

# Storm Water Quality Handbooks

Project Planning and Design Guide

Storm Water Pollution Prevention Plan (SWPPP)  
and Water Pollution Control Program (WPCP) Preparation Manual

**Construction Site  
Best Management Practices (BMPs) Manual**



*Caltrans*

**State of California  
Department of Transportation**

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# Section 1

## Construction Site

### Best Management Practices

#### 1.1 Introduction

On July 15, 1999, the State Water Resources Control Board (SWRCB) issued the “*National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)*” (Order No. 99-06-DWQ, NPDES No. CAS000003) hereby called “Permit”. The Permit regulates storm water discharges from Caltrans properties, facilities and activities, and requires that Caltrans’ construction program comply with the requirements of the “*NPDES General Permit, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity*” (Order No. 99-08-DWQ, NPDES No. CAS000002) (General Permit) issued by the SWRCB, to regulate discharges from construction sites that disturb 5 acres or more. Beginning March 10, 2003, U.S. Environmental Protection Agency (EPA) and SWRCB regulations will regulate discharges from projects with soil disturbance of 1 acre or more by amending the General Permit and thus including coverage of projects with soil disturbance of 1 acre or more. SWRCB Resolution No. 2001-46 modified provisions of the General Permit that require permittees to implement specific water quality sampling and analytical procedures implemented on a construction site.

#### 1.2 Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP)

Caltrans requires contractors to prepare and implement a program to control water pollution effectively during the construction of all projects (see Standard Specification Section 7-1.01G Water Pollution). Projects resulting in 0.4 hectares (ha) [1 ac] or more of soil disturbance are subject to the General Permit. Caltrans Special Provisions require that for larger projects, defined as those resulting in 0.4 ha (1 ac) or more of soil disturbance, Contractors prepare and submit a Storm Water Pollution Prevention Plan (SWPPP). When a SWPPP is required for a project, it will satisfy the requirements of Standard Specification Section 7-1.01G, in addition to meeting other permit requirements.

Caltrans requires that a Water Pollution Control Program (WPCP) addressing control measures be prepared and implemented by the construction contractor for projects resulting in soil disturbance of less than 0.4 ha (1ac). For detailed step-by-step procedures, instructions and templates to prepare a SWPPP or a WPCP, refer to the Caltrans *Storm Water Quality Handbooks, Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual*.



If two (2) or more small projects [less than 0.4 ha (1 ac) of soil disturbance] in the same corridor are part of a larger common plan of development [0.4 ha (1 ac) or more], then these small projects are also subject to the requirements of the General Permit to develop and implement a SWPPP.

### 1.3 Organization of this Manual

This *Storm Water Quality Handbooks, Construction Site Best Management Practices Manual* (manual) is intended to provide Contractors and Caltrans staff with detailed information of construction site BMPs. This Manual is organized as follows:

- Section 1 provides an introduction to the Construction Site Best Management Practices (BMPs) Manual.
- Section 2 provides instructions for the selection and implementation of construction site BMPs.
- Section 3 provides listing and working details for Caltrans construction site BMPs for Temporary Soil Stabilization.
- Section 4 provides listing and working details for Caltrans construction site BMPs for Temporary Sediment Control.
- Section 5 provides listing and working details for Caltrans construction site BMPs for Wind Erosion Control.
- Section 6 provides listing and working details for Caltrans construction site BMPs for Tracking Control.
- Section 7 provides listing and working details for Caltrans construction site BMPs for Non-Storm Water Management.
- Section 8 provides listing and working details for Caltrans construction site BMPs for Waste Management and Materials Pollution Control.
- Appendix A provides a listing of frequently used abbreviations, acronyms, and definitions of terms used throughout this Manual.
- Appendix B provides guidance on the selection of temporary soil stabilization controls.

### 1.4 Caltrans Construction Site BMPs

This section lists those BMPs considered during the construction of Caltrans projects. Construction site BMPs (also called temporary control practices) are best conventional technology/best available technology (BCT/BAT)-based BMPs that are consistent with the BMPs and control practices required under the General Permit. Caltrans construction site BMPs are divided into six categories (see Table 1-1):





### **1.4.1 Approved Construction Site BMPs for Statewide Use**

Approved construction site BMPs are BMPs that have been approved by Caltrans Deputy Directors or Program Managers for statewide implementation. Implementation is dependent on conditions/applicability of deployment described as part of the BMP. These BMPs are typically implemented in all Caltrans construction projects; they include practices for soil stabilization, sediment control, wind erosion control, tracking control, non-storm water management and waste management. Some of the approved construction site BMPs have been designated as “minimum requirements”; these BMPs will be implemented in all highway construction projects statewide when they are applicable to a project.

### **1.4.2 Approved Construction Site BMPs for Use on a Project-by-Project Basis**

These are other construction site BMPs have not been approved for statewide use by the Statewide Storm Water Management Plan (SWMP), but may be implemented, on a project-by-project basis, in addition to required approved BMPs and when determined necessary and feasible by the Resident Engineer (RE). Caltrans may, on a project-by-project basis, specify or require Contractors to implement some of these construction site BMPs. Additionally, Caltrans will consider a Contractor’s recommendation to implement some of these construction site BMPs on a project, subject to headquarters approval.

Construction site BMPs within each of these categories are described in Sections 3 through 8 of this Manual. Table 1-1 lists the construction site BMPs. It is important to note that some BMPs were grouped to show that a combination of those BMPs will enhance protection over the use of only one BMP.

**TABLE 1-1**

<b>CONSTRUCTION SITE BMPs</b>				
<b>ID</b>	<b>BMP NAME</b>	<b>APPROVED FOR STATEWIDE USE ON ALL PROJECTS <sup>(1)</sup></b>	<b>APPROVED FOR USE ON A PROJECT-BY-PROJECT BASIS</b>	<b>MINIMUM REQUIREMENT</b>
<b>TEMPORARY SOIL STABILIZATION</b>				
SS-1	Scheduling	X		✓
SS-2	Preservation of Existing Vegetation	X		✓
SS-3	Hydraulic Mulch	X		✓ <sup>(2)</sup>
SS-4	Hydroseeding	X		✓ <sup>(2)</sup>
SS-5	Soil Binders	X		✓ <sup>(2)</sup>
SS-6	Straw Mulch	X		✓ <sup>(2)</sup>
SS-7	Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats	X		✓ <sup>(2)</sup>
SS-8	Wood Mulching	X		
SS-9	Earth Dikes/Drainage Swales & Lined Ditches		X	
SS-10	Outlet Protection/Velocity Dissipation Devices		X	
SS-11	Slope Drains		X	
SS-12	Streambank Stabilization	X		
<b>TEMPORARY SEDIMENT CONTROL</b>				
SC-1	Silt Fence	X		✓ <sup>(3)</sup>
SC-2	Sediment/Desilting Basin		X	
SC-3	Sediment Trap		X	
SC-4	Check Dam		X	
SC-5	Fiber Rolls		X	✓ <sup>(3)</sup>
SC-6	Gravel Bag Berm		X	
SC-7	Street Sweeping and Vacuuming	X		✓
SC-8	Sandbag Barrier		X	
SC-9	Straw Bale Barrier		X	
SC-10	Storm Drain Inlet Protection		X	✓
<b>WIND EROSION CONTROL</b>				
WE-1	Wind Erosion Control	X		✓
<b>TRACKING CONTROL</b>				
TC-1	Stabilized Construction Entrance/Exit		X	
TC-2	Stabilized Construction Roadway		X	
TC-3	Entrance/Outlet Tire Wash		X	

<sup>(1)</sup> Implementation depends on applicability to a project

<sup>(2)</sup> The Contractor shall select one of the five measures listed or a combination thereof to achieve and maintain the contract's rainy season disturbed soil area (DSA) requirements

<sup>(3)</sup> The Contractor shall select one of the two measures listed or a combination thereof to achieve and maintain the contract's rainy season disturbed soil area (DSA) requirements"



**TABLE 1-1**

<b>CONSTRUCTION SITE BMPs</b>				
<b>ID</b>	<b>BMP NAME</b>	<b>APPROVED FOR STATEWIDE USE ON ALL PROJECTS <sup>(1)</sup></b>	<b>APPROVED FOR USE ON A PROJECT-BY-PROJECT BASIS</b>	<b>MINIMUM REQUIREMENT</b>
<b>NON-STORM WATER MANAGEMENT</b>				
NS-1	Water Conservation Practices	X		
NS-2	Dewatering Operations	X		
NS-3	Paving and Grinding Operations	X		
NS-4	Temporary Stream Crossing	X		
NS-5	Clear Water Diversion	X		
NS-6	Illicit Connection/Illegal Discharge Detection and Reporting	X		✓
NS-7	Potable Water/Irrigation	X		
NS-8	Vehicle and Equipment Cleaning	X		✓
NS-9	Vehicle and Equipment Fueling	X		✓
NS-10	Vehicle and Equipment Maintenance	X		✓
NS-11	Pile Driving Operations	X		
NS-12	Concrete Curing	X		
NS-13	Material and Equipment Use Over Water	X		
NS-14	Concrete Finishing	X		
NS-15	Structure Demolition/Removal Over or Adjacent to Water	X		
<b>WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL</b>				
WM-1	Material Delivery and Storage	X		✓
WM-2	Material Use	X		✓
WM-3	Stockpile Management	X		✓
WM-4	Spill Prevention and Control	X		✓
WM-5	Solid Waste Management	X		✓
WM-6	Hazardous Waste Management	X		
WM-7	Contaminated Soil Management	X		
WM-8	Concrete Waste Management	X		
WM-9	Sanitary/Septic Waste Management	X		✓
WM-10	Liquid Waste Management	X		

<sup>(1)</sup> Implementation depends on applicability to a project

<sup>(2)</sup> The Contractor shall select one of the five measures listed or a combination thereof to achieve and maintain the contract's rainy season disturbed soil area (DSA) requirements

<sup>(3)</sup> The Contractor shall select one of the two measures listed or a combination thereof to achieve and maintain the contract's rainy season disturbed soil area (DSA) requirements"



# Section 2

## Selecting and Implementing Construction Site Best Management Practices

This section provides instructions for the selection and implementation of construction site best management practices (BMPs). It is important to note that the requirements of this Section are Caltrans minimum requirements, and that Caltrans Districts may impose more stringent requirements on a project-by-project basis, and that the Contractor implements additional construction site BMPs if deemed necessary. Changes in field implementation of construction site BMPs require written approval of the Resident Engineer (RE). Any additional requirements will be included in the project's Standard Special Provisions (SSPs). Working details of construction site BMPs are presented in Sections 3 through 8 of this Manual.

### 2.1 Definitions

#### 2.1.1 Disturbed Soil Area (DSA)

Disturbed soil areas (DSAs) are areas of exposed, erodible soil that are within the construction limits and that result from construction activities. The following are not considered DSAs:

- Areas where soil stabilization, erosion control, highway planting, or slope protection are applied and associated drainage facilities are in place and functional.
- Roadways, construction roads, access roads or contractor's yards that have been stabilized by the placement of compacted subbase or base material or paved surfacing.
- Areas where construction has been completed in conformance with the contract plans and permanent erosion control is in place and functional.

Erosion control is considered functional when a uniform vegetative cover equivalent to 70 percent of the native background vegetation coverage has been established or equivalent stabilization measures have been employed.

#### 2.1.2 Active Areas and Non-Active Areas

*Active Areas* are construction areas where soil-disturbing activities have already occurred and continue to occur or will occur during the ensuing 21 days.

*Non-Active Areas* are construction areas (formerly active areas) that will be idle for at least 21 days.

The RE will conduct a review of the existing active areas on a regular basis to determine if a non-active status should be applied to some DSAs.



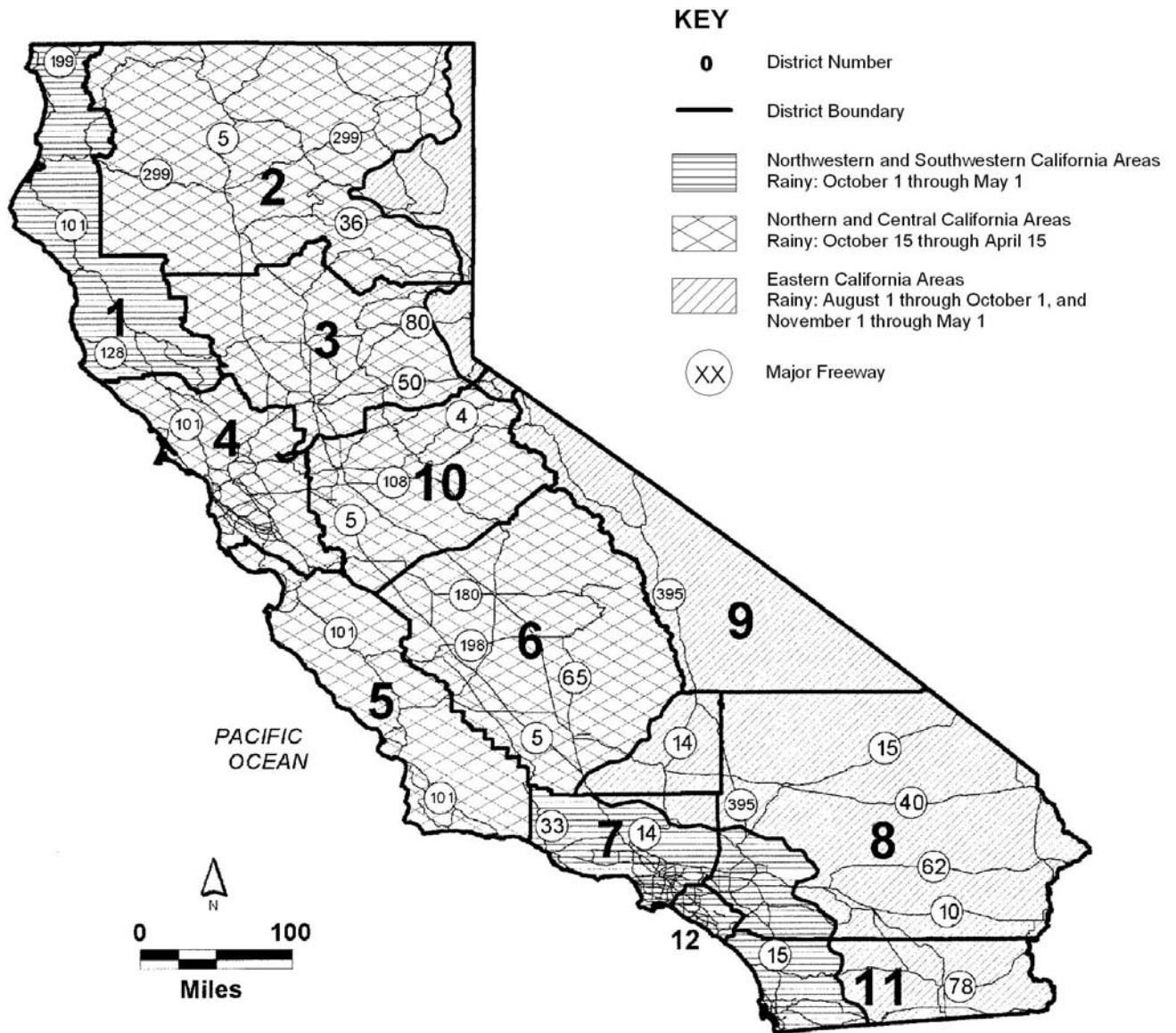
### **2.1.3 Slope Length and Benches**

*Slope length* is measured or calculated along the continuous inclined surface. Each discrete slope is between one of the following: top to toe, top to bench, bench to bench, and bench to toe.

*Benches* are drainage facilities that intercept surface flow and convey the resulting concentrated flow away from a slope. For the purpose of determining slope lengths, fiber rolls or other appropriate BMPs (used for temporary sediment control) can be considered equivalent to a bench.

### **2.1.4 Rainy Season**

The average rainfall in California varies greatly from region to region. To account for the various rainfall patterns (time frame, intensities, and amounts) the state is separated into several rainy seasons. Shown in Figure 2-1 is a map identifying the rainy seasons throughout the state. These rainy seasons are used to identify the appropriate level of soil stabilization and sediment control protection.



**Figure 2-1**  
**DESIGNATION OF RAINY SEASONS**

## **2.2 Temporary Soil Stabilization and Sediment Control Implementation Guidance**

Storm water pollution control requirements are intended to be implemented on a year-round basis at an appropriate level. The requirements must be implemented in a proactive manner during all seasons while construction is ongoing. California has varied rainfall patterns throughout the state; therefore, the appropriate level of BMP implementation will also vary throughout the state. The temporary sediment controls and soil stabilization specified in this section are based on rainfall patterns (time frames, intensities, and amounts), general soil types, the seasons, slope inclinations and slope lengths. Appropriate water pollution control includes the implementation of an effective combination of both soil stabilization and sediment controls.

This section describes both general principles and specific guidance for selecting and implementing temporary soil stabilization and sediment control BMPs. Sections 2.2.1, 2.2.2, and 2.2.3 provide key principles for preventing erosion on construction sites. Sections 2.2.4 and 2.2.5 provide the specific guidance for selecting and implementing temporary soil stabilization and sediment control BMPs to manage disturbed soil areas. It is important to note that the Districts may require implementation of additional construction site BMPs if deemed necessary.

### **2.2.1 Scheduling**

Construction scheduling shall consider the amount and duration of soil exposed to erosion by wind, rainfall, runoff, and vehicle tracking and seek to minimize disturbed soil area during the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with the installation and maintenance of soil stabilization and sediment control BMPs. See BMP SS-1, Scheduling, in this Manual for BMP details.

### **2.2.2 Preservation of Existing Vegetation**

Preserving existing vegetation to the maximum extent possible and for as long as possible on a construction site reduces or eliminates erosion in those areas. To facilitate this practice, on a year-round basis temporary fencing shall be provided prior to commencement of clearing and grubbing operations or other soil-disturbing activities in areas where no construction activity is planned or construction will occur at a later date. See BMP SS-2, Preservation of Existing Vegetation, for BMP details.

### **2.2.3 Storm Water Run-on and Concentrated Flows**

The diversion of storm water run-on and conveyance of concentrated flows must be considered in determining the appropriateness of the BMPs chosen. BMPs to divert or manage concentrated flows in a non-erodible fashion may be required on a project-by-project basis to divert off-site drainage through or around the construction site or to properly manage construction site storm water runoff. See BMPs SS-9, Earth Dikes, Drainage Swales and Lined Ditches; SS-10, Outlet Protection/ Velocity Dissipation Devices; and SS-11, Slope Drains, for BMP details.

## 2.2.4 Disturbed Soil Area Management

The DSA management guidelines are based on rainfall patterns (time frames, intensities, and amounts), general soil types, the seasons, slope inclinations, and slope lengths. All of these factors are considered in developing the appropriate levels of soil stabilization and sediment control, and will be considered by the RE when directing specific site-by-site actions.

### 2.2.4.1 Disturbed Soil Area Size Limitations

Limiting the amount of disturbed soil is a critical component in conducting an effective storm water management program; contract special provisions may specify limits of disturbed soil area. Standard Specifications Section 7-1.01G, Water Pollution states *“Unless otherwise approved by the Engineer in writing, the Contractor shall not expose a total area of erodible earth, which may cause water pollution, exceeding 70,000 m<sup>2</sup> for each separate location, operation or spread of equipment before either temporary or permanent erosion control measures are accomplished”*. The RE has the option of increasing the size of disturbed soil areas beyond 70,000 square meters (17 acres) if appropriate control practices and an implementation plan are included in an approved SWPPP.

Furthermore, District design teams may elect to further restrict the size of the project’s total disturbed soil area to 2 hectares (5 acres) during the rainy season. The RE has the option of increasing the limit of the total disturbed soil area during the rainy season beyond 5 acres if appropriate control practices and an implementation plan are included in an approved SWPPP.

## 2.2.5 DSA Protection by Temporary Soil Stabilization and Temporary Sediment Controls

To account for rainfall patterns (time frames, intensities, and amounts) and to a lesser extent general soil type differences, the state has been divided into seven areas requiring common protection requirements. These rainfall areas are described in Table 2-1. The specific temporary soil stabilization and sediment control practices for DSA protection in each area are determined from Tables 2-2 and 2-3 (for non-active disturbed soil areas and active disturbed soil areas, respectively). Based on consultation with experts, the slope length and slope inclination are seen as the most important criteria for soil stabilization and sediment control requirements, as these factors have the largest potential impact on the erosion rate. As indicated on these tables, the temporary soil stabilization and sediment controls at a construction site will increase with increasing slope length and slope inclination combination.

DSAs shall be protected as follows:

- Temporary control practices (as required in Table 2-2) shall be performed on non-active DSAs within 14 days from the cessation of soil-disturbing activities or one day prior to the onset of precipitation, whichever occurs first.
- Temporary control practices for active DSAs (as required in Table 2-3) shall be performed prior to the onset of precipitation and throughout each day for which precipitation is forecasted.



- For non-active DSAs, limit the erosive effects of storm water flow on slopes by implementing BMPs such as fiber rolls to break up the slope lengths as follows:
  - Slope inclination 1:4 (V:H) and flatter: BMPs shall be placed on slopes at intervals no greater than 6 m.
  - Slope inclination between 1:4 (V:H) and 1:2 (V:H): BMPs shall be placed on slopes at intervals no greater than 4.5 m.
  - Slope inclination 1:2 (V:H) or greater: BMPs shall be placed on slopes at intervals no greater than 3 m.
- For non-active DSAs, permanent erosion control shall be applied to areas deemed complete during the project's defined seeding window.
- Provide construction site BMPs in addition to those specified in Tables 2-2 and 2-3 to convey concentrated flows in a non-erodible fashion.

### **2.2.6 Procedures for Rainfall Area 7**

For construction sites within Rainfall Area 7 (District 8 within the Colorado River Basin RWQCB jurisdictions, District 9 and District 11 within the Colorado River Basin RWQCB jurisdiction), the soil stabilization and control practices required for the construction site will be determined by the applicable RWQCB on a site-by-site basis. The following procedure shall be used to notify the applicable RWQCB for construction sites in Rainfall Area 7:

- Caltrans will notify the applicable RWQCB staff of construction sites in these areas at least 30 days prior to the start of construction.
- During the 30-day notification period, the RWQCB staff may request to review the SWPPP or meet with Caltrans to discuss the construction project.
- Within the 30-day notification period, the RWQCB may respond with specific soil stabilization and sediment control practices required for the site. If the RWQCB does not respond within the 30-day review period, then Caltrans can proceed with its construction activities as scheduled.
- Regardless of the RWQCB action, the RWQCB may inspect the site and take enforcement actions, if necessary, pending inspection findings.

For construction sites within Rainfall Area 7 (District 6, 7, and 8 within the Lahontan RWQCB jurisdiction) and within one mile of the Mojave or Amargosa River and their tributaries that are within one mile of these waterways, soil stabilization and sediment control measures must be implemented as specified for Area 4. All equipment must also be removed from waterways prior to any flash floods. All other projects located in the Lahontan RWQCB are not required to implement soil stabilization and sediment control measures.

