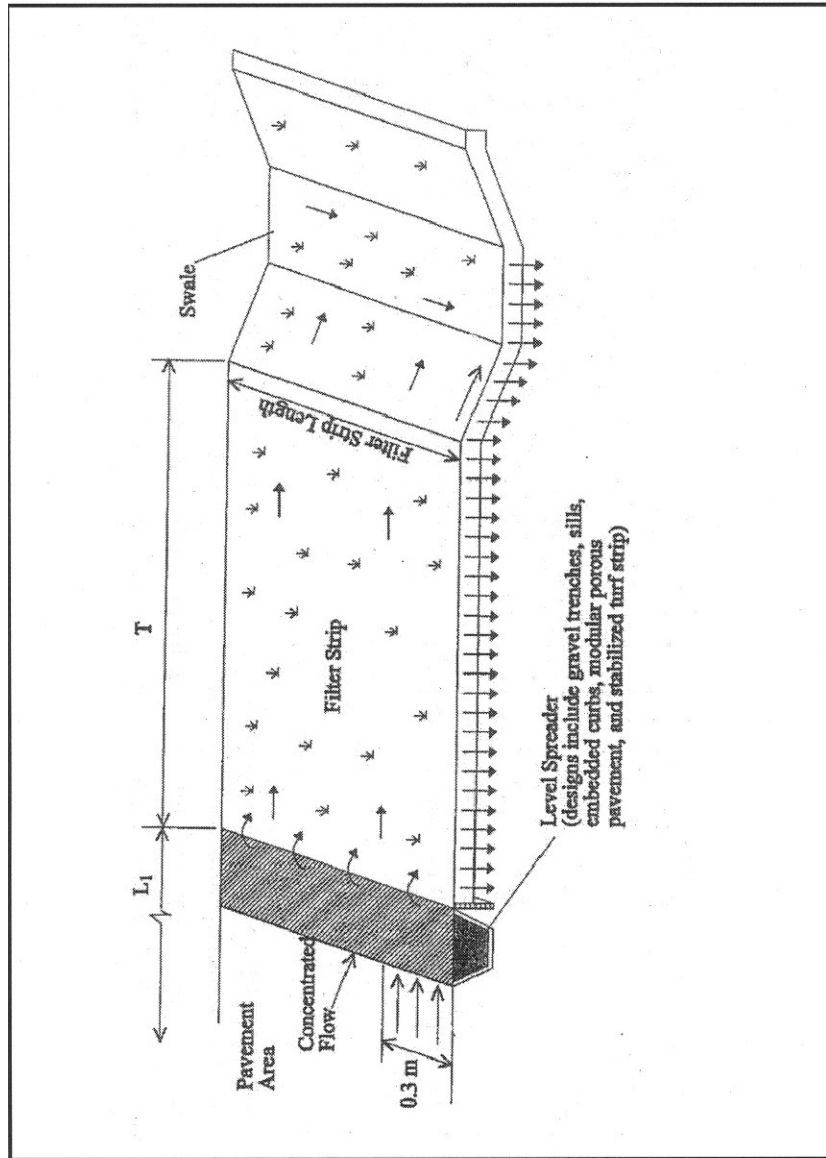


Figure 24. Vegetative Filter Strip
(Modified from Urbonas et. al. 1992 [TNRCC])

EXTENDED DETENTION BASIN

Description

An extended detention basin is a normally dry pond that temporarily stores storm water runoff following a storm and removes sediments and pollutants by settlement. Figure 25 shows the plan and profile of an extended detention basin.

Inspection and Installation Guidelines

Ensure that drainage area is greater than 10 acres and less than 30 acres.

Check that inlet structure reduces runoff velocity and erosion.

Remove trash or debris accumulating in the basin.

Determine if vegetation above the water line requires mowing.

Determine if any areas of erosion or inadequate vegetative growth are present on the side slopes, embankment, or emergency spillway.