**Table 2-1**

<b>AREA DEFINITIONS</b>		
<b>AREA</b>	<b>Applicability</b>	<b>Elevation</b>
1	<b>District 1</b> in the following areas: all of Del Norte and Humboldt Counties within 20 miles of the coast in Mendocino County	≤1200m
2	<b>District 1</b> (except within Area 1) <b>District 2</b> within the North Coast, Lahontan, and Central Valley RWQCB jurisdictions <b>Districts 3, 4 and 5</b> <b>District 10</b> within the Lahontan RWQCB jurisdiction	<250m
3	<b>District 1</b> (except within Area 1) <b>District 2</b> within the North Coast, Lahontan, and Central Valley RWQCB jurisdictions <b>Districts 3, 4 and 5</b> <b>District 10</b> within the Lahontan RWQCB jurisdiction	250m – 1200m
4	<b>District 6</b> within the Central Valley RWQCB jurisdiction <b>District 7</b> within the Central Coast, Los Angeles, and Central Valley RWQCB jurisdictions <b>District 8</b> within the Santa Ana and San Diego RWQCB jurisdictions <b>District 10</b> (except for the Lahontan RWQCB jurisdiction) <b>District 11</b> within the San Diego RWQCB jurisdiction <b>District 12</b>	<500m
5	<b>District 6</b> within the Central Valley RWQCB jurisdiction <b>District 7</b> within the Central Coast, Los Angeles, and Central Valley RWQCB jurisdictions <b>District 8</b> within the Santa Ana and San Diego RWQCB jurisdictions <b>District 10</b> (except for the Lahontan RWQCB jurisdiction) <b>District 11</b> within the San Diego RWQCB jurisdiction <b>District 12</b>	500m – 1200m
6	<b>Statewide</b>	>1200m
7	<b>District 6</b> within the Lahontan RWQCB jurisdiction <b>District 7</b> within the Lahontan RWQCB jurisdiction <b>District 8</b> within the Lahontan and Colorado River Basin RWQCB jurisdictions <b>District 9</b> <b>District 11</b> within the Colorado River Basin RWQCB jurisdiction	≤1200m

**Table 2-2**

REQUIRED COMBINATION OF TEMPORARY SOIL STABILIZATION AND TEMPORARY SEDIMENT CONTROLS AND BARRIERS <sup>(6)</sup> <sup>(7)</sup>						
NON-ACTIVE DISTURBED SOIL AREAS						
SEASON	AREA(S)	TEMPORARY BMP	SLOPE (V:H) <sup>(1)</sup>			
			≤ 1:20	> 1:20 ≤ 1:4	> 1:4 ≤ 1:2	> 1:2
RAINY <sup>(2)</sup>	1 & 6	SOIL STABILIZATION <sup>(5)</sup>	X	X	X	X
		SEDIMENT BARRIER <sup>(5)</sup>	X	X	X	X
		DESILTING BASIN <sup>(3)</sup>		X	X	X
	2, 3, 4 & 5	SOIL STABILIZATION <sup>(5)</sup>	X	X	X	X
		SEDIMENT BARRIER		X	X	X
		DESILTING BASIN				
	7	SOIL STABILIZATION AND SEDIMENT CONTROL PRACTICES TO BE DETERMINED BY APPLICABLE RWQCB <sup>(8)</sup>				
NON-RAINY	1	SOIL STABILIZATION <sup>(5)</sup>	X <sup>(4)</sup>	X <sup>(4)</sup>	X	X
		SEDIMENT BARRIER		X <sup>(4)</sup>	X	X
		DESILTING BASIN				
	2 & 4	SOIL STABILIZATION				
		SEDIMENT BARRIER				
		DESILTING BASIN				
	3 & 5	SOIL STABILIZATION				
		SEDIMENT BARRIER				X <sup>(4)</sup>
		DESILTING BASIN				
	6	SOIL STABILIZATION <sup>(5)</sup>	X <sup>(4)</sup>	X <sup>(4)</sup>	X	X
		SEDIMENT BARRIER		X <sup>(4)</sup>	X	X
		DESILTING BASIN <sup>(3)</sup>				X
	7	SOIL STABILIZATION AND SEDIMENT CONTROL PRACTICES TO BE DETERMINED BY APPLICABLE RWQCB <sup>(8)</sup>				

- (1) Unless otherwise noted, the temporary BMP is required for the slope inclinations indicated on slope lengths greater than 3 meters.
- (2) The maximum slope length is 30 meters for slope inclinations between 1:20 (V:H) and 1:2 (V:H) and 15 meters for steeper slopes.
- (3) Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such as available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.
- (4) Implementation of controls not required except at least 24 hours prior to all predicted rain events.
- (5) The indicated temporary BMP is required on all slope lengths.
- (6) Sediment controls and barriers include all temporary sediment control construction BMPs identified in the Statewide Storm Water Quality Practice Guidelines associated with the SWMP and Section 4 of these guidelines. Linear barrier systems are equivalent to what are referred to in the General Construction Permit as perimeter controls. The intent is prevent the transport of sediment at the downslope edge of disturbed soil areas.
- (7) Permanent erosion control seeding shall be applied to all non-active areas deemed substantially complete during the project's defined seeding window.
- (8) Refer to Section 2.2.6 for procedure.



**Table 2-3**

<b>REQUIRED COMBINATION OF TEMPORARY SOIL STABILIZATION AND TEMPORARY SEDIMENT CONTROLS AND BARRIERS <sup>(6)</sup></b>					
<b>ACTIVE DISTURBED SOIL AREAS <sup>(3)</sup></b>					
SEASON	AREA(S)	TEMPORARY BMP	SLOPE (V:H) <sup>(1)</sup>		
			≤ 1:20	> 1:20 ≤ 1:2	> 1:2
RAINY	1 & 6	SOIL STABILIZATION		X	X
		SEDIMENT BARRIER <sup>(4)</sup>	X	X	X
		DESILTING BASIN <sup>(2)</sup>		X	X
	2, 4 & 5	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN <sup>(2)</sup>			X
	3	SOIL STABILIZATION			X <sup>(5)</sup>
		SEDIMENT BARRIER		X	X
		DESILTING BASIN <sup>(2)</sup>			X
	7	SOIL STABILIZATION AND SEDIMENT CONTROL PRACTICES TO BE DETERMINED BY APPLICABLE RWQCB <sup>(7)</sup>			
NON-RAINY	1	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN <sup>(2)</sup>			X
	2, 3, 4 & 5	SOIL STABILIZATION			
		SEDIMENT BARRIER			
		DESILTING BASIN			
	6	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN <sup>(2)</sup>			X
	7	SOIL STABILIZATION AND SEDIMENT CONTROL PRACTICES TO BE DETERMINED BY APPLICABLE RWQCB <sup>(7)</sup>			

- (1) Unless otherwise noted, the BMP is required for the slope inclinations indicated on slope lengths greater than 3 meters.
- (2) Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such as available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.
- (3) Implementation of soil stabilization controls are not required except prior to predicted rain.
- (4) The indicated temporary BMP required on all slope lengths.
- (5) The indicated temporary BMP required on slope lengths greater than 15 meters.
- (6) Sediment controls and barriers include all temporary sediment control construction BMPs identified in the Statewide Storm Water Quality Practice Guidelines associated with the SWMP and Section 4 of these Guidelines. Linear barrier systems are equivalent to what are referred to in the General Construction Permit as perimeter controls. The intent is to provide a barrier to prevent the transport of sediment at the downslope edge of disturbed soil areas.
- (7) Refer to Section 2.2.6 for procedures.



## **2.2.7 Basins**

The practices described herein are typical of those that will be implemented on a project-by-project basis. However, it is important to note that there will be instances where project and site conditions require deviation from the BMPs and the descriptions provided in this manual. For instance, the proposed implementation of sediment/desilting basins (see BMP SC-2, “Sediment/Desilting Basin”) is a new commitment that has not been incorporated into existing designs. In addition, the nature of linear projects and constrained rights-of-way inherent to Caltrans work may prohibit the use of sediment/desilting basins at some locations on certain projects and on some projects altogether. Implementation of sediment/desilting basins will be considered on a project-by-project basis. Caltrans is committed to refining the sediment/desilting basin implementation criteria during the term of the Permit while implementing the sediment/desilting basins on projects as practicable.

## **2.2.8 Stockpile Management**

Soil stabilization and sediment control requirements as they apply to stockpiles of various materials are presented in BMP WM-3, Stockpile Management, in Section 8 of this Manual.

## **2.3 Guidance for Implementation of Other BMPs**

### **2.3.1 Mobile Operations**

Mobile operations common to the construction of a project include asphalt recycling, concrete mixing, crushing and the storage of materials. BMPs shall be implemented year-round, as appropriate, to control the individual situations these mobile operations can create.

### **2.3.2 Wind Erosion Controls**

Wind erosion controls shall be considered year-round for all disturbed soils on the project site that are subject to wind erosion and when significant wind and dry conditions are anticipated during construction of the project. See BMP WE-1, Wind Erosion, for BMP details.

### **2.3.3 Tracking Controls**

Tracking controls shall be implemented year-round, as needed, to reduce the tracking of sediment and debris from the construction site. At a minimum, entrances and exits shall be inspected daily, and controls implemented as needed. See Section 6 of this Manual for BMP details.

### **2.3.4 Non-Storm Water and Waste Management and Materials Pollution Controls**

The objective of the non-storm water and waste management and materials pollution controls is to reduce the discharge of materials other than storm water to the storm water drainage system or to receiving waters. These controls shall be implemented year-round for all applicable activities, material usage, and site conditions. Sections 7 and 8 of this Manual provide guidance on implementation of BMPs related to the specific activity being conducted.



## 2.4 BMP Inspections

The BMPs deployed on construction sites will be inspected on a frequency as described below. Improperly installed or damaged practices shall be corrected immediately, or by a later date and time if requested by the Contractor and approved by the Resident Engineer (RE) in writing, but not later than the onset of forecasted rain events. Inspections of construction site BMPs are conducted as follows:

- Prior to a forecast storm.
- After a rain event that causes runoff from the construction site.
- At 24-hour intervals during extended rain events.
- As specified in the project Special Provisions and/or SWPPP.
- Every two weeks during the non-rainy season.
- Weekly during the rainy season.
- Or as directed by BMP Inspection Requirements or the Resident Engineer (RE).

# Section 3

## Temporary Soil Stabilization Best Management Practices

### 3.1 Temporary Soil Stabilization

Temporary soil stabilization consists of preparing the soil surface and applying one of the best management practices (BMPs) shown in Table 3-1, or combination thereof, to disturbed soil areas. Temporary soil stabilization shall be applied to disturbed soil areas of construction projects in conformance with the criteria presented in Section 2, Selecting and Implementing Construction Site BMPs, of this Manual. Refer to Appendix B for additional guidance on the selection of temporary soil stabilization controls.

#### 3.1.1 Temporary Concentrated Flow Conveyance Controls

Temporary concentrated flow conveyance controls consist of a system of measures or BMPs that are used alone or in combination to intercept, divert, convey and discharge concentrated flows with a minimum of soil erosion, both on-site and downstream (off-site). Temporary concentrated flow conveyance controls may be required to direct run-on around or through the project in a non-erodible fashion. Temporary concentrated flow conveyance controls include the following BMPs:

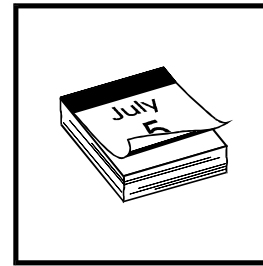
- Earth Dikes/Drainage Swales & Lined Ditches
- Outlet Protection/Velocity Dissipation Devices
- Slope Drains

**Table 3-1**

<b>TEMPORARY SOIL STABILIZATION BMPs</b>	
<b>ID</b>	<b>BMP NAME</b>
SS-1	Scheduling
SS-2	Preservation of Existing Vegetation
SS-3	Hydraulic Mulch
SS-4	Hydroseeding
SS-5	Soil Binders
SS-6	Straw Mulch
SS-7	Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats
SS-8	Wood Mulching
<b><i>Temporary Concentrated Flow Conveyance Controls</i></b>	
SS-9	Earth Dikes/Drainage Swales & Lined Ditches
SS-10	Outlet Protection/Velocity Dissipation Devices
SS-11	Slope Drains
SS-12	Streambank Stabilization

The remainder of this Section shows the working details for each of the temporary soil stabilization BMPs.





**Standard Symbol**

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

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

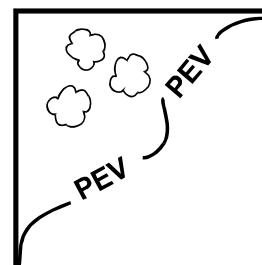
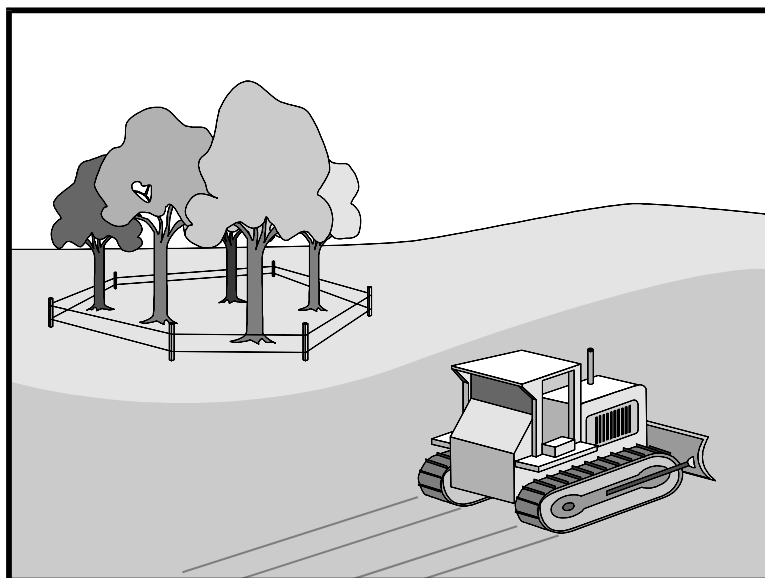
**Appropriate Applications** Construction sequencing shall be scheduled to minimize land disturbance for all projects during the rainy and non-rainy season. Appropriate BMPs shall be implemented during both rainy and non-rainy seasons.

**Limitations** None identified.

- Standards and Specifications**
- Developing a schedule and planning the project are the very first steps in an effective storm water program. The schedule shall clearly show how the rainy season relates to soil-disturbing and re-stabilization activities. The construction schedule shall be incorporated into the SWPPP or WPCP.
  - The schedule shall include detail on the rainy season implementation and deployment of:
    - Temporary soil stabilization BMPs.
    - Temporary sediment control BMPs.
    - Tracking control BMPs.
    - Wind erosion control BMPs.

- Non-storm water BMPs.
- Waste management and materials pollution control BMPs.
- Schedule shall also include dates for significant long-term operations or activities that may have planned non-storm water discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, bridge cleaning, etc.
- Schedule work to minimize soil disturbing activities during the rainy season.
- Develop the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, pouring foundations, installing utilities, etc., to minimize the active construction area during the rainy season.
- Schedule major grading operations for the non-rainy season when practical.
- Stabilize non-active areas within 14 days from the cessation of soil-disturbing activities or one day prior to the onset of precipitation, whichever occurs first.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment controls and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year-round to deploy soil stabilization and sediment control practices as required by Section 2 of this Manual. Erosion may be caused during dry seasons by unseasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year-round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Sequence trenching activities so that most open portions are closed before new trenching begins.
- Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
- Consider scheduling when establishing permanent vegetation (appropriate planting time for specified vegetation).
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

- Maintenance and Inspection
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
  - Amend the schedule when changes are warranted or when directed by the Resident Engineer (RE).
  - The Special Provisions require annual submittal of a rainy season implementation schedule. Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

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

- Appropriate Applications**
- Preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date. Specifications for preservation of existing vegetation can be found in Standard Specifications, Section 7-1.11.
  - On a year-round basis, temporary fencing shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas.
  - Clearing and grubbing operations should be staged to preserve existing vegetation.

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

**Standards and Specifications** *Timing*

- Preservation of existing vegetation shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas identified on the plans to be preserved, especially on areas designated as Environmentally Sensitive Areas (ESAs).
- Preservation of existing vegetation shall conform to scheduling requirements set forth in the special provisions.

**Design and Layout**

- Mark areas to be preserved with temporary fencing made of orange polypropylene that is stabilized against ultraviolet light. The temporary fencing shall be at least 1 meter (3.2. ft) tall and shall have openings not larger than 50 mm by 50 mm (2 in by 2 in).

- Fence posts shall be either wood or metal, at the Contractor's discretion, as appropriate for the intended purpose. The post spacing and depth shall be adequate to completely support the fence in an upright position.
- Minimize the disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling.
- Consider the impact of grade changes to existing vegetation and the root zone.

## ***Installation***

- Construction materials, equipment storage, and parking areas shall be located where they will not cause root compaction.
- Keep equipment away from trees to prevent trunk and root damage.
- Maintain existing irrigation systems.
- Employees and subcontractors shall be instructed to honor protective devices. No heavy equipment, vehicular traffic, or storage piles of any construction materials shall be permitted within the drip line of any tree to be retained. Removed trees shall not be felled, pushed, or pulled into any retained trees. Fires shall not be permitted within 30 m (100 ft) of the drip line of any retained trees. Any fires shall be of limited size, and shall be kept under continual surveillance. No toxic or construction materials (including paint, acid, nails, gypsum board, chemicals, fuels, and lubricants) shall be stored within 15 m (50 ft) of the drip line of any retained trees, nor disposed of in any way which would injure vegetation.

## ***Trenching and Tunneling***

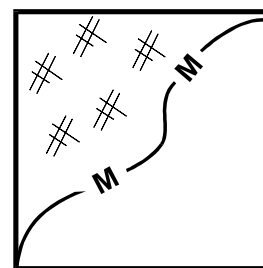
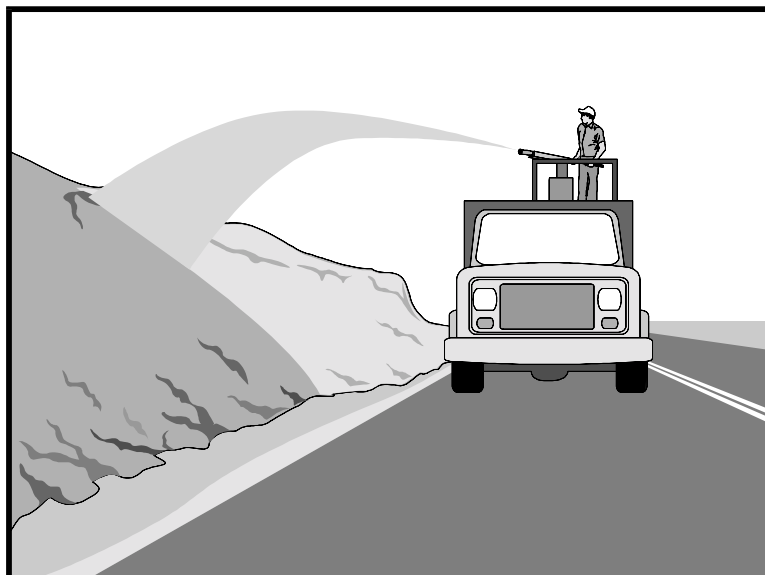
- Trenching shall be as far away from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching and/or tunneling near or under trees to be retained, tunnels shall be at least 450 mm (18 in) below the ground surface, and not below the tree center to minimize impact on the roots.
- Tree roots shall not be left exposed to air; they shall be covered with soil as soon as possible, protected, and kept moistened with wet burlap or peat moss until the tunnel and/or trench can be completed.
- The ends of damaged or cut roots shall be cut off smoothly.
- Trenches and tunnels shall be filled as soon as possible. Careful filling and tamping will eliminate air spaces in the soil which can damage roots.
- Remove any trees intended for retention if those trees are damaged seriously enough to affect their survival. If replacement is desired or required, the new tree shall be of similar species, and at least 50 mm (2 in) caliper, unless

otherwise required by the contract documents.

- After all other work is complete, fences and barriers shall be removed last. This is because protected trees may be destroyed by carelessness during the final cleanup and landscaping.

**Maintenance and Inspection** During construction, the limits of disturbance shall remain clearly marked at all times. Irrigation or maintenance of existing vegetation shall conform to the requirements in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below shall be followed:

- Serious tree injuries shall be attended to by an arborist.
- During construction, District Environmental shall be contacted to ensure that ESAs are protected.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

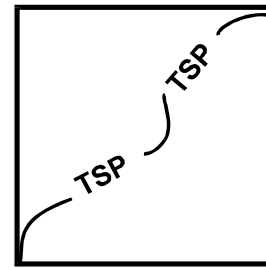
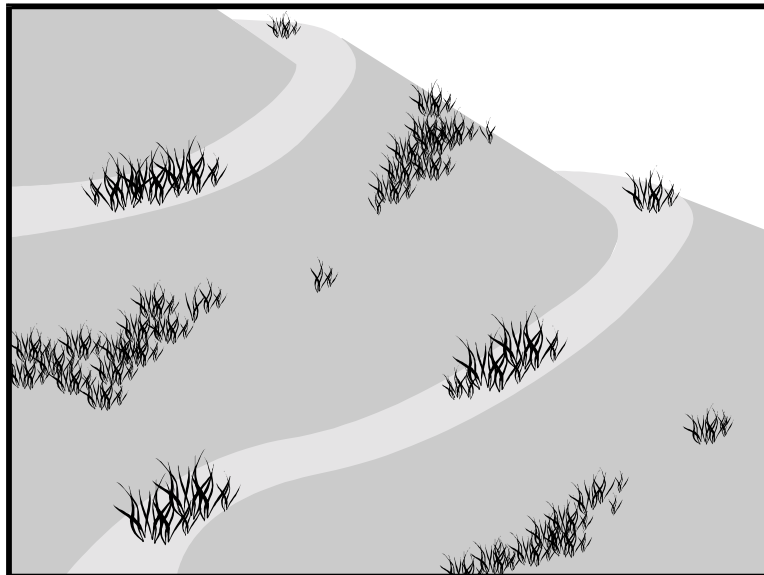
- Definition and Purpose** Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix and a stabilizing emulsion or tackifier with hydroseeding equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind. This is one of five temporary soil stabilization alternatives to consider.
- Appropriate Applications**
- Hydraulic mulch is applied to disturbed areas requiring temporary protection until permanent vegetation is established or disturbed areas that must re-disturbed following an extended period of inactivity.
- Limitations**
- Wood fiber hydraulic mulches are generally short-lived (only last a part of a growing season) and need 24 hours to dry before rainfall occurs to be effective.
  - Paper mulches are not permitted.
  - Avoid use in areas where the mulch would be incompatible with immediate future earthwork activities and would have to be removed.
- Standards and Specifications**
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
  - Hydraulic matrices require 24 hours to dry before rainfall occurs to be effective unless approved by the Resident Engineer.
  - Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.
  - Selection of hydraulic mulches by the Contractor must be approved by the Resident Engineer (RE) or Construction Storm Water Coordinator.

- Materials for wood fiber based hydraulic mulches and hydraulic matrices shall conform to Standard Specifications Section 20-2.07.
- Hydraulic Mulch
- Wood fiber mulch is a component of hydraulic applications. It is typically applied at the rate of 2,250 to 4,500 kilograms per hectare (kg/ha) (2,000 to 4,000 lb/ac) with 0-5% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer) and applied as a slurry. This type of mulch is manufactured from wood or wood waste from lumber mills or from urban sources. Specifications for wood fiber mulch can be found in Standard Specifications Sections 20-2.07 and 20-2.08.
- Hydraulic matrix is a combination of wood fiber mulch and a tackifier applied as a slurry. It is typically applied at the rate of 2,250 to 4,500 kilograms per hectare (kg/Ha) with 5-10% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer).
- Hydraulic Matrix
- Hydraulic matrix is a combination of wood fiber mulch and tackifier applied as a slurry. It is typically applied at the rate of 2,250 to 4,500 kg/ha with 5-10% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer).
- Bonded Fiber Matrix
- Bonded fiber matrix (BFM) is a hydraulically-applied system of fibers and adhesives that upon drying forms an erosion-resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,400 kg/ha to 4,500 kg/ha based on the manufacturer's recommendation. The biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs require 12 to 24 hours to dry to become effective.

## Maintenance and Inspections

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked. Inspect before expected rain storms and repair any damaged ground cover and re-mulch exposed areas of bare soil.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, which temporarily protects exposed soils from erosion by water and wind. This is one of five temporary soil stabilization alternatives to consider.

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

- Limitations**
- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and erosion control. Otherwise, hydroseeding must be used in conjunction with a soil binder or mulching (i.e., straw mulch), refer to BMP SS-5, Table 1 for options.
  - Steep slopes are difficult to protect with temporary seeding.
  - Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
  - Temporary vegetation may have to be removed before permanent vegetation is applied.
  - Temporary vegetation is not appropriate for short-term inactivity.

**Standards and Specifications** To select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

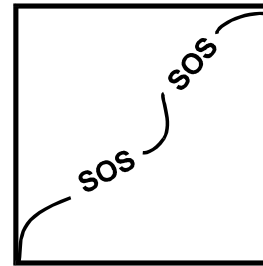
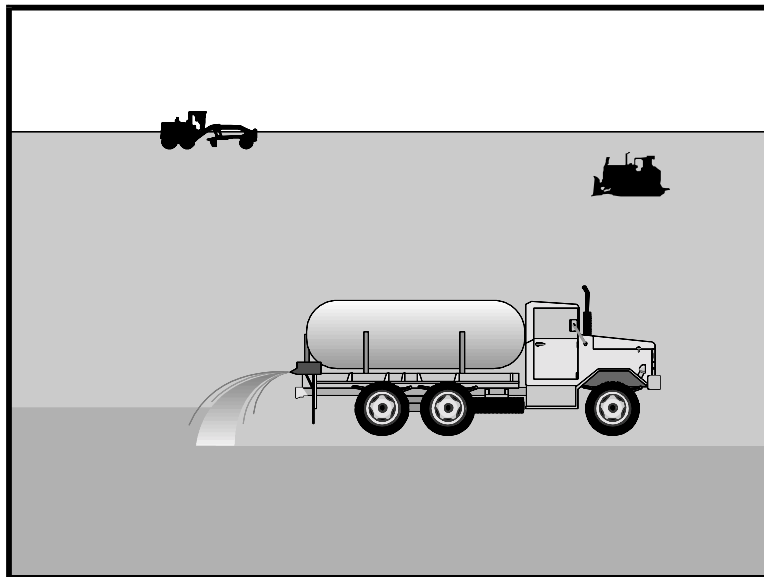
- Selection of hydroseeding mixtures shall be approved by the District Landscape Architect and the Construction Storm Water Coordinator.

The following steps shall be followed for implementation:

- Seed mix shall comply with the Standard Specifications Section 20-2.10, and the project’s special provisions.
- Hydroseeding can be accomplished using a multiple-step or one-step process; refer to the special provisions for specified process. The multiple-step process ensures maximum direct contact of the seeds to soil. When the one-step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the slope, fill area, or area to be seeded with the furrows trending along the contours. Rolling with a crimping or punching type roller or track walking is required on all slopes prior to hydroseeding. Track walking shall only be used where other methods are impractical.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow, refer to Standard Specifications Sections 20-2.06 and 20-3.03.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer’s guarantee, and dates of test; provide the Resident Engineer (RE) with such documentation. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet-inoculated. Inoculant sources shall be species-specific and shall be applied at a rate of 2 kg of inoculant per 100 kg of seed (2-lb inoculant per 100-lb seed), refer to Standard Specifications Section 20-2.10.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.

Maintenance and  
Inspection

- Follow-up applications shall be made as needed to cover weak spots, and to maintain adequate soil protection.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.
- All seeded areas shall be inspected for failures and re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates. Any temporary revegetation efforts that do not provide adequate cover must be reapplied at a scheduled recommended by the Caltrans Landscape Architect or RE.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.



Standard Symbol

- BMP Objectives**

  - Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water-induced erosion of exposed soils on construction sites. Soil binders also provide temporary dust, wind, and soil stabilization (erosion control) benefits. This is one of five temporary soil stabilization alternatives to consider.

**Appropriate Applications** Soil binders are typically applied to disturbed areas requiring short-term temporary protection. Because soil binders can often be incorporated into the work, they may be a good choice for areas where grading activities will soon resume. Application on stockpiles to prevent water and wind erosion.

- Limitations**
- Soil binders are temporary in nature and may need reapplication.
  - Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer, which may be 24 hours or longer. Soil binders may need reapplication after a storm event.
  - Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
  - Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
  - Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
  - Storm water quality runoff sampling is required for many soil binders. Soil binders that do not require sampling are identified in the Caltrans SWPPP/WPCP Preparation Manual, Pollutant Table, Attachment S.

- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- May not cure if low temperatures occur within 24 hours of application.

## Standards and Specifications

### **General Considerations**

- Site-specific soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and shall not stain paved or painted surfaces, refer to Standard Specifications Section 20-2.11.
- Some soil binders are compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

### **Soil Binders Applications**

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps shall be followed:

- Follow manufacturer's recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where rolling is impractical.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders shall not be applied during or immediately before rainfall.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Soil binders shall not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the air temperature is below 4oC (40oF) during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure times.

- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.14 to 1.4 L/m<sup>2</sup> (0.03 to 0.3 gal/yd<sup>2</sup>) or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 150 to 300 mm (6 to 12 in).
  - Allow treated area to cure for the time recommended by the manufacturer; typically, at least 24 hours.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.5 to 0.9 L/m<sup>2</sup> (0.1 to 0.2 gal/yd<sup>2</sup>).

### **Selecting a Soil Binder**

Properties of common soil binders used for erosion control are provided in Table 1 and Appendix B. Use Table 1 to select an appropriate soil binder.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied; determine if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean-up.

After considering the above factors, the soil binders in Table 1 will be generally appropriate as follows:

## ***Plant-Material Based (Short Lived)***

-*Guar*: Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersent agents for easy field mixing. It shall be diluted at the rate of 1.2 to 1.8 kg per 1,000 liters (1 to 5 lb per 100 gallons) of water, depending on application machine capacity. Recommended minimum application rates are as follows:

### **Application Rates for Guar Soil Stabilizer**

<b>Slope (V:H):</b>	<b>Flat</b>	<b>1:4</b>	<b>1:3</b>	<b>1:2</b>	<b>1:1</b>
Kg/Ha:	45	50	56	67	78
lb/ac	40	45	50	60	70

-*Psyllium*: Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Psyllium shall be applied at a rate of 90 to 225 kg/ha (80 to 200 lb/ac), with enough water in solution to allow for a uniform slurry flow.

-*Starch*: Starch is non-ionic, cold-water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 170 kg/ha (150 lb/ac). Approximate drying time is 9 to 12 hours.

## ***Plant-Material Based (Long Lived)***

-*Pitch and Rosin Emulsion*: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin shall be a minimum of 26% of the total solids content. The soil stabilizer shall be non-corrosive, water-dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and shall be applied as follows:

For clayey soil: 5 parts water to 1 part emulsion

For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion/product mixture applied at the rate specified by the manufacturer. Approximate drying time is 19 to 24 hours.

## ***Polymeric Emulsion Blends***

*-Acrylic Copolymers and Polymers:* Polymeric soil stabilizers shall consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound shall be handled and mixed in a manner that will not cause foaming or shall contain an anti-foaming agent. The polymeric emulsion shall not exceed its shelf life or expiration date; manufacturers shall provide the expiration date. Polymeric soil stabilizer shall be readily miscible in water, non-injurious to seed or animal life, non-flammable, shall provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and shall not re-emulsify when cured. The applied compound shall air cure within a maximum of 36 to 48 hours. Liquid copolymer shall be diluted at a rate of 10 parts water to 1 part polymer and applied to soil at a rate of 11,000 liters/hectare (1,175 gal/ac).

*-Liquid Polymers of Methacrylates and Acrylates:* This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer’s recommendations, and applied with a hydraulic seeder at the rate of 190 L/ha (20 gal/ac). Drying time is 12 to 18 hours after application.

*-Copolymers of Sodium Acrylates and Acrylamides:* These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (V:H)	kg/ha (lb/ac)
Flat to 1:5	3.4 – 5.6 (3-5)
1:5 to 1:3	5.6 – 11.2 (5-10)
1:2 to 1:1	11.2 – 22.4 (10-20)

*-Poly-Acrylamide and Copolymer of Acrylamide:* Linear copolymer polyacrylamide is packaged as a dry-flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 1.5 kg/1,000 liters (1 lb/100 gal) of water and applied at the rate of 5.6 kg/ha (5 lb/ac).

*-Hydro-Colloid Polymers:* Hydro-Colloid Polymers are various combinations of dry-flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 60 to 70 kg/ha (53 to 62 lb/ac). Drying times are 0 to 4 hours.



## ***Cementitious-Based Binders***

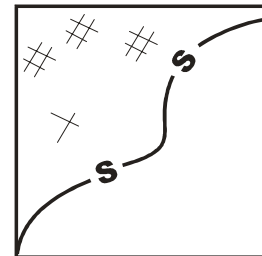
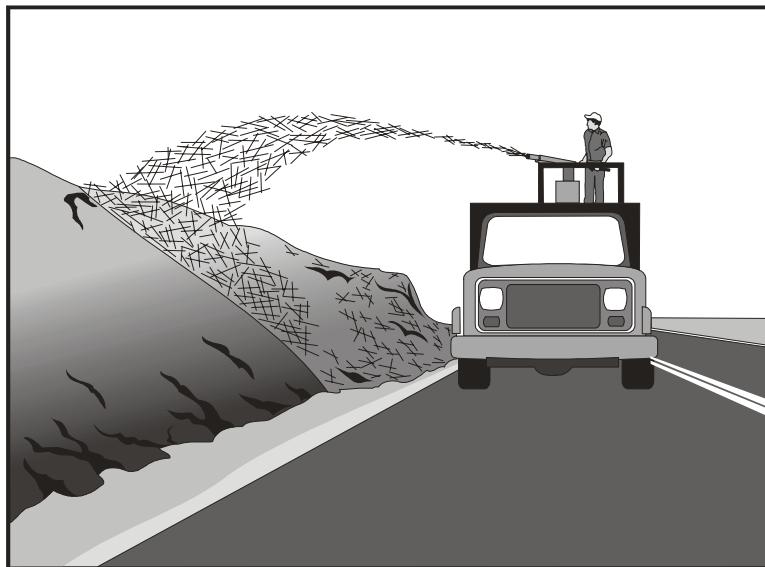
*-Gypsum:* This is a formulated gypsum-based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,500 to 13,500 kg/ha (4,000 to 12,000 lb/ac). Drying time is 4 to 8 hours.

### **Maintenance and Inspection**

- Reapplying the selected soil binder may be needed for proper maintenance. High traffic areas shall be inspected daily, and lower traffic areas shall be inspected weekly.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.
- Maintain an unbroken, temporary stabilized area while DSAs are nonactive. Repair any damaged stabilized area and re-apply soil binder to exposed areas.

<b>Table 1 Properties of Soil Binders for Erosion Control</b>				
<b>Chemicals</b>	<b>Plant Material Based (Short Lived)</b>	<b>Plant Material Based (Long Lived)</b>	<b>Polymeric Emulsion Blends</b>	<b>Cementitious-Based Binders</b>
Relative Cost	Low	Low	Low	Low
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean-Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies <sup>(1)</sup>	Varies <sup>(1)</sup>	Varies <sup>(1)</sup>	4,500 to 13,500 kg/ha

(1) Dependant on product, soil type, and slope inclination



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a stabilizing emulsion. This is one of five temporary soil stabilization alternatives to consider.

- Appropriate Applications**
- Straw mulch is typically used for soil stabilization as a temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetation is established.
  - Also typically used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

- Limitations**
- Availability of erosion control contractors and straw may be limited prior to the rainy season due to high demand.
  - There is a potential for introduction of weed-seed and unwanted plant material.
  - When straw blowers are used to apply straw mulch, the treatment areas must be within 45 m (150 ft) of a road or surface capable of supporting trucks.
  - Straw mulch applied by hand is more time intensive and potentially costly.
  - May have to be removed prior to permanent seeding or soil stabilization.
  - “Punching” of straw does not work in sandy soils.

## Standards and Specifications

- Straw shall be derived from wheat, rice, or barley.
- All materials shall conform to Standard Specifications Sections 20-2.06, 20-2.07 and 20-2.11.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track-walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.

## ***Application Procedures***

- Apply loose straw at a minimum rate of 3,570 kg/ha (4,000 lb/ac), or as indicated in the project's special provisions, either by machine or by hand distribution.
- If stabilizing emulsion will be used to anchor the straw mulch in lieu of incorporation, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- The straw mulch must be evenly distributed on the soil surface.
- Anchor the mulch in place by using a tackifier or by "punching" it into the soil mechanically (incorporating).
- A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place.
- A tackifier is typically applied at a rate of 140 kg/ha (125 lb/ac). In windy conditions, the rates are typically 200 kg/ha (178 lb/ac).
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity. If the selected method is incorporation of straw mulch into the soil, then do as follows:
  - Applying and incorporating straw shall follow the requirements in Standard Specifications Section 20-3.03.
  - On small areas, a spade or shovel can be used.

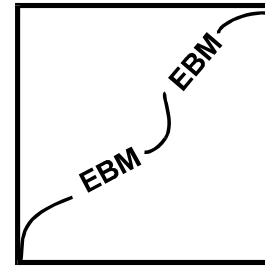
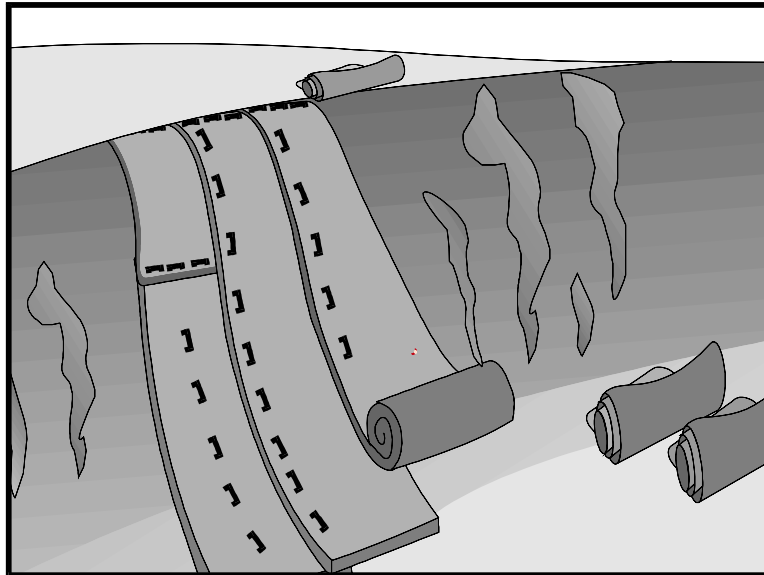
- On slopes with soils, which are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be “punched” into the ground using a knife-blade roller or a straight bladed coultter, known commercially as a “crimper.”
- On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes. Refer to BMP SS-7, “Geotextiles, Plastic Covers and Erosion Control Blankets/Mats.”

**Maintenance and Inspections**

- The key consideration in Maintenance and Inspection is that the straw needs to last long enough to achieve erosion control objectives.
- Maintain an unbroken, temporary mulched ground cover while DSAs are non-active. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required by the Resident Engineer (RE) to maintain effective soil stabilization over disturbed areas and slopes.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

**SS-7**



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** This Best Management Practice (BMP) involves the placement of geotextiles, mats, plastic covers, or erosion control blankets to stabilize disturbed soil areas and protect soils from erosion by wind or water. This is one of five temporary soil stabilization alternatives to consider.

**Appropriate Applications** These measures are used when disturbed soils may be particularly difficult to stabilize, including the following situations:

- Steep slopes, generally steeper than 1:3 (V:H).
- Slopes where the erosion potential is high.
- Slopes and disturbed soils where mulch must be anchored.
- Disturbed areas where plants are slow to develop.
- Channels with flows exceeding 1.0 m/s (3.3 ft/s).
- Channels to be vegetated.
- Stockpiles.
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs).

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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- Limitations
- Blankets and mats are more expensive than other erosion control measures, due to labor and material costs. This usually limits their application to areas inaccessible to hydraulic equipment, or where other measures are not applicable, such as channels.
  - Blankets and mats are generally not suitable for excessively rocky sites, or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
  - Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
  - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
  - Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
  - The use of plastic shall be limited to covering stockpiles, or very small graded areas for short periods of time (such as through one imminent storm event), until alternative measures, such as seeding and mulching, may be installed.
  - Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.

## Standards and Specifications **Material Selection**

There are many types of erosion control blankets and mats, and selection of the appropriate type shall be based on the specific type of application and site conditions. Selection(s) made by the Contractor must be approved by the Resident Engineer (RE); certification of compliance shall be in accordance with Standard Specifications Section 6-1.07.

### **Geotextiles**

- Material shall be a woven polypropylene fabric with minimum thickness of 1.5 mm (0.06 inch), minimum width of 3.7 m (12 ft) and shall have minimum tensile strength of 0.67 kN (warp) 0.36 kN (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric shall be approximately 0.07 sec<sup>-1</sup> in conformance with the requirements in ASTM Designation: D4491. The fabric shall have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets shall be secured in place with wire staples or sandbags and by keying into tops of slopes and edges to prevent infiltration of surface waters under Geotextile. Staples shall be made of 3.05-mm (0.12-inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.
- Geotextiles may be reused if, in the opinion of the RE, they are suitable for the use intended.

## *Plastic Covers*

- Plastic sheeting shall have a minimum thickness of 6 mil, and shall be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 3 m (10 ft) apart. Seams are typically taped or weighted down their entire length, and there shall be at least a 300 mm to 600 mm (12 to 24 inches) overlap of all seams. Edges shall be embedded a minimum of 150 mm (6 inches) in soil.
- All sheeting shall be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures shall be repaired immediately. If washout or breakages occurs, the material shall be re-installed after repairing the damage to the slope.

## *Erosion Control Blankets/Mats*

- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. For an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.
  - **Jute** is a natural fiber that is made into a yarn, which is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which shall be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - **Excelsior (curled wood fiber)** blanket material shall consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 150 mm (6 inches) or longer. The excelsior blanket shall be of consistent thickness. The wood fiber shall be evenly distributed over the entire area of the blanket. The top surface of the blanket shall be covered with a photodegradable extruded plastic mesh. The blanket shall be smolder resistant without the use of chemical additives and shall be non-toxic and non-injurious to plant and animal life. Excelsior blanket shall be furnished in rolled strips, a minimum of 1220 mm (48 inches) wide, and shall have an average weight of 0.5 kg/m<sup>2</sup> (12 lb/ft<sup>2</sup>), ±10 percent, at the time of manufacture. Excelsior blankets shall be secured in place with wire staples. Staples shall be made of 3.05-mm (0.12 inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.



# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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- **Straw blanket** shall be machine-produced mats of straw with a lightweight biodegradable netting top layer. The straw shall be attached to the netting with biodegradable thread or glue strips. The straw blanket shall be of consistent thickness. The straw shall be evenly distributed over the entire area of the blanket. Straw blanket shall be furnished in rolled strips a minimum of 2 m (6.5 ft) wide, a minimum of 25 m (80 ft) long and a minimum of 0.27 kg/m<sup>2</sup> (6.4 lb/ft<sup>2</sup>). Straw blankets shall be secured in place with wire staples. Staples shall be made of 3.05-mm (0.12 inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.
- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance revegetation. The material is furnished in rolled strips, which shall be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Coconut fiber blanket** shall be machine-produced mats of 100% coconut fiber with biodegradable netting on the top and bottom. The coconut fiber shall be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket shall be of consistent thickness. The coconut fiber shall be evenly distributed over the entire area of the blanket. Coconut fiber blanket shall be furnished in rolled strips with a minimum of 2 m (6.5 ft) wide, a minimum of 25 m (80 ft) long and a minimum of 0.27-kg/m<sup>2</sup> (6.4 lb/ft<sup>2</sup>). Coconut fiber blankets shall be secured in place with wire staples. Staples shall be made of 3.05-mm (0.12 inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.
- **Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which shall be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Straw coconut fiber blanket** shall be machine-produced mats of 70% straw and 30% coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber shall be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket shall be of consistent thickness. The straw and coconut fiber shall be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket shall be furnished in rolled strips a minimum of 2 m (6.5 ft) wide, a minimum of 25 m (80 ft) long and a minimum of 0.27 kg/m<sup>2</sup> (6.4 lb/ft<sup>2</sup>). Straw coconut fiber blankets shall be secured in place with wire staples. Staples shall be made of 3.05-mm (0.12-inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.
  - **Plastic netting** is a lightweight biaxially-oriented netting designed for securing loose mulches like straw to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which shall be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - **Plastic mesh** is an open-weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than 0.5 cm (0.2 inch). It is used with revegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which shall be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three-dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be revegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which shall be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - **Bonded synthetic fibers** consist of a three-dimensional geomatrix nylon (or other synthetic) matting. Typically it has more than 90% open area, which facilitates root growth. Its tough root-reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that shall be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high-strength continuous-filament geomatrix or net stitched to the bottom. The material is designed to enhance revegetation. The material is furnished in rolled strips, which shall be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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## ***Site Preparation***

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 50 mm (2 in) to 75 mm (3 in) of topsoil.

## ***Seeding***

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

## ***Anchoring***

- U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Staples shall be made of 3.05 mm (0.12 inch) steel wire and shall be U-shaped with 200-mm (8-inch) legs and 50-mm (2-inch) crown.
- Metal stake pins shall be 5 mm (0.188 in) diameter steel with a 40 mm (1.5 in) steel washer at the head of the pin.
- Wire staples and metal stakes shall be driven flush to the soil surface.
- All anchors shall be 150 mm (6 in) to 450 mm (18 in) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

## ***Installation on Slopes***

Installation shall be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 150 mm (6 in) deep by 150 mm (6 in) wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket downslope in the direction of water flow.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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- Overlap the edges of adjacent parallel rolls 50 mm (2 in) to 75 mm (3 in) and staple every 1 m (3 ft).
- When blankets must be spliced, place blankets end over end (shingle style) with 150 mm (6 in) overlap. Staple through overlapped area, approximately 300 mm (12 in) apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (V:H) to 1:2 (V:H), require a minimum of 2 staples/m<sup>2</sup> (2 staples/yd<sup>2</sup>). Moderate slopes, 1:2 (V:H) to 1:3 (V:H), require a minimum of 1½ staples/m<sup>2</sup> (1½ staples/yd<sup>2</sup>), placing 1 staple/m (1 staple/yd) on centers. Gentle slopes require a minimum of 1 staple/m<sup>2</sup> (1 staple/yd<sup>2</sup>).

## ***Installation in Channels***

Installation shall be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 300 mm (12 in) deep and 150 mm (6 in) wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 150 mm (6 in) deep and 150 mm (6 in) wide across the channel at 8 m to 10 m (25 ft to 30 ft) intervals along the channels.
- Cut longitudinal channel anchor slots 100 mm (4 in) deep and 100 mm (4 in) wide along each side of the installation to bury edges of matting, whenever possible extend matting 50 mm (2 in) to 75 mm (3 in) above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 300 mm (12 in) intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 75 mm (3 in).
- Secure these initial ends of mats with anchors at 300 mm (12 in) intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 75 mm (3 in) overlap.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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**SS-7**

- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 300 mm (12 in) intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 150 mm (6 in) centers at 8 m (25 ft) to 10 m (30 ft) intervals in lieu of excavated check slots.
- Shingle-lap spliced ends by a minimum of 300 mm (12 in) apart on 300 mm (12 in) intervals.
- Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.
- Anchor, fill and compact upstream end of mat in a 300 mm (12 in) by 150 mm (6 in) terminal trench.
- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

## ***Soil Filling (if specified for turf reinforcement)***

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes or brooms for fine grading and touch up.
- Smooth out soil filling, just exposing top netting of mat.

## ***Temporary Soil Stabilization Removal***

- When no longer required for the work, temporary soil stabilization shall become the property of the Contractor. Temporary soil stabilization removed from the site of the work shall be disposed of outside the highway right-of-way in conformance with the provisions in Standard Specifications Section 7-1.13. If approved by the RE, the contractor may leave the temporary soil stabilizer in place.