Implement nuisance (odors, weeds, insects, etc.) control if necessary.

Remove accumulated sediment when buildup fills 50% of the volume allocated for sediment or when structure functioning is impaired.

Ensure that any sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Ensure that embankments/surrounding edges do not exhibit water leakage or seepage.

Examine structural features for deterioration, leakage, and/or cracking.

Irrigate vegetation initially and as dry conditions require.

Maintenance Guidelines

Reseed, mow, and irrigate vegetation.

Remove trash, debris, and sediment.

Control nuisance conditions.

Repair and replace earthen and structural components.

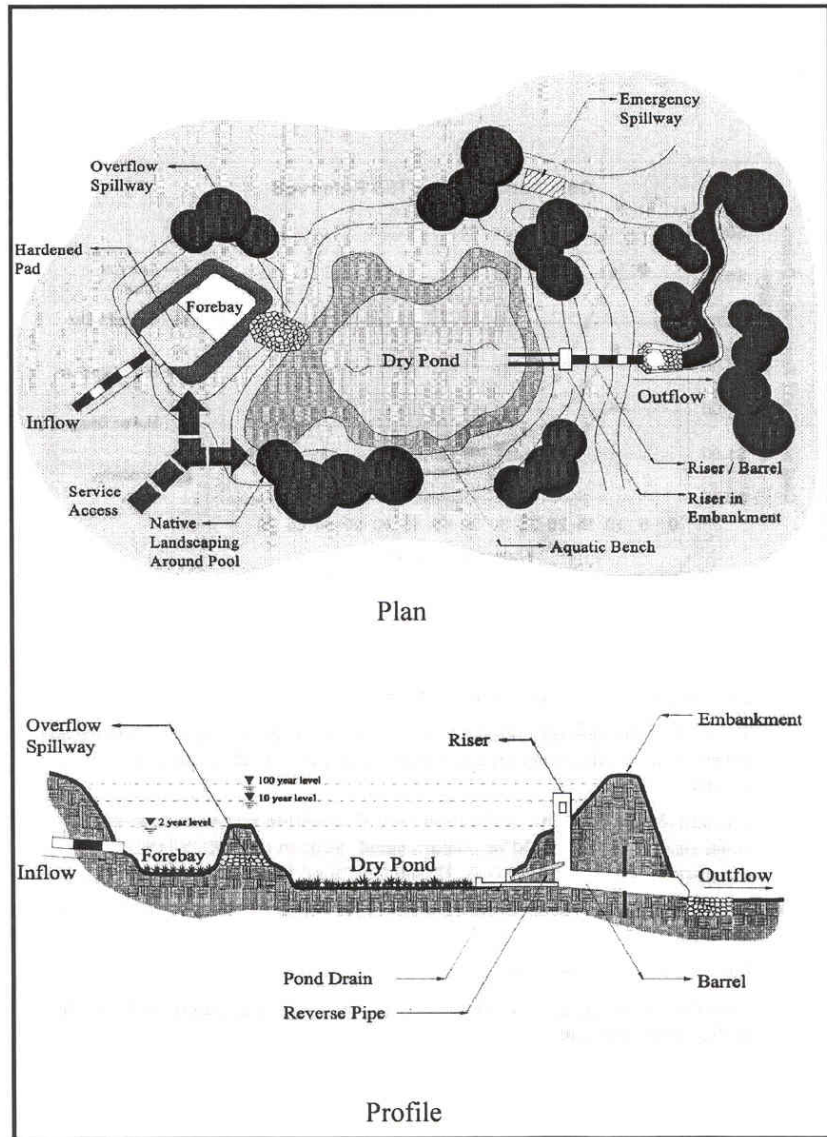


Figure 25. Extended Detention Basin—Plan and Profile

CONSTRUCTED WETLAND

Description

A constructed wetland is a permanent pond that removes sediments and pollutants from storm water runoff through physical, chemical, and biological processes. Physical processes include decreasing flow velocities; chemical processes include precipitation and chemical adsorption; and biological processes include decomposition, plant uptake, and biodegradation. Figure 26 shows the plan and profile of a constructed wetland.