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

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**SS-7**

## Maintenance and Inspection

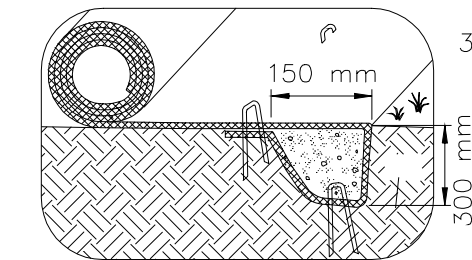
Areas treated with temporary soil stabilization shall be inspected as specified in the special provisions. Areas treated with temporary soil stabilization shall be maintained to provide adequate erosion control. Temporary soil stabilization shall be reapplied or replaced on exposed soils when area becomes exposed or exhibits visible erosion.

- All blankets and mats shall be inspected periodically after installation.
- Installation shall be inspected after significant rain storms to check for erosion and undermining. Any failures shall be repaired immediately.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.

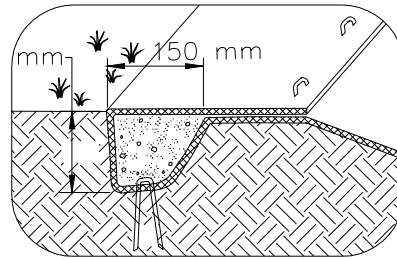
# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

**SS-7**

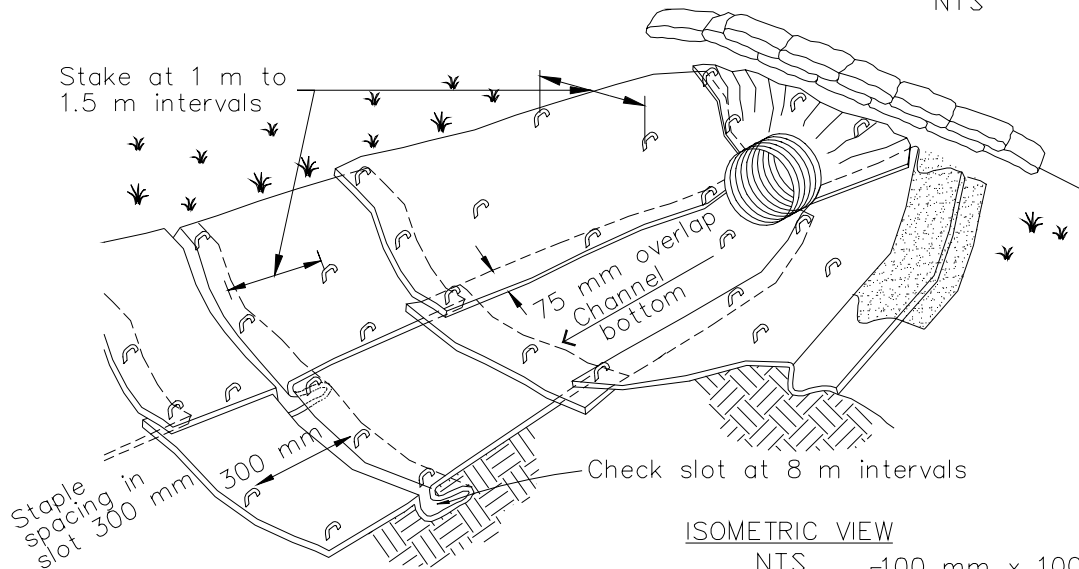
## Typical Installation Detail



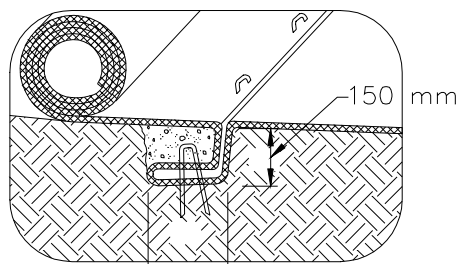
INITIAL CHANNEL ANCHOR TRENCH  
NTS



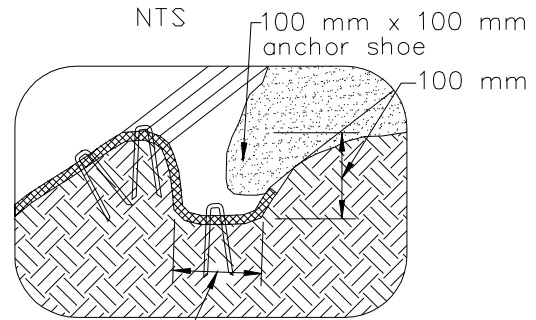
TERMINAL SLOPE AND CHANNEL  
ANCHOR TRENCH  
NTS



ISOMETRIC VIEW  
NTS



INTERMITTENT CHECK SLOT  
NTS



LONGITUDINAL ANCHOR TRENCH  
NTS

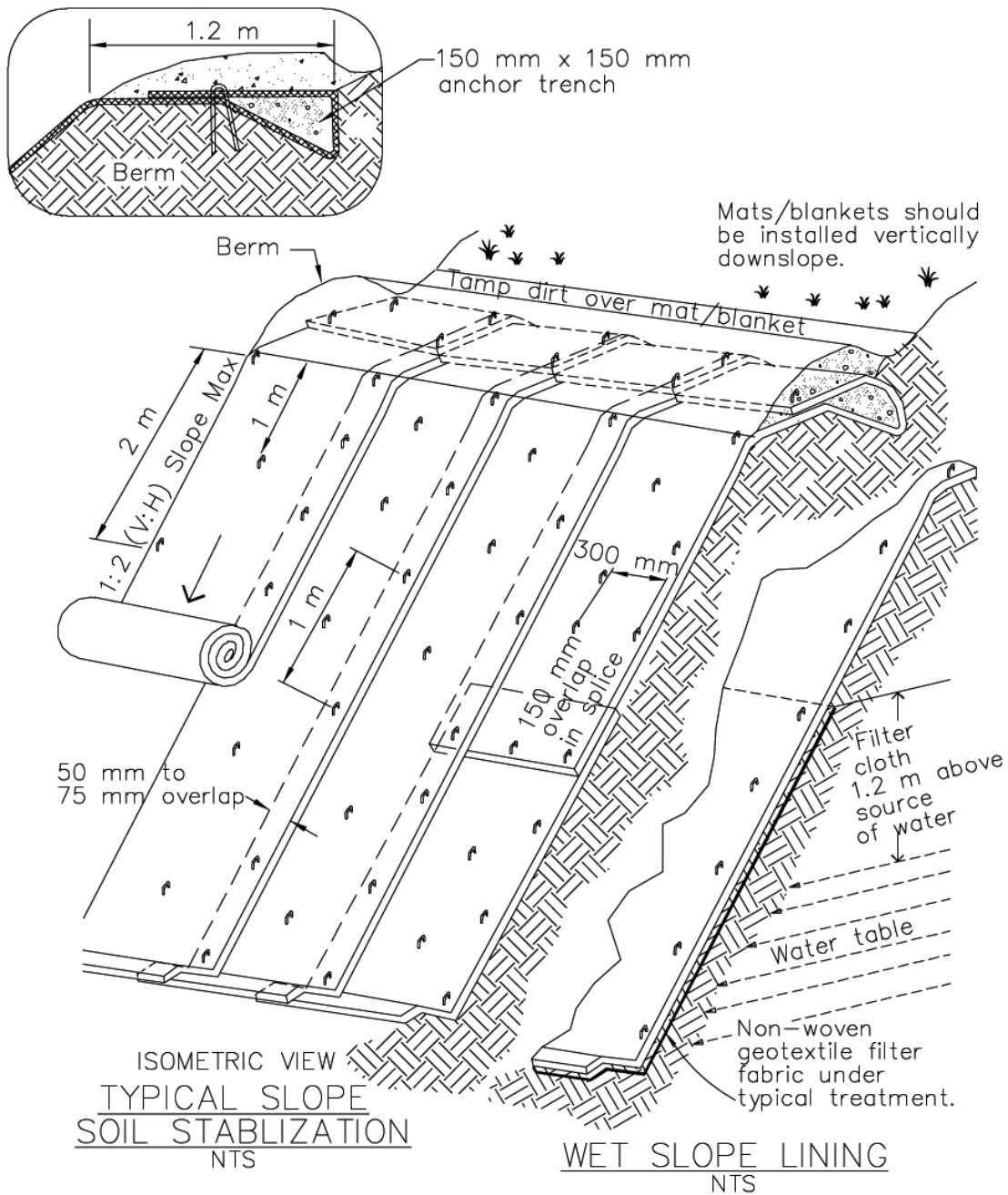
**NOTES:**

1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

# Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

**SS-7**

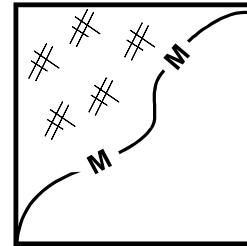
## Typical Installation Detail



### NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Wood mulching consist of applying a mixture of shredded wood mulch, bark or compost. Wood mulch is mostly applicable to landscape projects.

The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

**Appropriate Applications** Wood mulching is considered a temporary soil stabilization (erosion control) alternative in the following situations:

- As a stand-alone temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetative cover can be established.
- As short term, non-vegetative ground cover on slopes to reduce rainfall impact, decrease the velocity of sheet flow, settle out sediment and reduce wind erosion.

**Limitations**

- Wood mulch may introduce unwanted species.
- Shredded wood does not withstand concentrated flows and is prone to sheet erosion.
- Green material has the potential for the presence of unwanted weeds and other plant materials. Delivery system is primarily by manual labor, although pneumatic application equipment is available.

## Standards and Specifications

### ***Mulch Selection***

There are many types of mulches, and selection of the appropriate type shall be based on the type of application and site conditions. Prior to use of wood mulches, there shall be concurrence with the District Landscape Architect since some mulch use on construction projects may not be compatible with planned or future projects. Selection of wood mulches by the Contractor shall comply with Standard Specifications Section 20-2.08, and must be approved by the Resident Engineer (RE).

### ***Application Procedures***

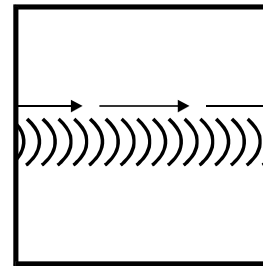
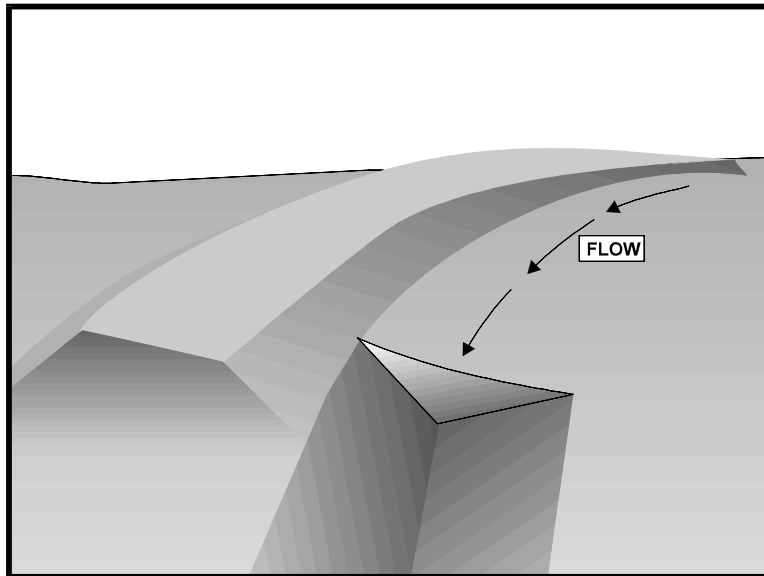
Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a punching-type roller or by track walking. The construction-application procedures for mulches vary significantly depending upon the type of mulching method specified. Two (2) methods are highlighted here:

- **Green Material:** This type of mulch is produced by recycling vegetation trimmings such as grass, shredded shrubs and trees. Methods of application are generally by hand, although pneumatic methods are available. Mulch shall be composted to kill weed seeds.
  - It can be used as a temporary ground cover with or without seeding.
  - The green material shall be evenly distributed on site to a depth of not more than 50 mm (2 in).
- **Shredded Wood:** Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable; see note under limitations.
  - Shall be distributed by hand (although pneumatic methods may be available).
  - The mulch shall be evenly distributed across the soil surface to a depth of 50 mm (2 in) to 75 mm (3 in).
- Avoid mulch placement onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- All material must be removed before re-starting work on the slopes.

## Maintenance and Inspection

- Regardless of the mulching technique selected, the key consideration in Maintenance and Inspection is that the mulch needs to last long enough to achieve erosion-control objectives. If the mulch is applied as a stand-alone erosion control method over disturbed areas (without seed), it shall last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance shall focus on longevity and integrity of the mulch.

# Earth Dikes/Drainage Swales and Lined Ditches



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

These are structures that intercept, divert and convey surface run-on, generally sheet flow, to prevent erosion.

### Appropriate Applications

- Earth dikes/drainage swales and lined ditches may be used to:
  - Convey surface runoff down sloping land.
  - Intercept and divert runoff to avoid sheet flow over sloped surfaces.
  - Divert and direct runoff towards a stabilized watercourse, drainage pipe or channel.
  - Intercept runoff from paved surfaces.
- Earth dikes/drainage swales and lined ditches also may be used:
  - Below steep grades where runoff begins to concentrate.
  - Along roadways and facility improvements subject to flood drainage.
  - At the top of slopes to divert run-on from adjacent or undisturbed slopes.
  - At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

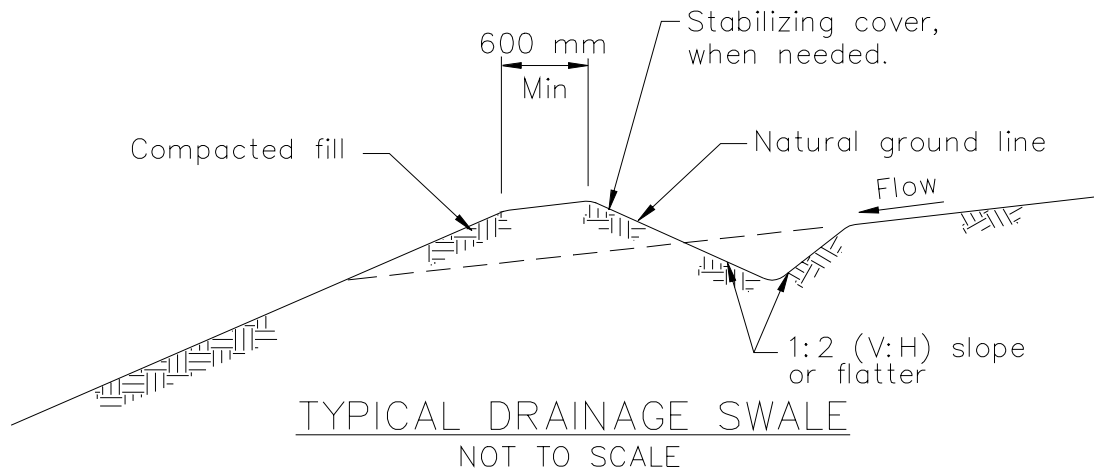
# Earth Dikes/Drainage Swales and Lined Ditches

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**SS-9**

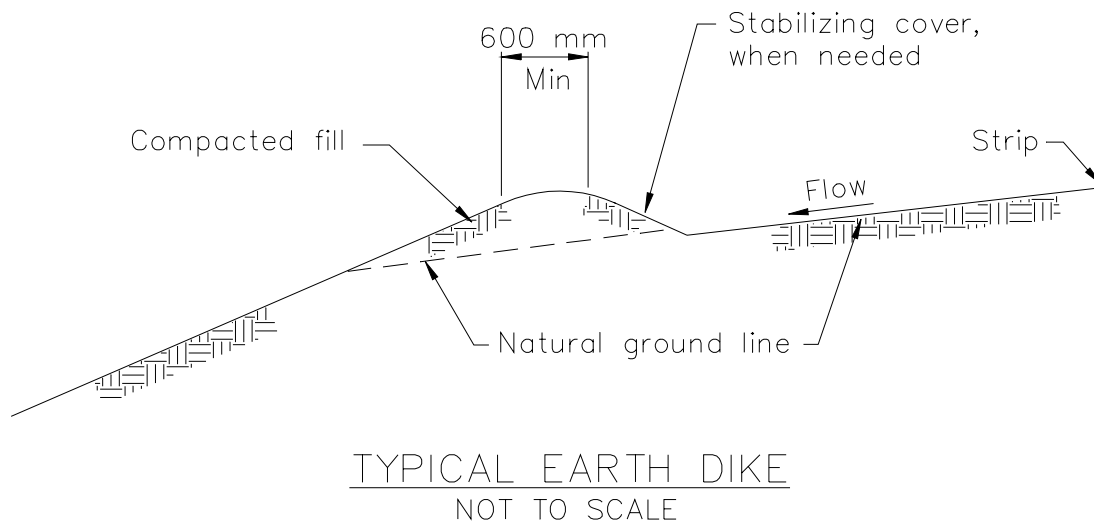
- Limitations**
- Earth dikes/drainage swales and lined ditches are not suitable as sediment trapping devices.
  - May be necessary to use other soil stabilization and sediment controls, such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales and ditches.
- Standards and Specifications**
- Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
  - Conveyances shall be stabilized.
  - Use a lined ditch for high flow velocities.
  - Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, over topping, flow backups, washout, and drainage flow patterns for each project site.
  - Compact any fills to prevent unequal settlement.
  - Do not divert runoff from the highway right-of-way onto other property.
  - When possible, install and utilize permanent dikes, swales and ditches early in the construction process.
  - Provide stabilized outlets. Refer to SS-10, “Outlet Protection/Velocity/Dissipation Devices.”
- Maintenance and Inspections**
- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season.
  - Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
  - Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment, and repair linings and embankments as needed or as directed by the RE.
  - Temporary conveyances shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.

# Earth Dikes/Drainage Swales and Lined Ditches



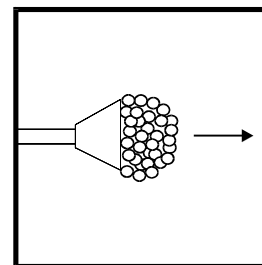
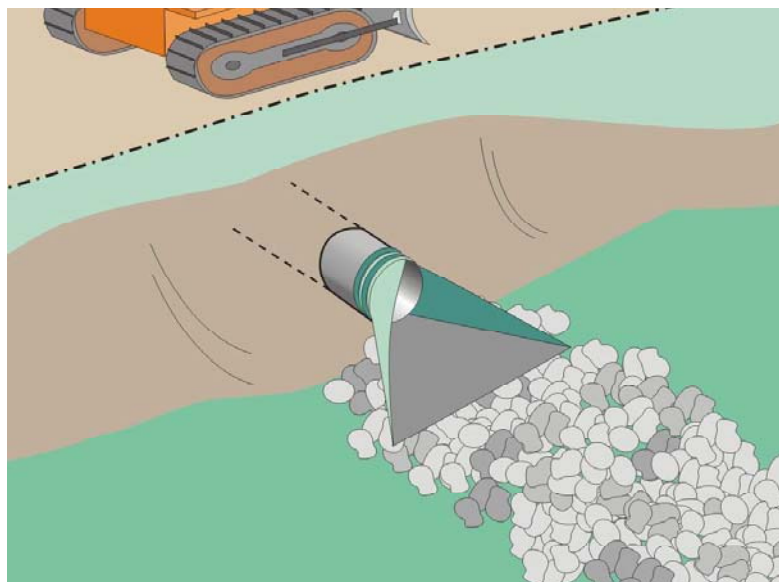
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade, in conformance with Section 19-5 of the Caltrans Standard Specifications.



# Outlet Protection/Velocity Dissipation Devices

**SS-10**



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** These devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of storm water flows.

### Appropriate Applications

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

### Limitations

- Loose rock may have stones washed away during high flows.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

# Outlet Protection/Velocity Dissipation Devices

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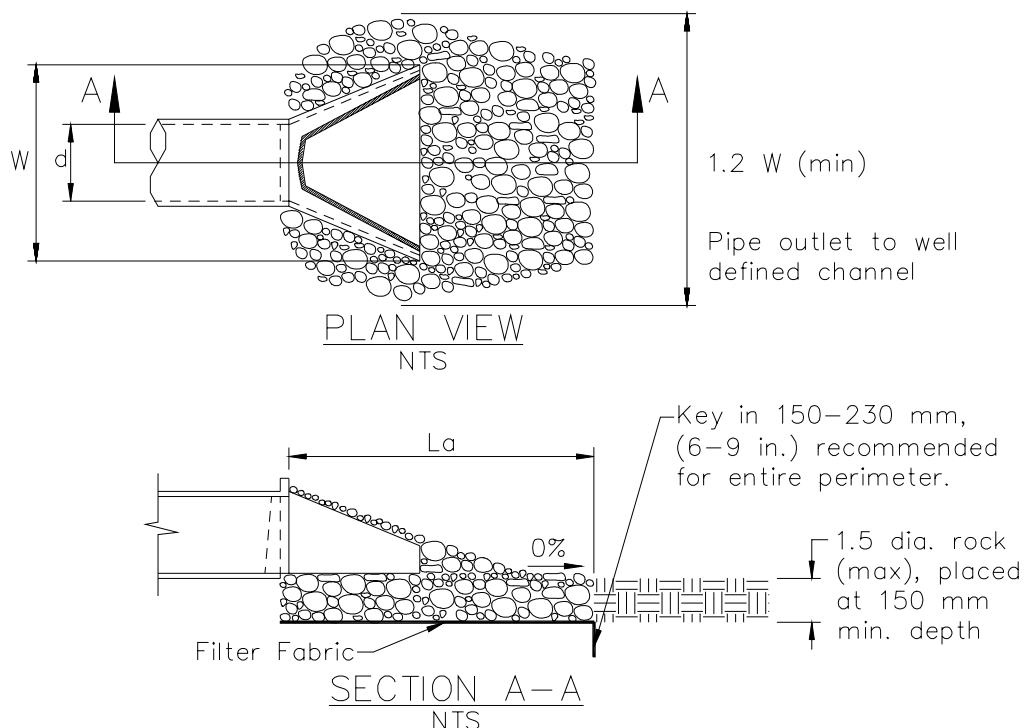
**SS-10**

- Standards and Specifications**
- There are many types of energy dissipaters, with rock being the one that is represented in the figure on Page 3. Please note that this is only one example and the RE may approve other types of devices proposed by the contractor.
  - Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction.
  - Carefully place riprap to avoid damaging the filter fabric.
  - For proper operation of apron:
    - Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
    - If size of apron riprap is large, protect underlying filter fabric with a gravel blanket.
  - Outlets on slopes steeper than 10% shall have additional protection.
- Maintenance and Inspection**
- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season.
  - Inspect apron for displacement of the riprap and/or damage to the underlying fabric. Repair fabric and replace riprap that has washed away.
  - Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.
  - Temporary devices shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.



# Outlet Protection/Velocity Dissipation Devices

**SS-10**

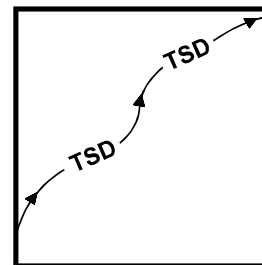
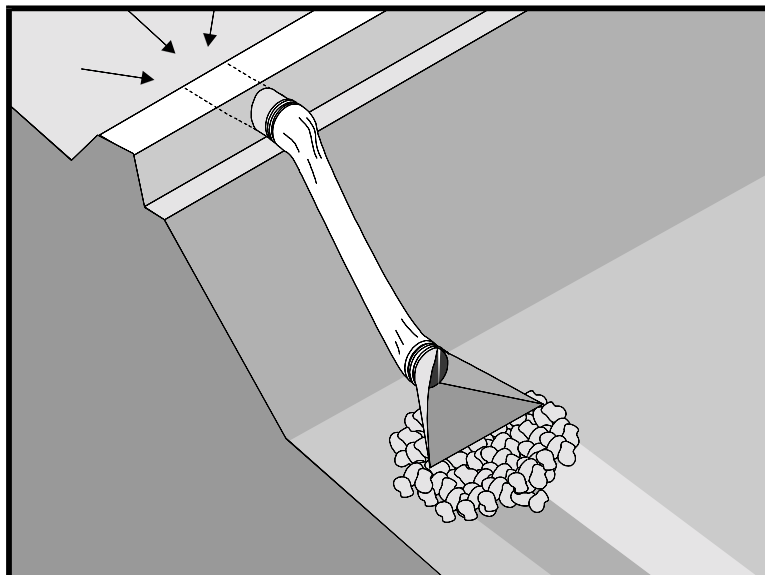


Pipe Diameter mm	Discharge m <sup>3</sup> /s	Apron Length, La m	Rip Rap D <sub>50</sub> Diameter Min mm
300	0.14	3	100
	0.28	4	150
450	0.28	3	150
	0.57	5	200
	0.85	7	300
	1.13	8	400
600	0.85	5	200
	1.13	8	200
	1.42	8	300
	1.70	9	400

**For larger or higher flows, consult a Registered Civil Engineer**

Source: USDA – SCS





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area. Slope drains are used with lined ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

**Appropriate Applications**

- Slope drains may be used on construction sites where slopes may be eroded by surface runoff.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

**Limitations**

- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

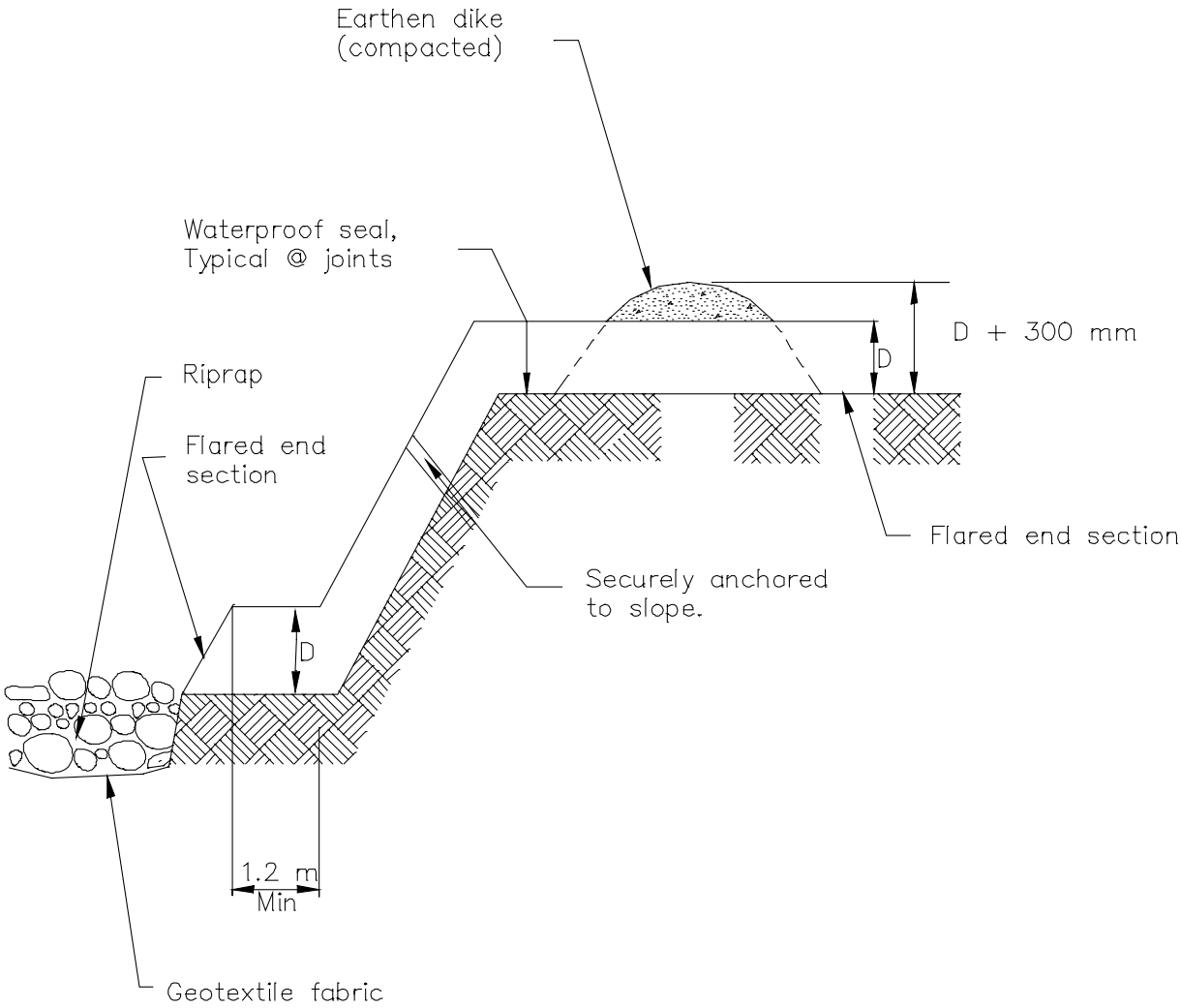
**Standards and Specifications**

- When using slope drains, limit drainage area to 4 ha (10 ac) per pipe. For larger areas, use a rock-lined channel or a series of pipes.
- Maximum slope generally limited to 1:2 (V:H), as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP SS-8, "Earth Dikes/Drainage Swales, and Lined Ditches."
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials are PVC, ABS, or comparable pipe.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.

- Compact soil around and under entrance, outlet, and along length of pipe.
- Securely anchor and stabilize pipe and appurtenances into soil.
- Check to ensure that pipe connections are water tight.
- Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
- Protect inlet and outlet of slope drains; use standard flared end section at entrance and exit for pipe slope drains 300 mm (12in) and larger.

## Maintenance and Inspection

- Inspect before and after each rain storm, and twice monthly until the tributary drainage area has been stabilized. Follow routine inspection procedures for inlets thereafter.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Inspect slope drainage for accumulations of debris and sediment.
- Remove built-up sediment from entrances, outlets, and within drains as required.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).



TYPICAL SLOPE DRAIN  
NOT TO SCALE



**Standard Symbol**

- BMP Objectives**

  - Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Drainage systems including the stream channel, streambank, and associated riparian areas, are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream’s sediment load, which can cause channel erosion or sedimentation and have adverse affects on the biotic system. Best Management Practices can reduce the discharge of sediment and other pollutants and minimize the impact of construction activities on watercourses. Streams included on the 303(d) list by the State Water Resources Control Board (SWRCB) may require careful evaluation to prevent any increases in sedimentation, siltation and/or turbidity to the stream.

**Appropriate Applications** These procedures typically apply to all construction projects that disturb or occur within stream channels and their associated riparian areas.

**Limitations** Specific permit requirements or mitigation measures such as Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game may be included in contract documents. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams included on the 303(d) list by the State Water Resources Control Board because of being impaired by sediment, silt, or turbidity are required to conduct sampling to verify that there is no net increase in sediment load due to construction activities.

**Standards and Specifications** **PLANNING**

- Proper planning, design, and construction techniques can minimize impacts normally associated with in-stream construction activities. Poor planning can adversely affect soil, fish, and wildlife resources, land uses, or land users. Planning should take into account: scheduling, avoidance of in-stream construction; minimizing disturbance area and construction time period; using

pre-disturbed areas; selecting crossing location; and selecting equipment.

## ***Scheduling (SS-1)***

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with SS-1, “Scheduling.” Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows:
  - Construction work in perennial streams should optimally be performed during the rainy season. This is because in the summer, any sediment-containing water that is discharged into the watercourse will cause a large change in both water clarity and water chemistry. During the rainy season, there is typically more and faster flowing water in the stream so discharges are diluted faster. However, should in-stream work be scheduled for summer, establishing an isolation area, or diverting the stream will significantly decrease the amount of sediment stirred up by construction work. Construction work near perennial streams should optimally be performed during the dry season (see below).
  - When working in or near ephemeral streams, or near perennial streams, work should be performed during the dry season. By their very nature, ephemeral streams are usually dry in the summer, and therefore, in-stream construction activities will not cause significant water quality problems. However, when closing the site at the end of the project, wash any fines (see Washing Fines) that accumulated in the channel back into the bed material, to decrease pollution from the first rainstorm (“first flush”) of the season. When working near ephemeral or perennial streams, erosion and sediment controls (see silt fences, straw bale barriers, etc.) should be implemented to keep sediment out of stream channel.

## ***Minimize Disturbance***

- Minimize disturbance through: selection of the narrowest crossing location; limiting the number of equipment trips across a stream during construction; and, minimizing the number and size of work areas (equipment staging areas and spoil storage areas). Place work areas at least 15 m (50 ft) from the stream channel. Provide stabilized access to the stream when in-stream work is required. Field reconnaissance should be conducted during the planning stage to identify work areas.

## ***Use of Pre-Disturbed Areas***

- Locate project sites and work areas in pre-disturbed areas when possible.

## ***Selection of Project Site***

- Avoid steep and unstable banks, highly erodible or saturated soils, or highly fractured rock.
- Select project site that minimizes disturbance to aquatic species or habitat.

## ***Equipment Selection***

- Select equipment that reduces the amount of pressure exerted on the ground surface, and therefore, reduces erosion potential and/or use overhead or aerial access for transporting equipment across drainage channels. Use equipment that exerts ground pressures of less than 5 or 6 pounds per square inch (PSI), where possible. Low ground pressure equipment includes: wide or high flotation tires (860 to 1850 mm [34 to 72 in] wide); dual tires; bogie axle systems; tracked machines; lightweight equipment; and, central tire inflation systems.

## **STREAMBANK STABILIZATION**

### ***Preservation of Existing Vegetation (SS-2)***

- Preserve existing vegetation in accordance with SS-2, “Preservation of Existing Vegetation.” In a streambank environment preservation of existing vegetation provides the following benefits:

#### *Water Quality Protection:*

Vegetated buffers on slopes trap sediment and promote groundwater recharge. The buffer width needed to maintain water quality ranges from 5 to 30 m (16 to 98 ft). On gradual slopes, most of the filtering occurs within the first 10 m (33 ft). Steeper slopes require a greater width of vegetative buffer to provide water quality benefits.

#### *Streambank Stabilization:*

The root system of riparian vegetation stabilizes streambanks by increasing tensile strength in the soil. The presence of vegetation modifies the moisture condition of slopes (infiltration, evapotranspiration, interception) and increases bank stability.

#### *Riparian Habitat*

Buffers of diverse riparian vegetation provide food and shelter for riparian and aquatic organisms. Minimizing impacts to fisheries habitat is a major concern when working near streams and rivers. Riparian vegetation provides shade, shelter, organic matter (leaf detritus and large woody debris), and other nutrients that are necessary for fish and other aquatic organisms. Buffer widths for habitat concerns are typically wider than those recommended for water quality concerns (30 to 500 m [98 to 1,640 ft]).

When working near watercourses, it is important to understand the work site’s placement in the watershed. Riparian vegetation in the headwater streams has a greater impact on overall water quality than vegetation in downstream reaches. Preserving existing vegetation upstream is necessary to maintain water quality, minimize bank failure, and maximize riparian habitat downstream of the work site.

### **Limitations:**

- Local county and municipal ordinances regarding width, extent and type of vegetative buffer required may exceed the specifications provided here; these ordinances should be investigated prior to construction.

### **Streambank Stabilization Specific Installation:**

- As a general rule, the width of a buffer strip between a road and the stream is recommended to be 15 m (48 ft) plus four times the percent slope of the land, measured between the road and the top of stream bank.

### **Hydraulic Mulch (SS-3)**

- Apply hydraulic mulch on disturbed streambanks above the mean high water level in accordance with SS-3, “Hydraulic Mulch” to provide temporary soil stabilization.

### **Limitations**

- Do not place hydraulic mulch or tackifiers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication.

### **Hydroseeding (SS-4)**

- Hydroseed disturbed streambanks in accordance with SS-4, “Hydroseeding.”

### **Limitations**

- Do not place tackifiers or fertilizers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication.

### **Soil Binders (SS-5)**

- Apply soil binders to disturbed streambanks in accordance with SS-5, “Soil Binders.”

### **Limitations**

- Do not place soil binders below the mean high water level. Soil binder must be environmentally benign and non-toxic to aquatic organisms.

### **Straw Mulch (SS-6)**

- Apply straw mulch to disturbed streambanks in accordance with SS-6, “Straw Mulch.”

### **Limitations**

- Do not place straw mulch below the mean high water level, as this material could wash into the channel and impact water quality or possibly cause eutrophication.



## ***Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats (SS-7)***

- Install geotextiles, erosion control blankets and plastic as described in SS-7, “Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats” to stabilize disturbed channels and streambanks. Not all applications should be in the channel, for example, certain geotextile netting may snag fish gills and are not appropriate in fish-bearing streams. Geotextile fabrics that are not biodegradable are not appropriate for in-stream use. Additionally, geotextile fabric or blankets placed in channels must be adequate to sustain anticipated hydraulic forces.

## ***Earth Dikes/Drainage Swales, and Lined Ditches (SS-9)***

- Convey, intercept, or divert runoff from disturbed streambanks using SS-9, “Earth Dikes/Drainage Swales, and Lined Ditches.”

### ***Limitations***

- Do not place earth dikes in watercourses, as these structures are only suited for intercepting sheet flow, and should not be used to intercept concentrated flow.
- Place appropriately sized outlet protection and energy dissipation in accordance with SS-10, “Outlet Protection/Velocity dissipation Devices.”

## ***Outlet Protection/Velocity Dissipation Devices (SS-10)***

- Place outlet protection or velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with SS-10.

## ***Slope Drains (SS-11)***

- Use slope drains to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area in accordance with SS-11, “Slope Drains.”

### ***Limitations***

- Appropriately sized outlet protection/velocity dissipation devices must be placed at outlets to minimize erosion and scour.

## ***STREAMBANK SEDIMENT CONTROL***

### ***Silt Fences (SC-1)***

- Install silt fences in accordance with SC-1, “Silt Fence” to control sediment. Silt fences should only be installed where sediment-laden water can pond, thus allowing the sediment to settle out.

## ***Fiber Rolls (SC-5)***

- Install fiber rolls in accordance with SC-5, “Fiber Rolls” along slope contour above the high water level to intercept runoff, reduce flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. In a stream environment, fiber rolls should be used in conjunction with other sediment control methods such as SC-1, “Silt Fence” or SC-9, “Straw Bale Barrier.” Install silt fence, straw bale barrier, or other erosion control methods along the toe of slope above the high water level.

## ***Gravel Bag Berm (SC-6)***

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment-laden sheet flow runoff in accordance with SC-6, “Gravel Bag Berm.” In a stream environment gravel bag barriers can allow sediment to settle from runoff before water leaves the construction site and can be used to isolate the work area from the stream.

### ***Limitations:***

- Gravel bag barriers are not recommended as a perimeter sediment control practice around streams.

## ***Straw Bale Barrier (SC-9)***

- Install straw bale barriers in accordance with SC-9, “Straw Bale Barrier” to control sediment. Straw bale barriers should only be installed where sediment-laden water can pond, thus allowing the sediment to settle out. Install a silt fence in accordance with SC-1, “Silt Fence” on the down-slope side of the straw bale barrier closest to stream channel to provide added sediment control.

## ***Rock Filter***

### ***Description and Purpose:***

- Rock filters are temporary erosion-control barriers composed of rock that is anchored in place. Rock filters detain the sediment-laden runoff, retain the sediment, and release the water as sheet flow at a reduced velocity. Typical rock filter installations are illustrated at the end of this Section.

### ***Applications:***

- Near the toe of slopes that may be subject to flow and rill erosion.

### ***Limitations:***

- Inappropriate for drainage areas greater than 2 ha (5 ac).
- Requires sufficient space for ponded water.
- Ineffective for diverting runoff because filters allow water to slowly seep through.

- Rock filter berms are difficult to remove when construction is complete.
- Unsuitable in developed areas or locations where esthetics is a concern.

### **Specifications:**

- Rock: open-graded rock, 19 to 125 mm (0.75 to 5 inches) for concentrated flow applications.
- Woven wire sheathing: 25 mm (1 inch) diameter, hexagonal mesh, galvanized 20-gauge (used with rock filters in areas of concentrated flow).
- In construction traffic areas, maximum rock berm heights should be 300 mm (12 in). Berms should be constructed every 90 m (300 ft) on slopes less than 5:100 (V:H) (5%), every 60 m (200 ft) on slopes between 5:100 (V:H) (5%) and 10:100 (V:H) (10%), and every 30 m (100 ft) on slopes greater than 10:100 (V:H) (10%).

### **Maintenance and Inspection:**

- Inspect berms before and after each significant rainfall event and weekly throughout the rainy season.
- Reshape berms as needed and replace lost or dislodged rock, and/or filter fabric.
- Inspect for sediment accumulation, remove sediment when depth reaches one-third of the berm height or 300 mm (12 in), whichever occurs first.

### **K-rail**

#### **Description and Purpose:**

- This is temporary sediment control that uses K-rails to form the sediment deposition area, or to isolate the near-bank construction area. Install K-rails at toe of slope in accordance with procedures described in NS-5, "Clear Water Diversion."
- Barriers are placed end-to-end in a pre-designed configuration and gravel-filled bags are used at the toe of the barrier and also at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

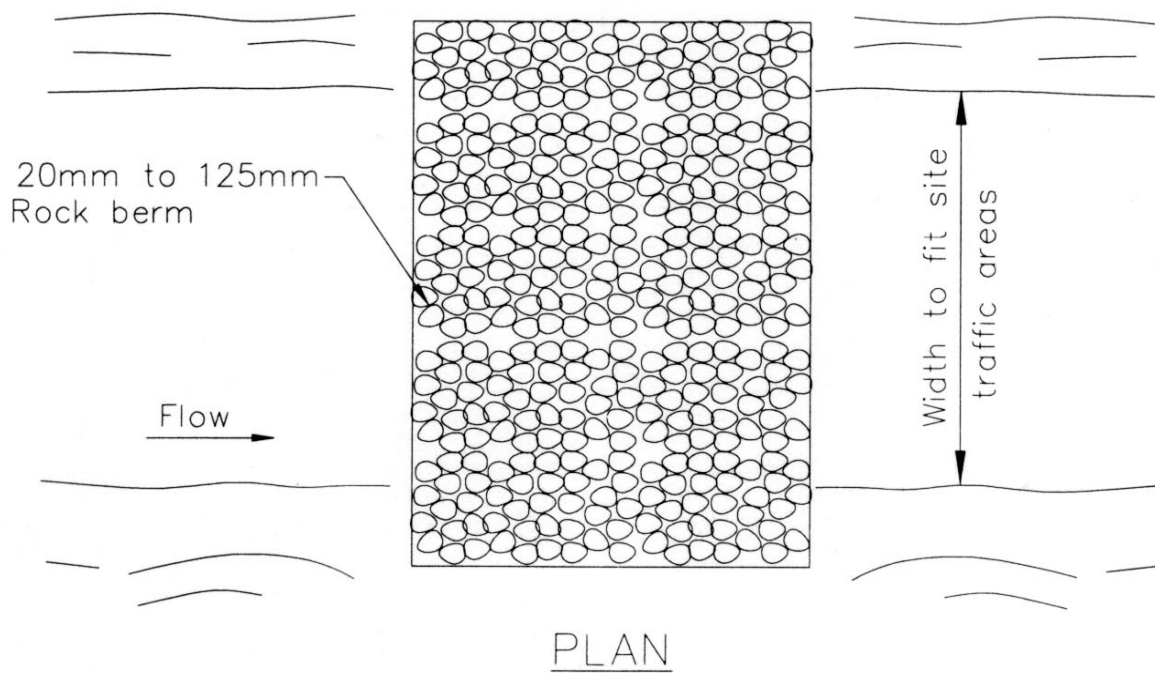
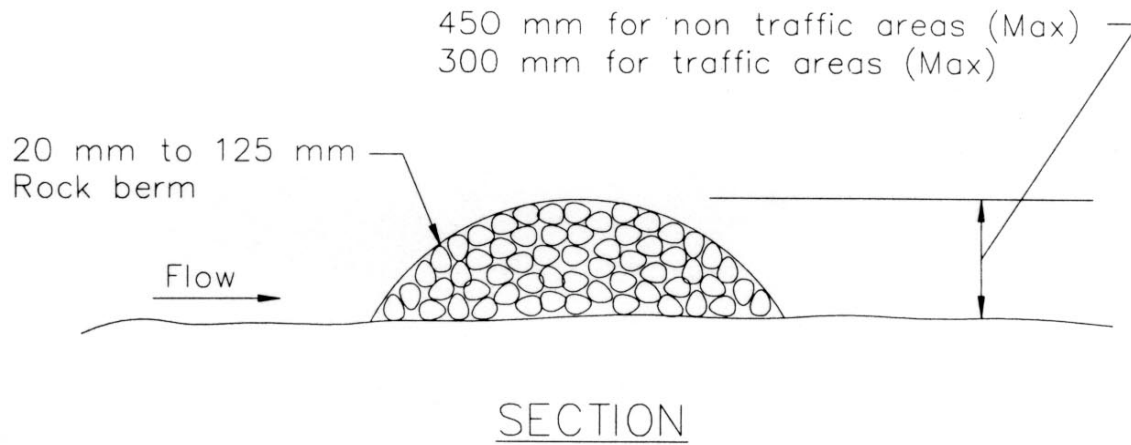
#### **Appropriate Applications:**

- This technique is useful at the toe of embankments, cut or fill slopes.

#### **Limitations:**

- The K-rail method is not watertight and its proper use should be considered accordingly.

- Inspection and Maintenance
- Inspect BMPs daily during construction.
  - Maintain and repair BMPs.
  - Remove accumulated sediment as necessary.



TYPICAL ROCK FILTER  
NOT TO SCALE

# Section 4

## Temporary Sediment Control Best Management Practices

### 4.1 Temporary Sediment Controls

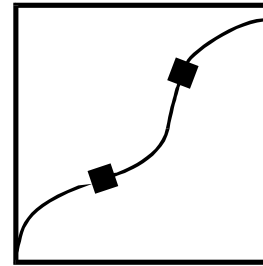
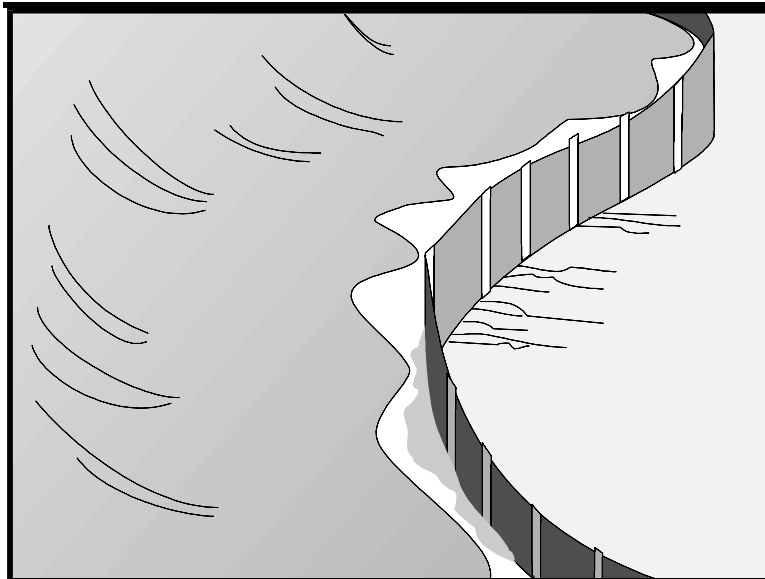
Temporary sediment control practices include those practices that intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped. These practices can consist of installing temporary linear sediment barriers (such as silt fences, sandbag barriers, and straw bale barriers); providing fiber rolls, gravel bag berms, or check dams to break up slope length or flow; or constructing a temporary sediment/desilting basin or sediment trap. Linear sediment barriers are typically placed below the toe of exposed and erodible slopes, downslope of exposed soil areas, around temporary stockpiles, and at other appropriate locations along the site perimeter.

Temporary sediment control practices shall be implemented in conformance with the criteria presented in Section 2, Selecting and Implementing Construction Site Best Management Practices, of this Manual. Temporary sediment control practices include the BMPs listed in Table 4-1.