Inspection and Installation Guidelines

Ensure that the depth of the permanent pool is 3 to 6 feet.

Remove trash or debris accumulating in the wetland.

Determine if storm water runoff is providing a sufficient supply of water to maintain a permanent pond.

Mow or irrigate vegetation above the water line as necessary.

Determine if any areas of erosion or inadequate vegetative growth are present on the side slopes, embankment, or emergency spillway.

Ensure that any sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Implement nuisance (odors, weeds, insects, etc.) control if required.

Ensure that structural features and embankments/surrounding edges do not exhibit signs of deterioration, leakage, and/or cracking.

Maintenance Guidelines

Obtain a supplemental water source if necessary.

Reseed, mow, and irrigate vegetation.

Remove trash and debris. Remove sediment every year.

Control nuisance conditions.

Repair and replace earthen and structural components.

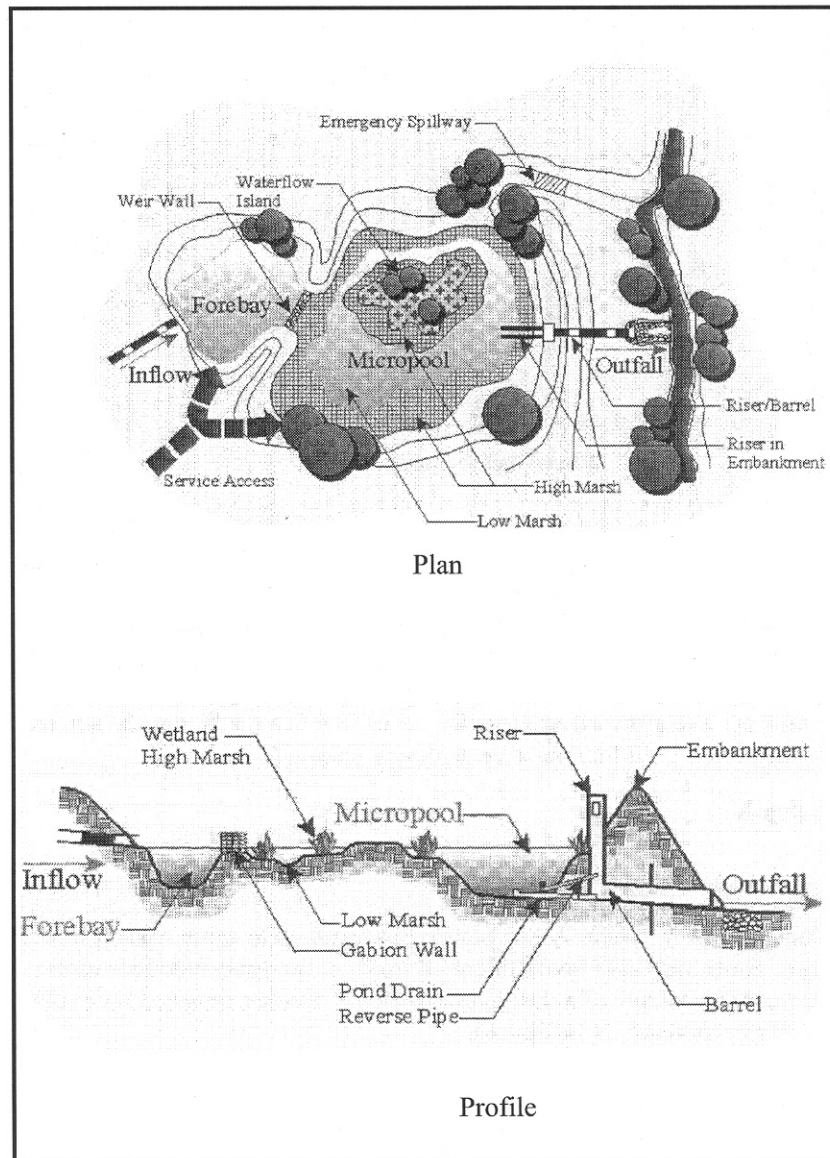


Figure 26. Constructed Wetland—Plan and Profile

WET BASIN

Description

A wet basin is a permanent pond that removes sediments and pollutants from storm water runoff through settling and biological processes. Figure 27 shows the plan and profile of a wet basin.

Inspection and Installation Guidelines

Ensure that the depth of the permanent pool is 3 to 6 feet.

Determine if storm water runoff is providing a sufficient supply of water to maintain a permanent pond.

Determine if vegetation above the water line requires mowing.

Determine if any areas of erosion or inadequate vegetative growth are present on the side slopes, embankment, or emergency spillway.

Remove trash or debris accumulating in the wet basin.

Ensure that any sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Implement nuisance (odors, weeds, insects, etc.) control if required.

Ensure that structural features and embankments/surrounding edges do not exhibit signs of deterioration, leakage, and/or cracking.

Irrigate vegetation initially and as dry conditions require above the water line.

Maintenance Guidelines

Obtain a supplemental water source if necessary.

Reseed, mow, and irrigate vegetation.

Remove trash and debris.

Control nuisance conditions.

Remove sediments every year.

Repair and replace earthen and structural components.

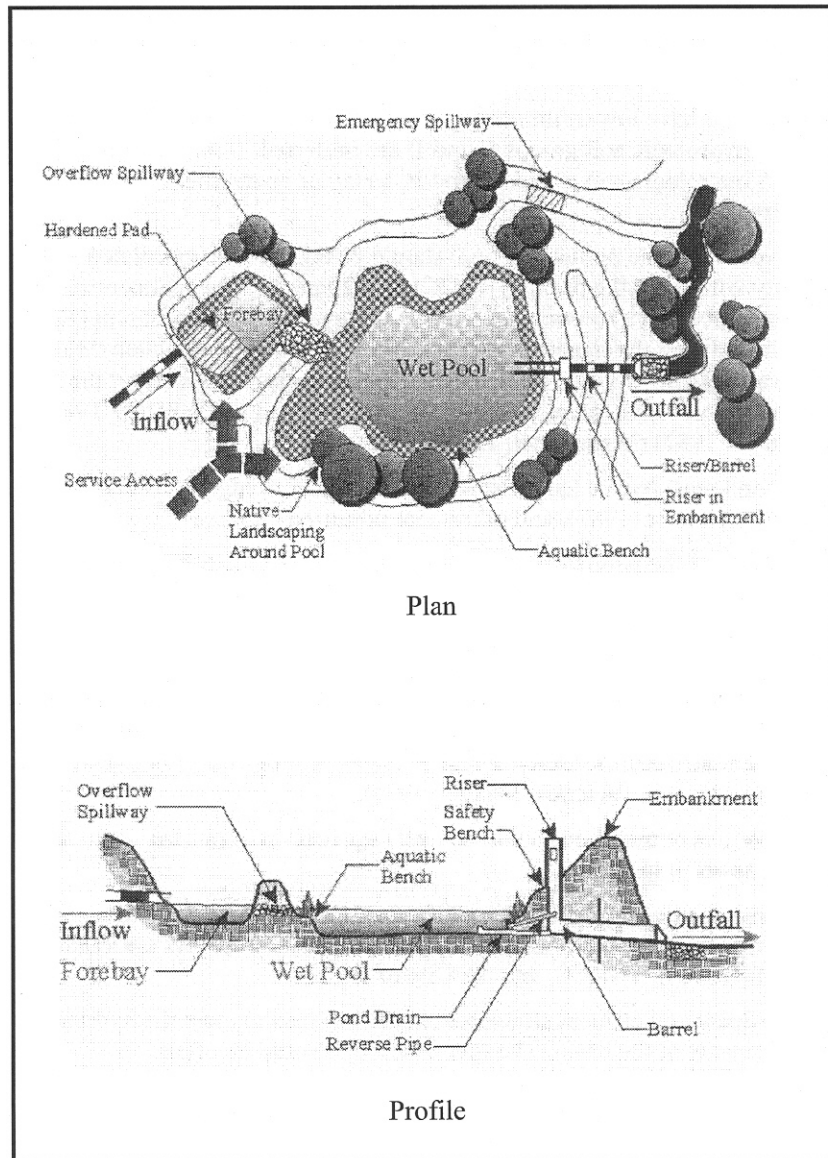


Figure 27. Wet Basin—Plan and Profile

SAND FILTER

Description

A sand filter bed uses sand to remove sediment and pollutants from storm water runoff by filtration. Figure 28 shows the plan and profile of a sand filter.

Inspection and Installation Guidelines

Ensure that the surface of the sand filter bed is level.

Determine if a vegetative cover has been established on the surface of the sand filter bed.

Remove trash or debris accumulating within the sand filter bed.

Remove sediment when it reaches a depth of 6 inches.

Ensure that any sediment removed from sediment basins is being stockpiled or redistributed to an area that is protected from erosion.

Ensure that underground pipe is accessible for cleaning purposes.

Check to see if the sand exhibits discoloration or clogging.

Repair areas that exhibit any signs of damage to structural components (pipes, concrete drainage structures, retaining walls, etc.).

Mow vegetative cover of the filter bed to a height of 4 to 6 inches.

Maintenance Guidelines

Reseed, mow, and irrigate vegetation.

Remove trash, debris, and sediment.

Replace sand every 3 to 5 years.

Repair structural components as necessary.