*Table 4-1*

<b>TEMPORARY SEDIMENT CONTROL BMPs</b>	
<b>ID</b>	<b>BMP NAME</b>
SC-1	Silt Fence
SC-2	Sediment/Desilting Basin
SC-3	Sediment Trap
SC-4	Check Dam
SC-5	Fiber Rolls
SC-6	Gravel Bag Berm
SC-7	Street Sweeping and Vacuuming
SC-8	Sandbag Barrier
SC-9	Straw Bale Barrier
SC-10	Storm Drain Inlet Protection

The remainder of this Section shows the working details for each of the temporary sediment control BMPs.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.

**Appropriate Applications** Silt fences are placed:

- Below the toe of exposed and erodible slopes.
- Down-slope of exposed soil areas.
- Around temporary stockpiles.
- Along streams and channels.
- Along the perimeter of a project.

**Limitations**

- Not effective unless trenched and keyed in.
- Not intended for use as mid-slope protection on slopes greater than 1:4 (V:H).
- Must be maintained.
- Must be removed and disposed of.
- Don't use below slopes subject to creep, slumping, or landslides.
- Don't use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Don't use silt fences to divert flow.

## Standards and Specifications *Design and Layout*

- The maximum length of slope draining to any point along the silt fence shall be 61 m (200 ft) or less.
- Slope of area draining to silt fence shall be less than 1:1 (V:H).
- Limit to locations suitable for temporary ponding or deposition of sediment.
- Fabric life span generally limited to between five and eight months. Longer periods may require fabric replacement.
- Silt fences shall not be used in concentrated flow areas.
- Lay out in accordance with Pages 5 and 6 of this BMP.
- For slopes steeper than 1:2 (V:H) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to water bodies or Environmentally Sensitive Areas (ESAs), additional temporary soil stabilization BMPs shall be used.

## *Materials*

- Silt fence fabric shall be woven polypropylene with a minimum width of 900 mm (36 inches) and a minimum tensile strength of 0.45-kN. The fabric shall conform to the requirements in ASTM designation D4632 and shall have an integral reinforcement layer. The reinforcement layer shall be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric shall be between  $0.1 \text{ sec}^{-1}$  and  $0.15 \text{ sec}^{-1}$  in conformance with the requirements in ASTM designation D4491. Contractor must submit certificate of compliance in accordance with Standard Specifications Section 6-1.07.
- Wood stakes shall be commercial quality lumber of the size and shape shown on the plans. Each stake shall be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.
- Bar reinforcement may be used, and its size shall be equal to a number four (4) or greater. End protection shall be provided for any exposed bar reinforcement.
- Staples used to fasten the fence fabric to the stakes shall be not less than 45 mm (1.75 inches) long and shall be fabricated from 1.57 mm (0.06 inch) or heavier wire. The wire used to fasten the tops of the stakes together when



joining two sections of fence shall be 3.05 mm (0.12 inch) or heavier wire. Galvanizing of the fastening wire is not required.

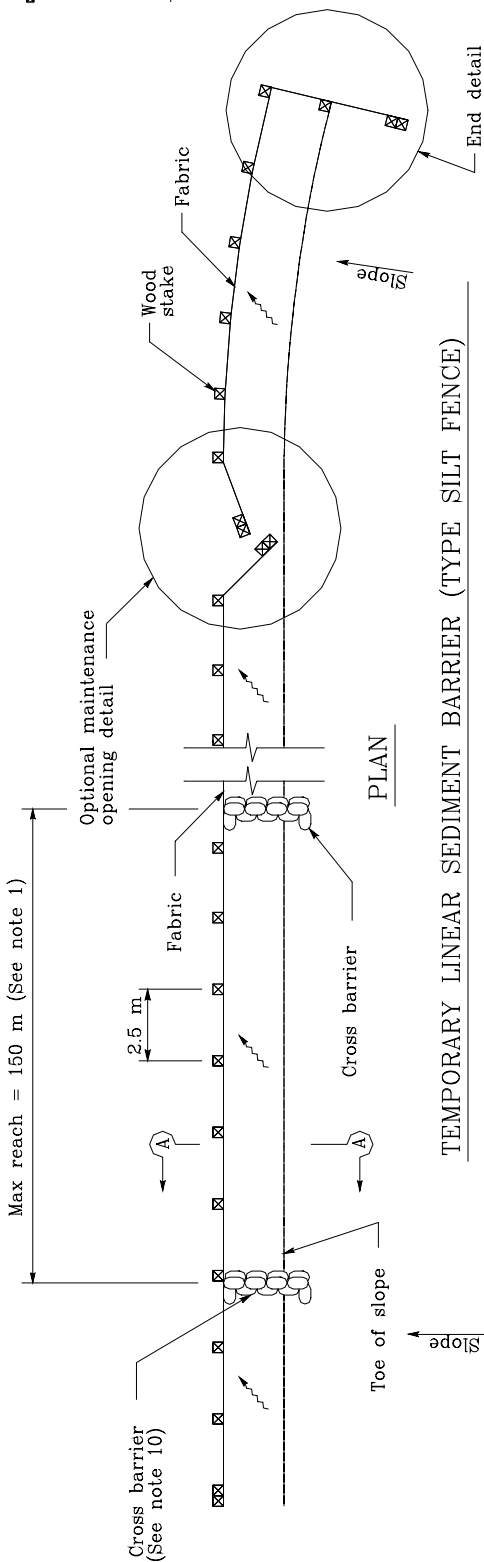
## ***Installation***

- Generally, silt fences shall be used in conjunction with soil stabilization source controls up slope to provide effective erosion and sediment control.
- Bottom of the silt fence shall be keyed-in a minimum of 150 mm (12 inches).
- Trenches shall not be excavated wider and deeper than necessary for proper installation of the temporary linear sediment barriers.
- Excavation of the trenches shall be performed immediately before installation of the temporary linear sediment barriers.
- Construct silt fences with a set-back of at least 1m (3 ft) from the toe of a slope. Where a silt fence is determined to be not practical due to specific site conditions, the silt fence may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practical.
- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case shall the reach exceed 150 meters (490 ft).
- Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
- Install in accordance with Pages 5 and 6 of this BMP.

## Maintenance and Inspection

- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric.
- Inspect silt fence when rain is forecast. Perform necessary maintenance, or maintenance required by the Resident Engineer (RE).
- Inspect silt fence following rainfall events. Perform maintenance as necessary, or as required by the RE.
- Maintain silt fences to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches one-third (1/3) of the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the right-of-way in conformance with the Standard Specifications.
- Silt fences that are damaged and become unsuitable for the intended purpose, as determined by the RE, shall be removed from the site of work, disposed of outside the highway right-of-way in conformance with the Standard Specifications, and replaced with new silt fence barriers.

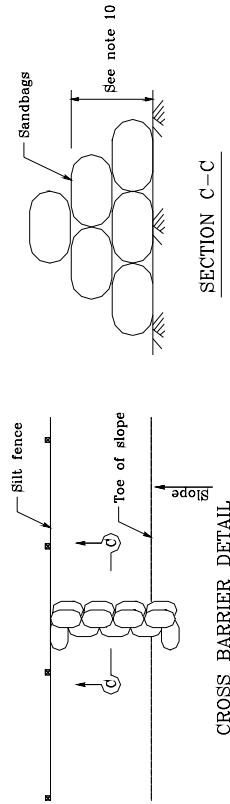
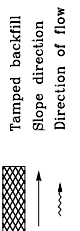
- Holes, depressions or other ground disturbance caused by the removal of the temporary silt fences shall be backfilled and repaired in conformance with the Standard Specifications.
- Remove silt fence when no longer needed or as required by the RE. Fill and compact post holes and anchorage trench, remove sediment accumulation, and grade fence alignment to blend with adjacent ground.



**NOTES**

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 150m.
2. The last 2.5 m of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 2.5 m maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.

**LEGEND**

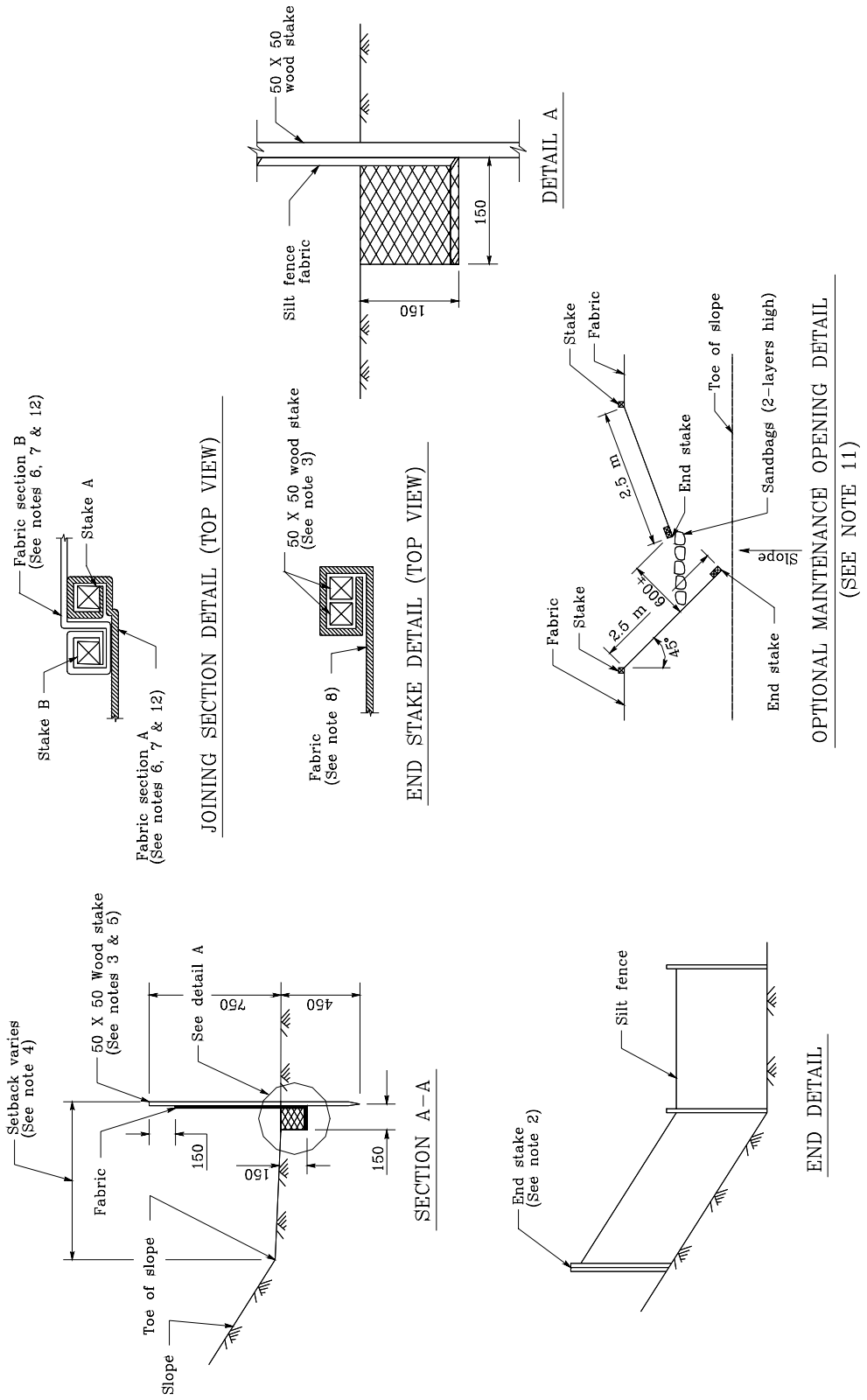


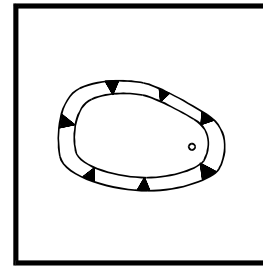
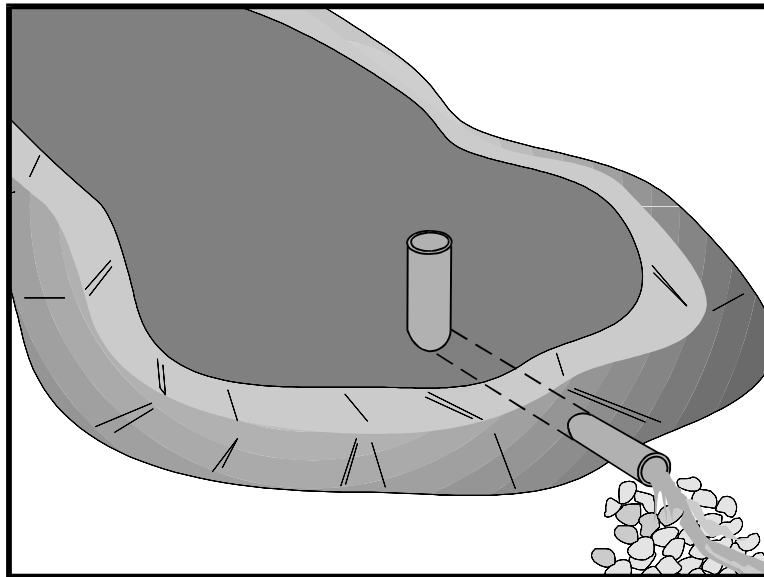
STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION  
**TEMPORARY LINEAR SEDIMENT BARRIER**  
(TYPE SILT FENCE)

NO SCALE  
ALL DIMENSIONS ARE IN  
MILLIMETERS UNLESS OTHERWISE SHOWN

# Silt Fence

**SC-1**





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

A sediment/desilting basin is a temporary basin formed by excavating and/or constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged (refer to Figures 1 and 2).

### Appropriate Applications

Sediment basins shall be designed in accordance with Section A of the State of California NPDES General Permit for Storm Water Discharges Associated with Construction Activities (General Permit). If there is insufficient area to construct a sediment basin in accordance with the General Permit requirements, then the alternate desilting design standards specified herein may be used. This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.

Sediment/Desilting Basins shall be considered for use:

- On construction projects with disturbed areas during the rainy season.
- Where sediment-laden water may enter the drainage system or watercourses.
- At outlets of disturbed soil areas with areas between 2 ha and 4 ha (5 ac and 10 ac).

### Limitations

- Alternative BMPs must be thoroughly investigated for erosion control before selecting temporary desilting basins.
- Requires large surface areas to permit settling of sediment.
- Not appropriate for drainage areas greater than 30 ha (75 ac).
- Not to be located in live streams

## Standards and Specifications

- For safety reasons, basins shall have protective fencing.
- Size may be limited by availability of right-of-way.
- Limit the contributing area to the sediment/desilting basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment/desilting basin.

### **Sediment Basin**

- Sediment basins shall, at a minimum, be designed as follows:
  - Option 1: Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

- Option 2: Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 102 cubic meters (3,600 cubic feet) of storage per 0.4 hectare (1 acre) draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than 0.9 m (3 ft) nor greater than 1.5 m (5 ft) for safety reasons and for maximum efficiency.

OR

- Option 3: Sediment basin(s) shall be designed using the standard equation:

$$A_s = 1.2Q/V_s \quad (\text{Eq. 1})$$

Where:

$A_s$  = Minimum surface area for trapping soil particles of a certain size

$V_s$  = Settling velocity of the design particle size chosen

$$Q = CIA$$

Where:

$Q$  = Discharge rate measured in cubic feet per second

$C$  = Runoff coefficient

$I$  = Precipitation intensity for the 10-year, 6-hour rain event

$A$  = Area draining into the sediment basin in acres

The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm) particle, and the  $V_s$  used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than 0.9 m (3 ft) nor greater than 1.5 m (5 ft) for safety reasons and for maximum efficiency [0.6 m (2 ft) of sediment storage, 0.6 m (2 ft) of capacity]. The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the 0.6 m (2 ft) of capacity.

OR

- Option 4: The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

### ***Desilting Basin***

- Desilting basins shall be designed to have a capacity equivalent to 100 cubic meters of storage (as measured from the top of the basin to the principal outlet) per hectare of contributory area. This design is less than the required to capture the 0.01 mm particle size but larger than that required to capture particles 0.02 mm or larger.
- The length of the basin shall be more than twice the width of the basin; the length shall be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than one (1) meter nor greater than 1.5 m.
- Basins with an impounding levee greater than 1.5 m (5 ft) tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 1000 cubic meters (35,300 cubic feet), shall be designed by a professional Civil Engineer registered with the state of California. The design must be submitted to the Resident Engineer (RE) for approval at least 7 days prior to the basin construction. The design shall include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.

### ***General Requirements***

- Design and locate sediment/desilting basins so that they can be maintained. Construct desilting basins prior to the rainy season and construction activities.
- Sediment/desilting basins, regardless of size and storage volume, shall include features to accommodate overflow or bypass flows that exceed the design storm event. The calculated basin volume and proposed location shall be submitted to

the RE for approval at least 3 days prior to the basin construction.

- Construct an emergency spillway to accommodate flows not carried by the principal spillway. Spillway shall consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
- Spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, shall be a minimum of 6 m (20 ft) in length.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.
- Basin inlets shall be located to maximize travel distance to the basin outlet.
- Rock or vegetation shall be used to protect the basin inlet and slopes against erosion.
- The outflow from the basins shall be provided with outlet protection to prevent erosion and scouring of the embankment and channel. See BMP SS-10, "Outlet Protection/Velocity Dissipation Devices."
- Basin shall be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, (3) where failure would not cause loss of life or property damage, (4) where the basins can be maintained on a year-round basins to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.
- Areas under embankments, structural works, and sediment/desilting basin must be cleared, stripped of vegetation in accordance with Standard Specifications Section 16 – "Clearing and Grubbing."
- Earthwork shall be in accordance with Standard Specifications Section 19 – "Earthwork". Contractor is specifically directed to Standard Specifications Sections 19-5, "Compaction," and 19-6, "Embankment Construction."
- Structure shall be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Discharge from the basin shall be accomplished through a water quality outlet. An example is shown in Figure 3. The Principal outlet shall consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure shall be designed



to accommodate the inflow design storm.

- A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The water quality outlet should be designed to drain the basin within 24 to 72 hours (also referred to as “drawdown time”). (The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.)
- The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. Design guidance for single orifice and perforated riser outlets are as follows:

***Flow Control Using a Single Orifice At The Bottom Of The Basin (Figure 1):*** The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H - Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7 \times 10^{-5})A(H - Ho)^{0.5}}{CT} \quad (\text{Eq. 2})$$

where:

- $a$  = area of orifice (ft<sup>2</sup>) (1 ft<sup>2</sup> = 0.0929m<sup>2</sup>)
- $A$  = surface area of the basin at mid elevation (ft<sup>2</sup>)
- $C$  = orifice coefficient
- $T$  = drawdown time of full basin (hrs)
- $G$  = gravity (32.2 ft/s<sup>2</sup>)
- $H$  = elevation when the basin is full (ft)
- $Ho$  = final elevation when basin is empty (ft)

With a drawdown time of 40 hours, the equation becomes:

$$a = \frac{(1.75 \times 10^{-6})A(H - Ho)^{0.5}}{C} \quad (\text{Eq. 3})$$

***Flow Control Using Multiple Orifices (see Figure2):***

$$a_t = \frac{2A(h_{max})}{CT(2g[h_{max} - h_{centroid\ of\ orifices}])^{0.5}} \quad (\text{Eq. 4})$$

With terms as described above except:

$a_t$  = total area of orifices

$h_{max}$  = maximum height from lowest orifice to the maximum water surface (ft)

$h_{centroid\ of\ orifices}$  = height from the lowest orifice to the centroid of the orifice configuration (ft)

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally (refer to Figure 3).

Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

- The Contractor shall verify that the outlet is properly designed to handle the design and peak flows.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel), which extends through the embankment to toe of fill. Provide anti-seep collars on the barrel.
- Cleanout level shall be clearly marked on the riser pipe
- Avoid dewatering of groundwater to the sediment/desilting basin during the rainy season. Insignificant quantities of accumulated precipitation may be dewatered to the sediment/desilting basin unless precipitation is forecasted within 24 hours. Refer to NS-2 "Dewatering Operations."
- Chain link fencing shall be provided around each sediment/desilting basin to prevent unauthorized entry to the basin or if safety is a concern. Fencing shall be in accordance with Standard Specifications Section 80 – "Fencing."

## Maintenance and Inspection

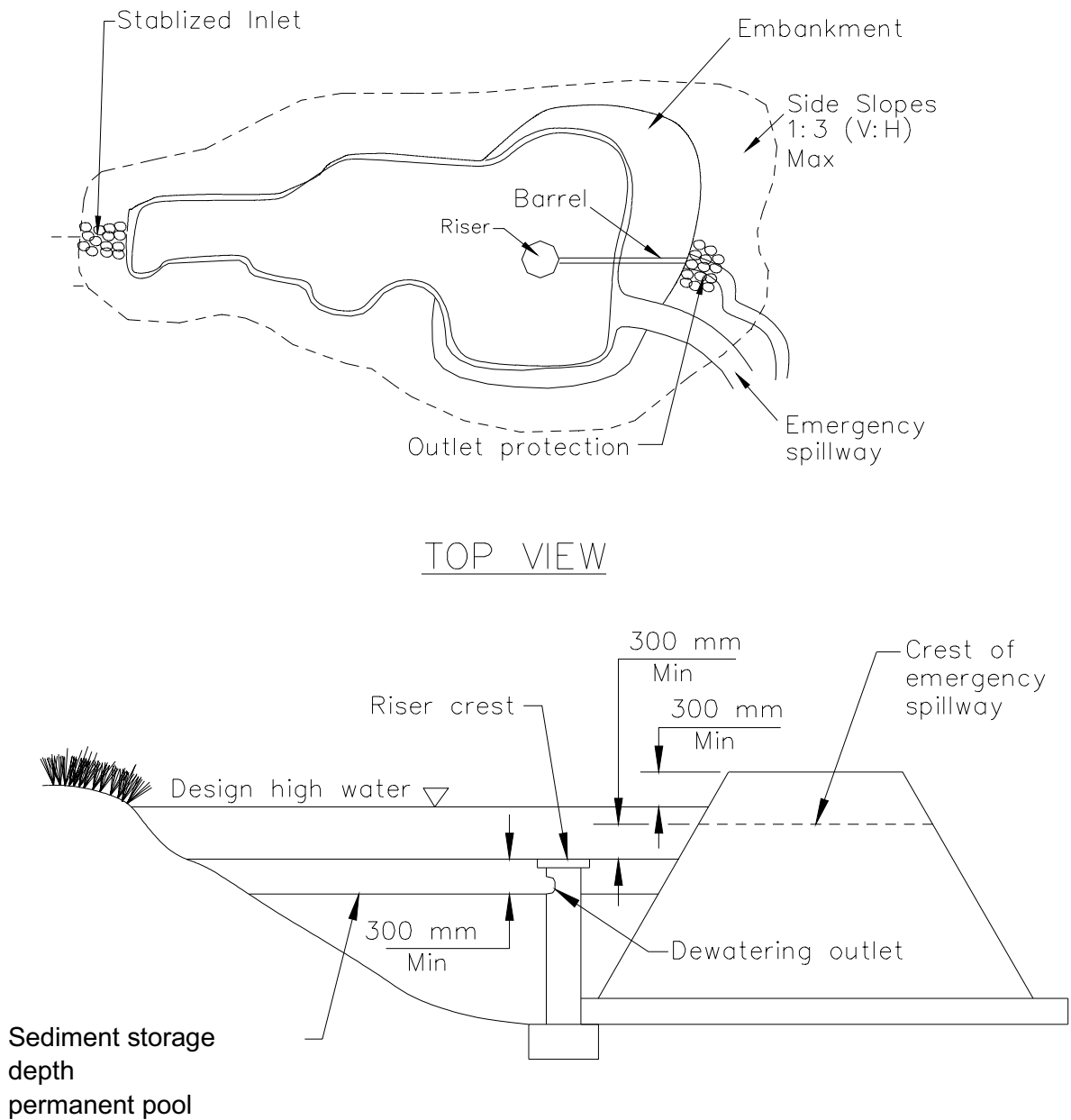
- Inspect sediment/desilting basins before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect at

least every 24 hours.

- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed, or as directed by the RE.
- Remove standing water from the basin within 72 hours after accumulation.
- Check inlet and outlet area for erosion and stabilize if required, or if directed by the RE.
- Remove accumulated sediment when its volume reaches one-third the volume of the sediment storage. Properly dispose of sediment and debris removed from the basin.
- Check fencing for damage and repair as needed or as directed by the RE.

# Sediment/Desilting Basin

**SC-2**

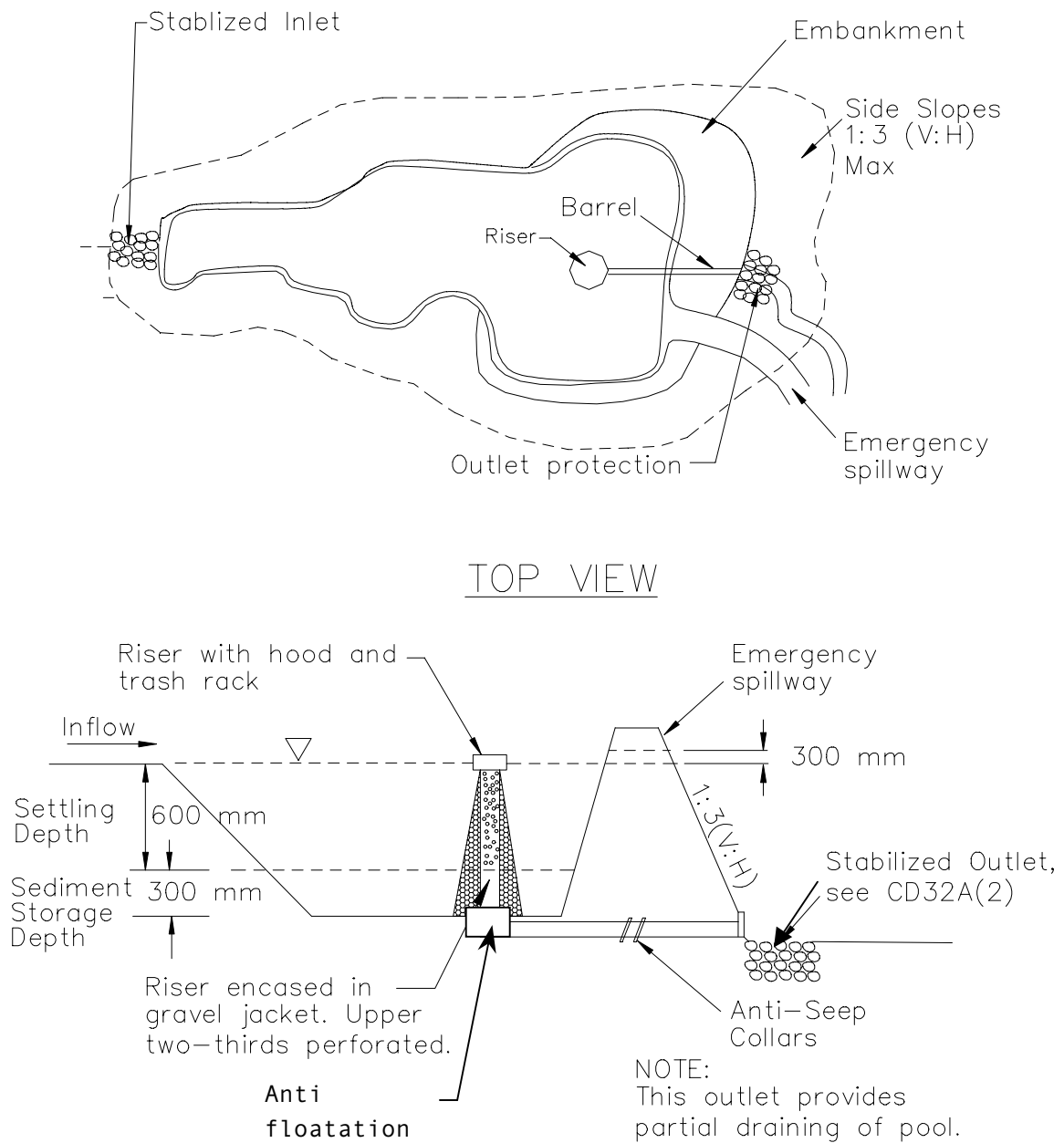


This outlet provides no drainage for permanent pool.

**FIGURE 1: SINGLE ORIFICE DESIGN**  
NOT TO SCALE

# Sediment/Desilting Basin

**SC-2**

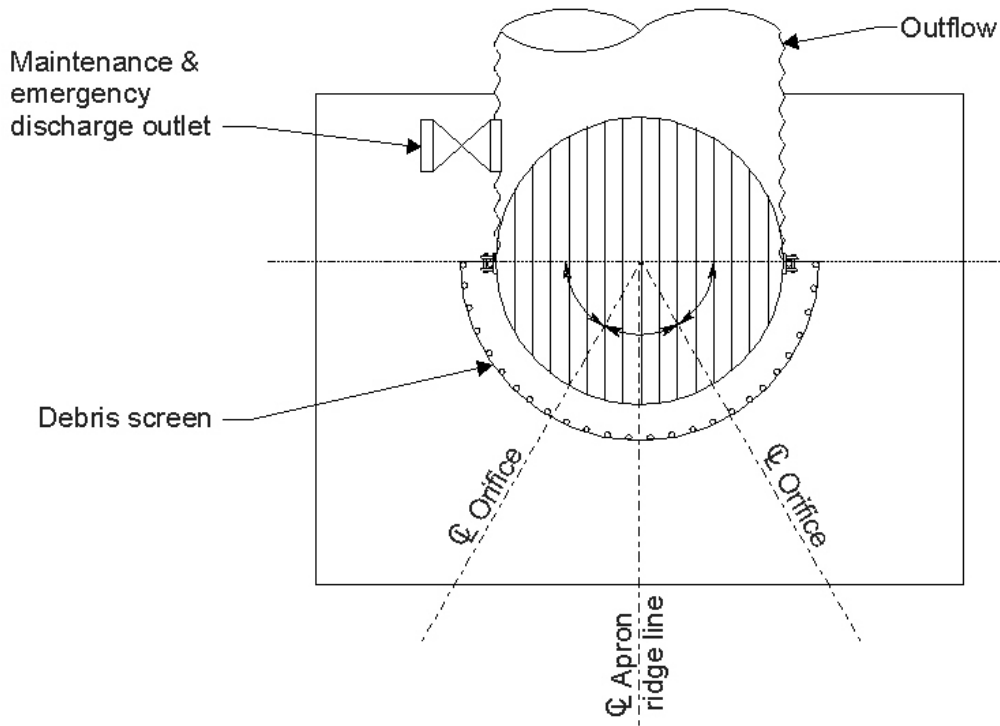


**FIGURE 2: MULTIPLE ORIFICE DESIGN**  
**NOT TO SCALE**

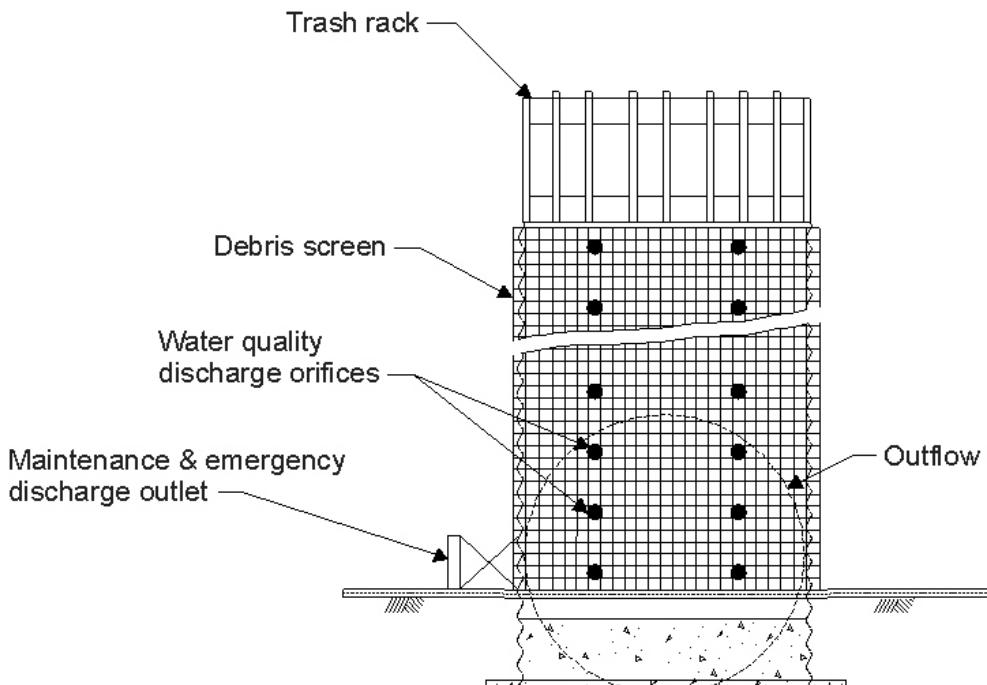
# Sediment/Desilting Basin

**SC-2**

Plan

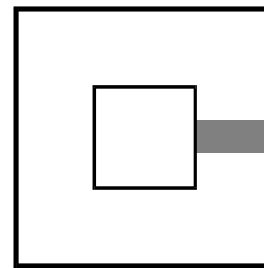
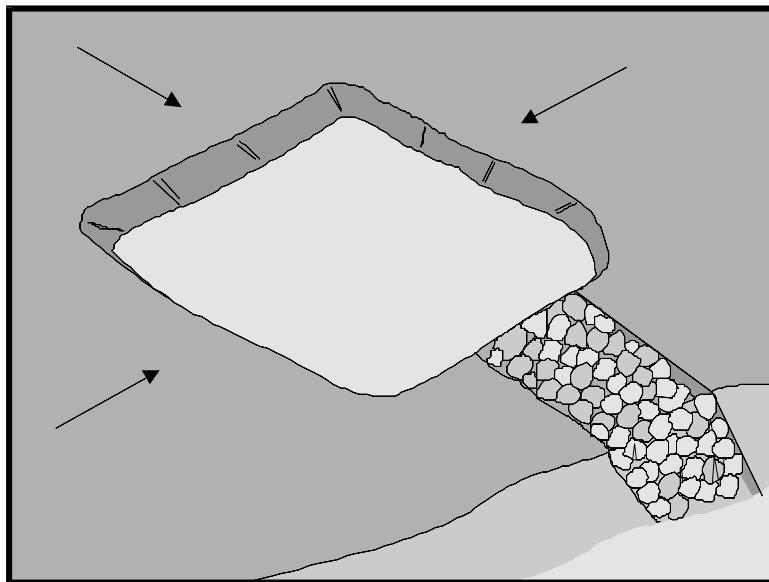


Profile



**FIGURE 3: MULTIPLE ORIFICE OUTLET RISER  
NOT TO SCALE**





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A sediment trap is a temporary containment area that allows sediment in collected storm water to settle out during infiltration or before the runoff is discharged through a stabilized spillway. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

- Appropriate Applications**
- Sediment traps may be used on construction projects where the drainage area is less than 2 ha (5 ac). Traps should be placed where sediment-laden storm water enters a storm drain or watercourse.
  - This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).
  - As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

- Limitations**
- Requires large surface areas to permit infiltration and settling of sediment.
  - Not appropriate for drainage areas greater than 2 ha (5 ac).
  - Only removes large and medium sized particles and requires upstream erosion control.
  - Attractive and dangerous to children, requiring protective fencing.
  - Not to be located in live streams.
  - Size may be limited by availability of right-of-way.

## Standards and Specifications

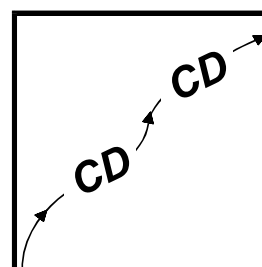
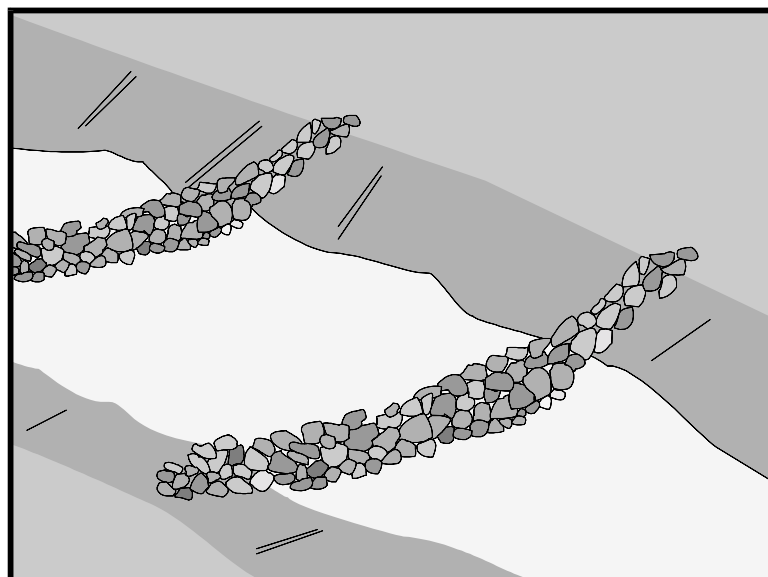
- Construct sediment traps prior to rainy season and construction activities.
- Trap shall be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap shall be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 130 m<sup>3</sup>/ha (67 yd<sup>3</sup>/ac) and 65 m<sup>3</sup>/ha (33 yd<sup>3</sup>/ac) of contributing drainage area, respectively, based on 12.7 mm (0.5 in) of runoff volume over a 24-hr period. Multiple traps and/or additional volume may be required to accommodate site specific rainfall and soil conditions.
- Traps with an impounding levee greater than 1.5 m (5 ft) tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 1000 cubic meters (35,300 cubic feet), shall be designed by a professional Civil Engineer registered with the state of California. The design must be submitted to the Resident Engineer (RE) for approval at least 7 days prior to the basin construction. The design shall include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- Earthwork shall be in accordance with Standard Specifications Section 19 – “Earthwork”. Contractor is specifically directed to Standard Specifications Sections 19-5 and 19-6 entitled, “Compaction” and “Embankment Construction,” respectively.
- Areas under embankments, structural works, and sediment traps shall be cleared and stripped of vegetation in accordance with Standard Specifications Section 16 – “Clearing and Grubbing.”
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing, in accordance with Standard Specifications Section 80 – “Fencing,” shall be provided to prevent unauthorized entry.

## Maintenance and Inspection

- Inspect sediment traps before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect sediment traps at least every 24 hours.
- If captured runoff has not completely infiltrated within 72 hours then the sediment trap must be dewatered.
- Inspect trap banks for embankment seepage and structural soundness.



- Inspect outlet structure and rock spillway for any damage or obstructions. Repair damage and remove obstructions as needed or as directed by the RE.
- Inspect outlet area for erosion and stabilize if required, or as directed by the RE.
- Remove accumulated sediment when the volume has reached one-third the original trap volume.
- Properly disposed of sediment and debris removed from the trap.
- Inspect fencing for damage and repair as needed or as directed by the RE.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment settlement. A check dam is a small device constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary product placed across a natural or man-made channel or drainage ditch.

- Appropriate Applications**
- Check dams may be installed:
    - In small open channels that drain 4 ha (10 ac) or less.
    - In steep channels where storm water runoff velocities exceed 1.5 m/s (4.9 ft/sec).
    - During the establishment of grass linings in drainage ditches or channels.
    - In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
  - This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

- Limitations**
- Not to be used in live streams.
  - Not appropriate in channels that drain areas greater than 4 ha (10 ac).
  - Not to be placed in channels that are already grass lined unless erosion is expected, as installation may damage vegetation.
  - Require extensive maintenance following high velocity flows.
  - Promotes sediment trapping, which can be re-suspended during subsequent storms or removal of the check dam.

## Standards and Specifications

- Not to be constructed from straw bales or silt fence.
- Check dams shall be placed at a distance and height to allow small pools to form behind them. Install the first check dam approximately 5 meters (16 ft) from the outfall device and at regular intervals based on slope gradient and soil type.
- For multiple check dam installation, backwater from downstream check dam shall reach the toe of the upstream dam.
- High flows (typically a 2-year storm or larger) shall safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams shall be removed when grass has matured sufficiently to protect the ditch or swale.
- Rock shall be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Fiber rolls may be used as check dams if approved by the RE or the Construction NPDES Coordinator. Refer to SC-5 “Fiber Rolls.”
- Gravel bags may be used as check dams with the following specifications:

### **Materials**

- **Bag Material:** Bags shall be either polypropylene, polyethylene or polyamide woven fabric, minimum unit weight 135 g/m<sup>2</sup> (four ounces per square yard), mullen burst strength exceeding 2,070 kPa (300 psi) in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
- **Bag Size:** Each gravel-filled bag shall have a length of 450 mm (18 in), width of 300 mm (12 in), thickness of 75 mm (3 in), and mass of approximately 15 kg (33 lb). Bag dimensions are nominal, and may vary based on locally available materials. Alternative bag sizes shall be submitted to the RE for approval prior to deployment.
- **Fill Material:** Fill material shall be between 10 mm and 20 mm (0.4 and 0.8 inch) in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials. The opening of gravel-filled bags shall be secured such that gravel does not escape. Gravel-filled bags shall be between 13 kg and 22 kg (28 and 48 lb) in mass. Fill material is subject to approval by the RE.

### **Installation**

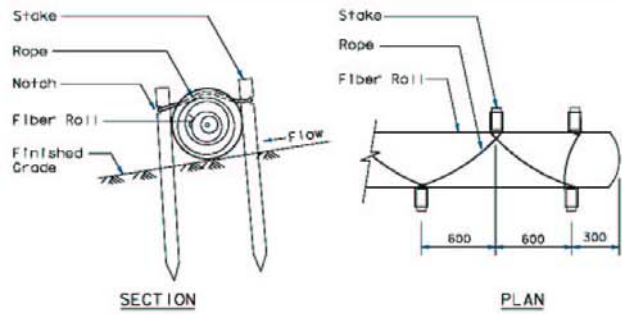
- Install along a level contour.
- Tightly abut bags and stack gravel bags using a pyramid approach.

Gravel bags shall not be stacked any higher than 1 meter (3.2 ft).

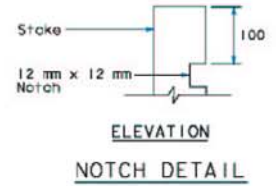
- Upper rows of gravel bags shall overlap joints in lower rows.
- Inspect check dams after each significant rainfall event. Repair damage as needed or as required by the RE.
- Remove sediment when depth reaches one-third of the check dam height.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed or when required by the RE.
- Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.

Maintenance and Inspection

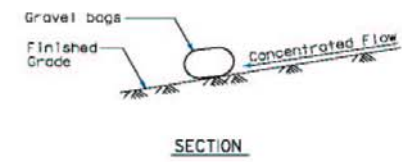
# Check Dams



**STAKING AND LASHING DETAIL**



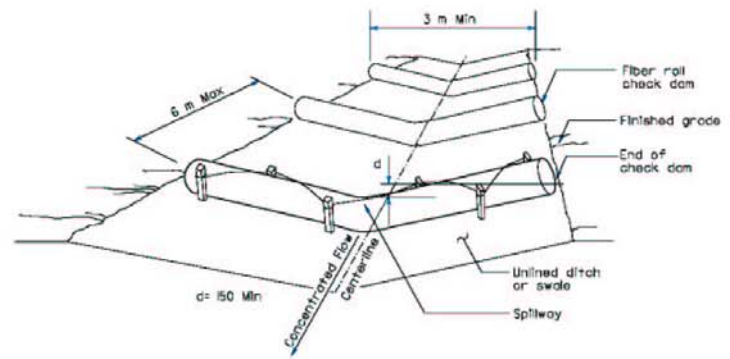
**NOTCH DETAIL**



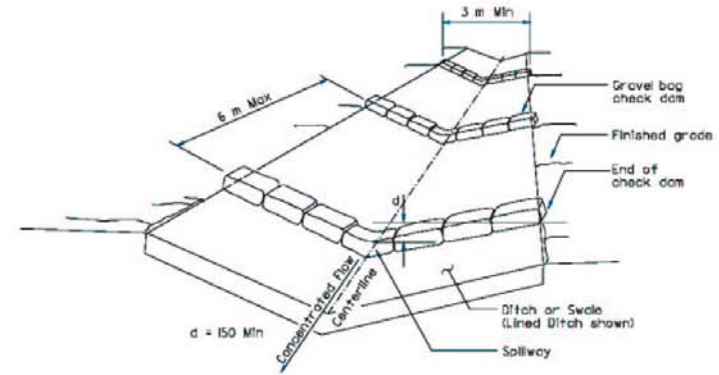
**SECTION**

**NOTE**  
 1. Spillway depth 'd' shall be maintained to prevent flanking of concentrated flow around the ends of check dam.

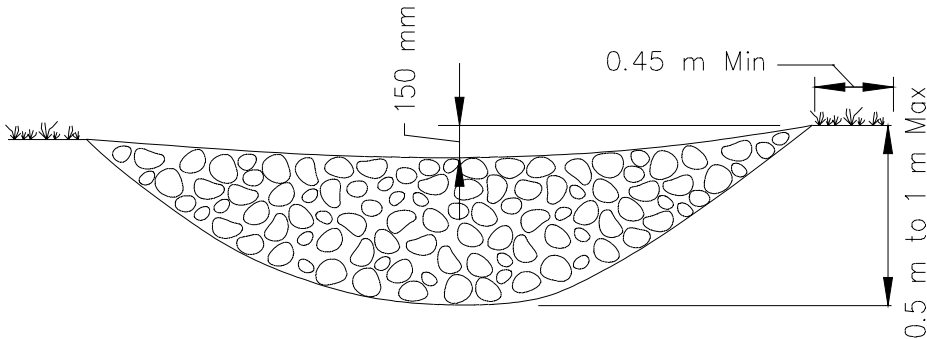
**TEMPORARY CHECK DAM (TYPE 2)**



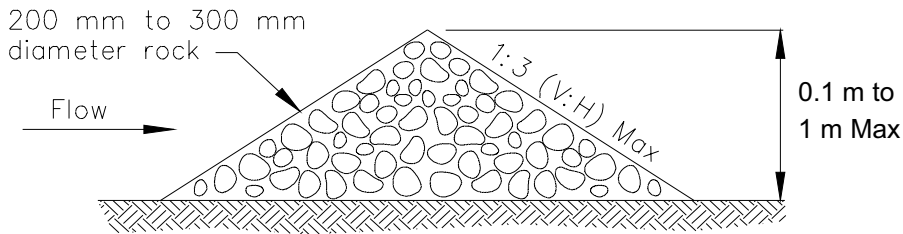
**PERSPECTIVE  
 TEMPORARY CHECK DAM (TYPE 1)**



**PERSPECTIVE  
 TEMPORARY CHECK DAM (TYPE 2)**



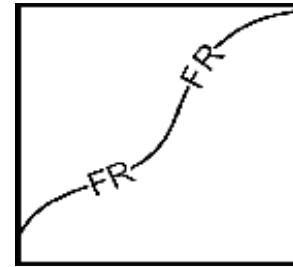
ELEVATION



TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM  
NOT TO SCALE

|



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A fiber roll consists of wood excelsior, rice or wheat straw, or coconut fibers that is rolled or bound into a tight tubular roll and placed on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. Fiber rolls may also be used for inlet protection and as check dams under certain situations.