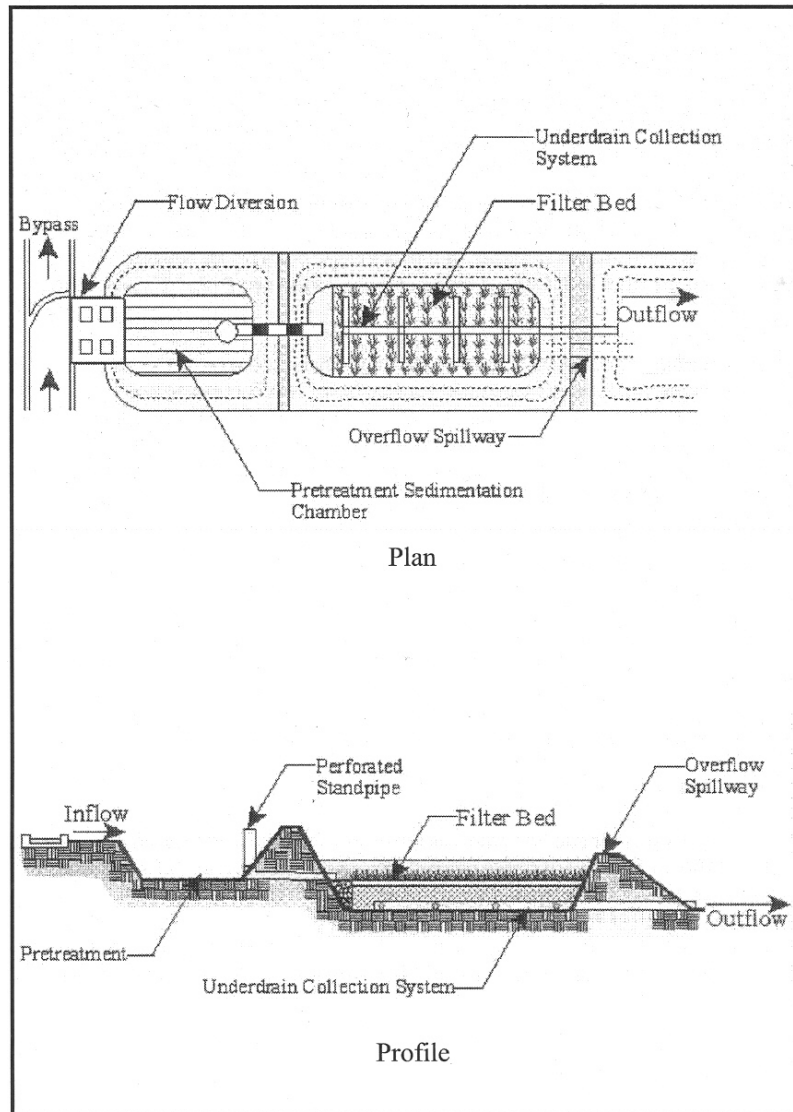


Figure 28. Sand Filter—Plan and Profile

OTHER BEST MANAGEMENT PRACTICES

Good Housekeeping

Construction Wastes

Hazardous Materials

Off-Site Vehicle Tracking

Sanitary Facilities

Spills

GOOD HOUSEKEEPING

Good housekeeping refers to keeping a clean, orderly construction site. Good housekeeping practices are necessary to prevent storm water contamination. Examples of good housekeeping practices include the following:

- Storing chemicals, pesticides, fertilizers, fuels, etc., in a manner that prevents contact with storm water.
- Scheduling regular collection of garbage, rubbish, construction waste, and sanitary waste.
- Cleaning up spills of liquid or dry materials promptly.
- Cleaning up sediments that have been tracked by vehicles onto the site or nearby roadways.
- Controlling the dumping of excess concrete and concrete wastewater on the site.
- Ensuring that stockpiles of material such as fill are located to prevent storm water from transporting off-site.

CONSTRUCTION WASTES

Construction projects tend to generate a variety of excess or unused material. These wastes are sometimes called “construction wastes.” Construction wastes may include, but are not limited to, the following:

- Trees and shrubs removed during clearing and grubbing.
- Packaging materials (wood, paper, plastic, etc.).
- Scrap or surplus building materials (scrap metals, rubber, plastic and glass pieces, masonry products, plywood lumber, etc.).
- Materials resulting from the demolition of structures.

The following steps will help ensure proper disposal of construction waste as well as prevent storm water contamination:

- Select a designated waste collection area on-site.
- Provide an adequate number of containers with lids or covers that can be placed over the container prior to rainfall.
- When possible, place containers in a covered area.
- Arrange for waste collection before containers become full.
- Conduct daily site cleanups so that wastes are properly managed prior to leaving the site.
- Clean up any spills immediately.
- Plan for additional containers and more frequent pickups during the demolition phase of construction.
- Verify that construction waste is collected, removed, and disposed of only at authorized disposal areas.
- Check with the local solid waste management agency for specific guidance.

HAZARDOUS MATERIALS

Many of the materials found at construction sites may be hazardous to the environment or to human health. At a minimum, any products in the categories listed below are considered to be hazardous:

- Paints.
- Acids for cleaning masonry surfaces.
- Cleaning chemicals.
- Asphalt products.
- Chemicals used for soil stabilization.
- Concrete-curing chemicals.
- Fuel products.

The following practices will help ensure proper disposal of hazardous wastes as well as prevent storm water contamination:

- Store materials in a manner that prevents contact with runoff.
- Check with local management authorities to determine the requirements for disposal of hazardous materials.
- Use the entire product before throwing away the container.
- Do not remove the original product label from the container.
- If surplus products are thrown away, avoid mixing products together.
- Follow the manufacturer's recommended method of disposal.

- Contaminated soil is soil that has been in contact with or contains hazardous substances. Contaminated soil may be encountered on-site during earthwork activities or during the cleanup of a spill or leak of a hazardous substance. Material storage areas may also have been contaminated by undetected spills. A state or local solid waste regulatory agency should be contacted for information and procedures necessary to handle contaminated soil. Some landfills may accept contaminated soil; however, laboratory testing may be required prior to a final decision.
- Concrete trucks should not be washed out at the construction site unless sufficient area has been made available to fully capture the wash water. The wash water must be prevented from entering any storm water drainage systems.
- Sandblasting is commonly used to remove paint, dirt, etc., from surfaces. Sandblasting grit, which consists of both the spent sand and the particles of paint and dirt removed from the surface, is hazardous if used to clean old structures on which metal-based paints were used. The grit should not be washed into the storm drain or sanitary sewer.

OFF-SITE VEHICLE TRACKING

Day-to-day practices can have a major impact on storm water contamination because of their potential for generating sediments. A common problem is vehicles leaving the construction site and transporting sediments to off-site roadways. Measures used to minimize off-site vehicle tracking of sediments include the following:

- Building stabilized construction exits and construction roads out of rocks or other material that will not stick to vehicle tires.
- Cleaning paved streets adjacent to the site to remove any excess mud, dirt, or rock tracked from the site.
- Scheduling deliveries or other traffic at a time when personnel are available to provide cleanup if it is required.

SANITARY FACILITIES

Sanitary waste facilities are those facilities used to manage raw sewage at the construction site. The most common facilities are portable facilities that store the sanitary wastes. Other facilities include temporary facilities that employ septic systems for treatment and disposal of sewage, or temporary facilities that release wastes to a sanitary sewer system. Sanitary or septic wastes that are generated on-site should be managed in accordance with state and/or local requirements. To prevent sanitary waste from contacting storm water, the following measures should be implemented:

- Schedule approved waste haulers to regularly remove sanitary and septic wastes and to maintain the facilities in good working order.
- Properly connect the sanitary waste facilities to the sanitary sewer system to prevent releases to the construction site or use appropriate portable facilities.
- Never release or bury untreated, raw sewage waste at the construction site.

SPILLS

Spills are a common source of storm water contamination. Construction site supervisors should create and adopt a spill control plan that includes the following measures:

- Store and handle materials to prevent spills.
 - Seal containers tightly.
 - Make sure all containers are clearly labeled.
 - Stack containers neatly and securely.
- Reduce storm water contact with the spilled material.
 - Post cleanup procedures.
 - Make cleanup materials readily available.
 - Capture the spilled liquid.
 - Stop the source of the spill.
 - Cover spills with absorbent material such as kitty litter or sawdust.
- Dispose of contaminated materials according to manufacturer's instructions or according to state and/or local requirements.
- Identify personnel responsible for responding to a spill of toxic or hazardous materials.
 - Provide personnel with spill response training.
 - Post the names of spill response personnel.
- Keep the spill well ventilated.
- If necessary, use a private firm that specializes in spill cleanup.

**TXDOT SPECIFICATIONS
AND DRAWINGS**

TXDOT SPECIFICATIONS AND DRAWINGS

TxDOT maintains an active database of specifications and drawings for all TxDOT-related construction work. Some of these specifications and drawings are specific to erosion and sediment control measures. The following table presents specifications and drawings listed in TxDOT's *Storm Water Management Guidelines for Construction Activities* (2003).

Special Specification	Title	Standard Drawing
5004	Temporary Erosion, Sedimentation, and Water Pollution Prevention and Control	EC(1)-93
5005	Rock Filter Dams for Erosion and Sedimentation Control	EC(2)-93
5006	Temporary Pipe Slope Drains for Erosion and Sedimentation Control	EC(7)-93
5007	Baled Hay for Erosion and Sedimentation Control	EC(1)-93
5008	Temporary Paved Flumes for Erosion and Sedimentation Control	EC(8)-93
5010	Construction Exits	EC(3)-93
5012	Earthwork for Erosion Control	EC(4)-93 EC(5)-93 EC(6)-93
5013	Construction Perimeter Fence	
5014	Gabions and Gabion Mattresses	
5145	Sandbags for Erosion Control	
5249	Temporary Sediment Control Fence	EC(1)-93

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