- Appropriate Applications**
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
  - Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - Below the toe of exposed and erodible slopes.
  - Fiber rolls may be used as check dams in unlined ditches if approved by the Resident Engineer (RE) or the District Construction Storm Water Coordinator (refer to SC-4 “Check Dams”).
  - Fiber rolls may be used for drain inlet protection if approved by the RE or the District Construction Storm Water Coordinator (refer to SC-10 “Storm Drain Inlet Protection”).
  - Down-slope of exposed soil areas.
  - Around temporary stockpiles.
  - Along the perimeter of a project.

- Limitations
- Runoff and erosion may occur if fiber roll is not adequately trenched in.
  - Fiber rolls at the toe of slopes greater than 1:5 may require the use of 500 mm (20" diameter) or installations achieving the same protection (i.e., stacked smaller diameter fiber rolls, etc.).
  - Fiber rolls may be used for drainage inlet protection if they can be properly anchored.
  - Difficult to move once saturated.
  - Fiber rolls could be transported by high flows if not properly staked and trenched in.
  - Fiber rolls have limited sediment capture zone.
  - Do not use fiber rolls on slopes subject to creep, slumping, or landslide.

## Standards and Specifications

### ***Fiber Roll Materials***

- Fiber rolls shall be either:
  - (1) Prefabricated rolls.
  - (2) Rolled tubes of erosion control blanket.

### ***Assembly of Field Rolled Fiber Roll***

- Roll length of erosion control blanket into a tube of minimum 200 mm (8 in) diameter.
- Bind roll at each end and every 1.2 m (4 ft) along length of roll with jute-type twine.

### ***Installation***

- Slope inclination of 1:4 or flatter: fiber rolls shall be placed on slopes 6.0 m apart.
- Slope inclination of 1:4 to 1:2: fiber rolls shall be placed on slopes 4.5 m apart.
- Slope inclination 1:2 or greater: fiber rolls shall be placed on slopes 3.0 m apart.
- Stake fiber rolls into a 50 to 100 mm (2 to 4 in) trench.



- Drive stakes at the end of each fiber roll and spaced 600 mm (2 ft) apart if Type 2 installation is used (refer to Page 4). Otherwise, space stakes 1.2 m (4 ft) maximum on center if installed as shown on Pages 5 and 6.
- Use wood stakes with a nominal classification of 19 by 19 mm (3/4 by 3/4 in), and minimum length of 600 mm (24 in).
- If more than one fiber roll is placed in a row, the rolls shall be overlapped; not abutted.

### **Removal**

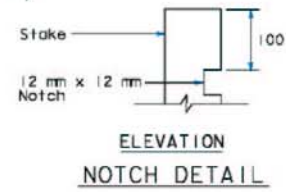
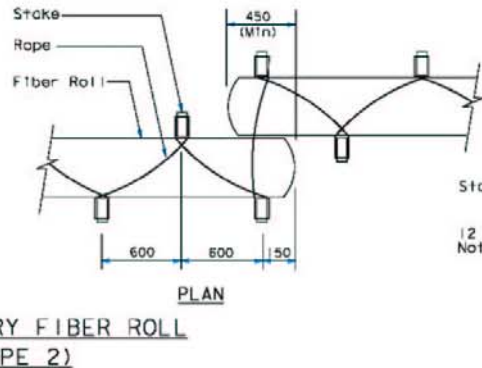
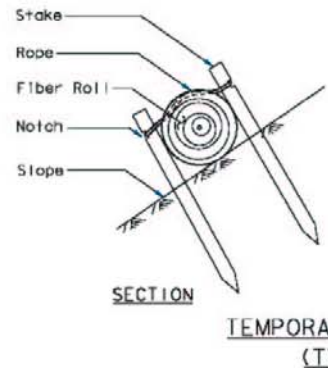
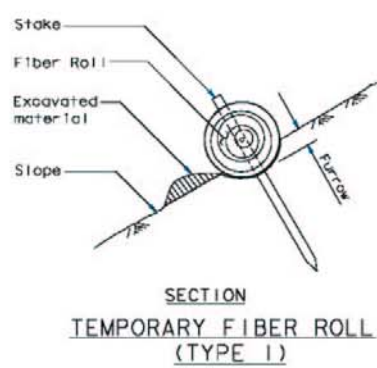
- Fiber rolls are typically left in place.
- If fiber rolls are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

### **Maintenance and Inspection**

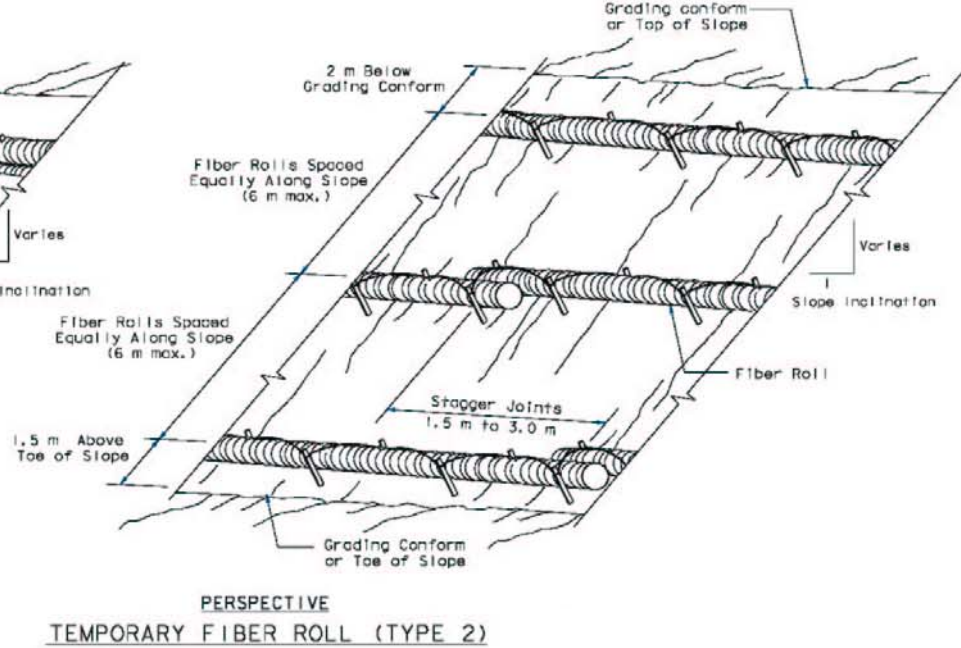
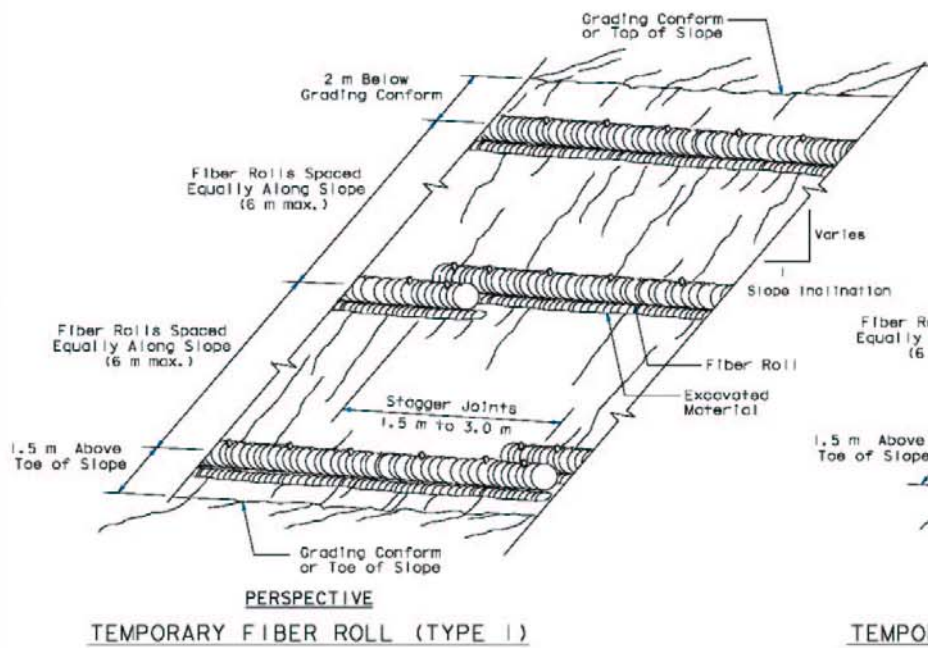
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- Inspect fiber rolls when rain is forecast. Perform maintenance as needed or as required by the RE.
- Inspect fiber rolls following rainfall events and at least daily during prolonged rainfall. Perform maintenance as needed or as required by the RE.
- Maintain fiber rolls to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches three quarters (3/4) of the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.

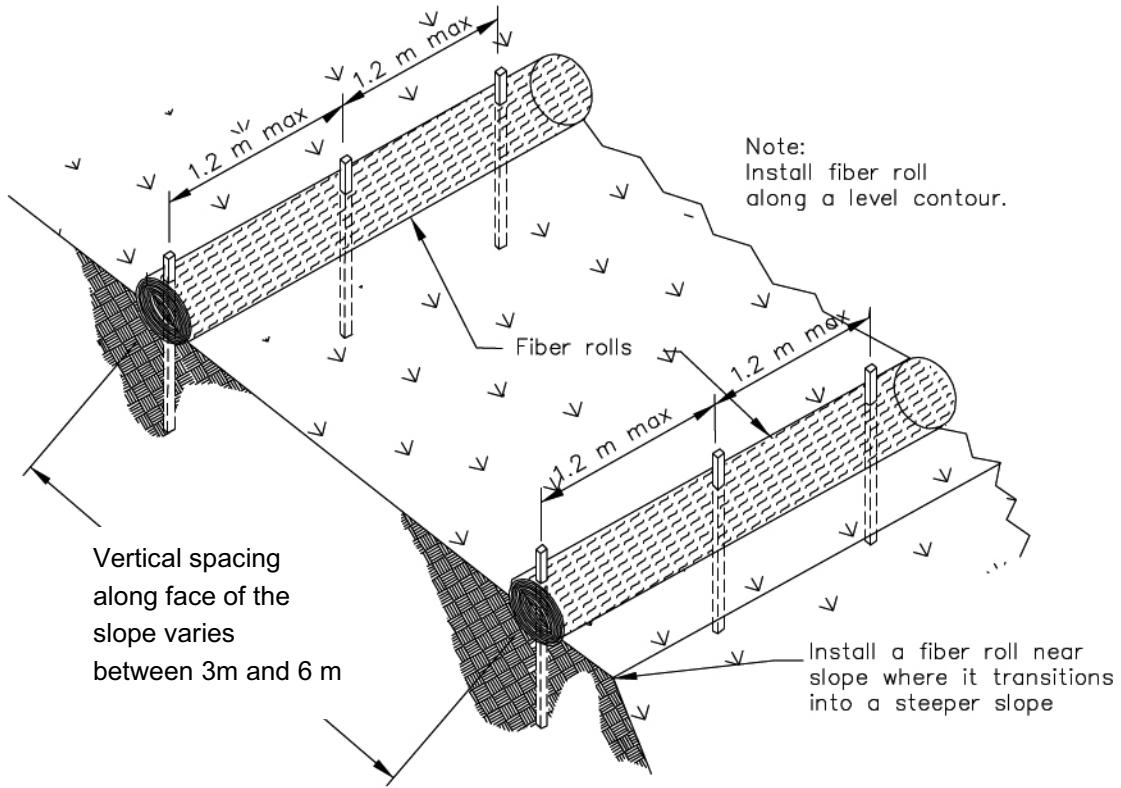
# Fiber Rolls

**SC-5**

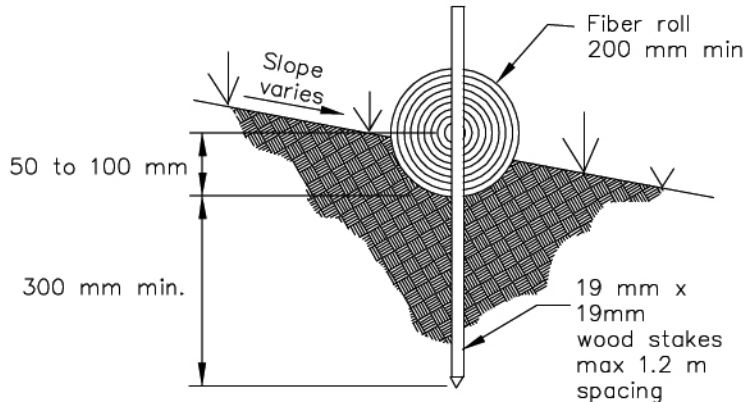


**NOTE**  
1. Temporary fiber roll spacing varies depending upon slope inclination.

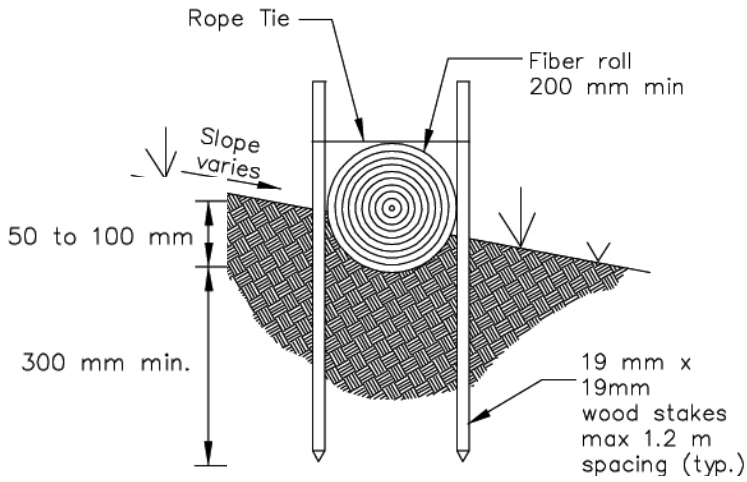
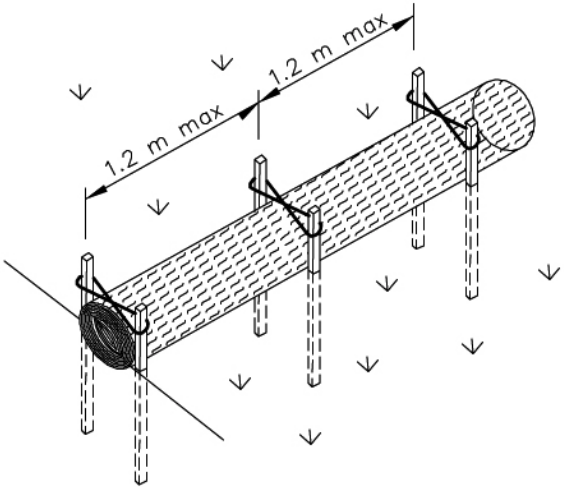




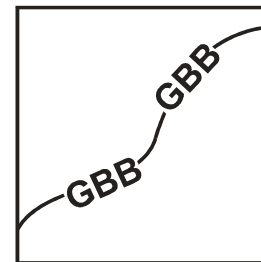
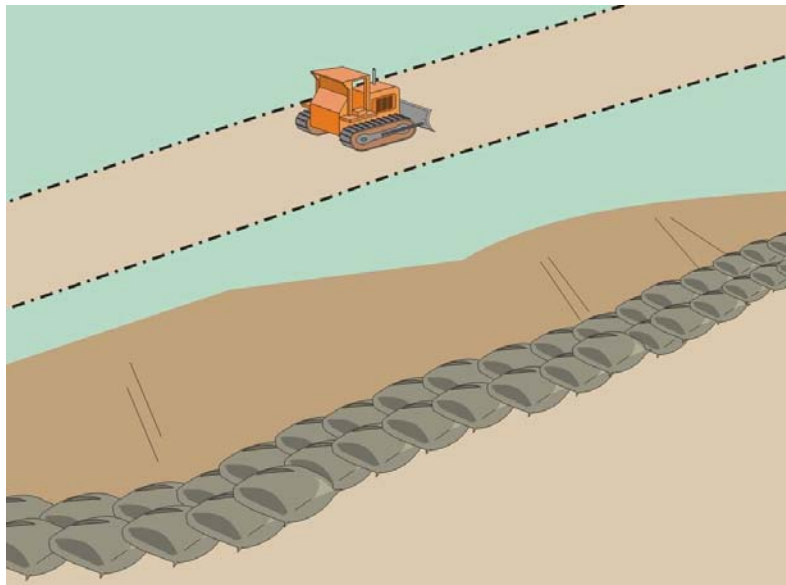
TYPICAL FIBER ROLL INSTALLATION  
N.T.S.



ENTRENCHMENT DETAIL  
N.T.S.



OPTIONAL ENTRENCHMENT DETAIL  
N.T.S.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A gravel bag berm consists of a single row of gravel bags that are installed end to end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide some sediment removal. Gravel bags can be used where flows are moderately concentrated, such as ditches, swales, and storm drain inlets (see BMP SC-10, Storm Drain Inlet Protection) to divert and/or detain flows.

- Appropriate Applications**
- BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
  - Along streams and channels.
  - Below the toe of exposed and erodible slopes.
  - Down slope of exposed soil areas.
  - Around stockpiles.
  - Across channels to serve as a barrier for utility trenches or provide a temporary channel crossing for construction equipment, to reduce stream impacts.
  - Parallel to a roadway to keep sediment off paved areas.
  - At the top of slopes to divert roadway runoff away from disturbed slopes.
  - Along the perimeter of a site.
  - To divert or direct flow or create a temporary sediment basin.
  - During construction activities in stream beds when the contributing drainage

area is less than 2 ha (5 ac).

- When extended construction period limits the use of either silt fences or straw bale barriers.
- When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- At grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

## Limitations

- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Limited durability for long term projects.
- When used to detain concentrated flows, maintenance requirements increase.

## Standards and Specifications

### **Materials**

- **Bag Material:** Bags shall be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight 135 g/m<sup>2</sup> (four ounces per square yard), mullen burst strength exceeding 2,070 kPa (300 psi) in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
- **Bag Size:** Each gravel-filled bag shall have a length of 450 mm (18 in), width of 300 mm (12 in), thickness of 75 mm (3 in), and mass of approximately 15 kg (33 lb). Bag dimensions are nominal, and may vary based on locally available materials. Alternative bag sizes shall be submitted to the RE for approval prior to deployment.
- **Fill Material:** Gravel shall be between 10 mm and 20 mm (0.4 and 0.8 inch) in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials. The opening of gravel-filled bags shall be between 13 kg and 22 kg (28 and 48 lb) in mass. Fill material is subject to approval by the RE.

### **Installation**

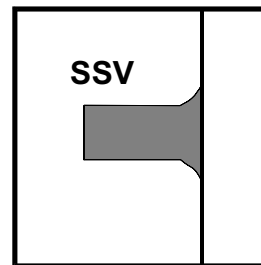
- When used as a linear control for sediment removal:
  - Install along a level contour.
  - Turn ends of gravel bag row up slope to prevent flow around the ends.
  - Generally, gravel bag barriers shall be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment

control.

- When used for concentrated flows:
  - Stack gravel bags to required height using a pyramid approach.
  - Upper rows of gravel bags shall overlap joints in lower rows.
- Construct gravel bag barriers with a set-back of at least 1m from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the gravel bag barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.
- Requires Certificate of Compliance per Standard Specifications 6-1.07.

## Maintenance and Inspection

- Inspect gravel bag berms before and after each rainfall event, and weekly throughout the rainy season.
- Reshape or replace gravel bags as needed, or as directed by the RE.
- Repair washouts or other damages as needed, or as directed by the RE.
- Inspect gravel bag berms for sediment accumulations and remove sediments when accumulation reaches one-third of the berm height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Remove gravel bag berms when no longer needed. Remove sediment accumulations and clean, re-grade, and stabilize the area.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Practices to remove tracked sediment to prevent the sediment from entering a storm drain or watercourse.

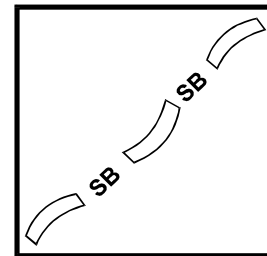
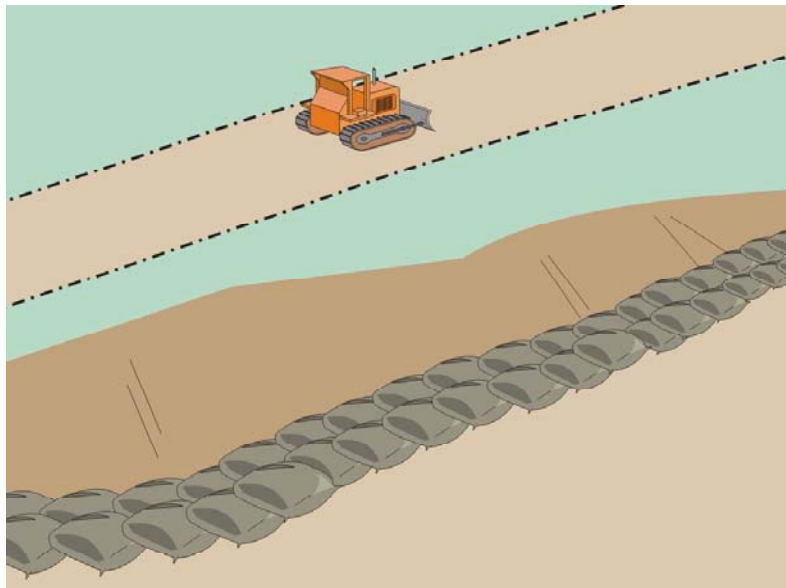
**Appropriate Applications** These practices are implemented anywhere sediment is tracked from the project site onto public or private paved roads, typically at points of ingress/egress.

**Limitations** Sweeping and vacuuming may not be effective when soil is wet or muddy.

- Standards and Specifications**
- Kick brooms or sweeper attachments shall not be used.
  - Inspect potential sediment tracking locations daily.
  - Visible sediment tracking shall be swept and/or vacuumed daily.
  - If not mixed with debris or trash, consider incorporating the removed sediment back into the project.

- Maintenance and Inspection**
- Inspect ingress/egress access points daily and sweep tracked sediment as needed, or as required by the Resident Engineer (RE).
  - Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
  - Adjust brooms frequently; maximize efficiency of sweeping operations.
  - After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite in conformance with the provisions in Standard Specifications Section 7-1.13 .





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag barriers allow sediment to settle from runoff before water leaves the construction site.

- Appropriate Applications**
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).
  - Along the perimeter of a site.
  - Along streams and channels.
  - Below the toe of exposed and erodible slopes.
  - Down slope of exposed soil areas.
  - Around stockpiles.
  - Across channels to serve as a barrier for utility trenches or provide a temporary channel crossing for construction equipment, to reduce stream impacts.
  - Parallel to a roadway to keep sediment off paved areas.
  - At the top of slopes to divert roadway runoff away from disturbed slopes.
  - To divert or direct flow or create a temporary sediment/desilting basin.
  - During construction activities in stream beds when the contributing drainage area is less than 2 ha (5 ac).

- When extended construction period limits the use of either silt fences or straw bale barriers.
- Along the perimeter of vehicle and equipment fueling and maintenance areas or chemical storage areas.
- To capture and detain non-storm water flows until proper cleaning operations occur.
- When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- To temporarily close or continue broken, damaged or incomplete curbs.

## Limitations

- Limit the drainage area upstream of the barrier to 2 ha (5 ac).
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

## Standards and Specifications

### **Materials**

- Sandbag Material: Sandbag shall be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight 135 g/m<sup>2</sup> (four ounces per square yard), mullen burst strength exceeding 2,070 kPa (300 psi) in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not acceptable.
- Sandbag Size: Each sand-filled bag shall have a length of 450 mm (18 in), width of 300 mm (12 in), thickness of 75 mm (3 in), and mass of approximately 15 kg (33 lb.). Bag dimensions are nominal, and may vary based on locally available materials. Alternative bag sizes shall be submitted to the RE for approval prior to deployment.
- Fill Material: All sandbag fill material shall be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material, conforming to the provisions in Standard Specifications Section 68-1.025 "Permeable Material". The requirements for the Durability Index and Sand Equivalent do not apply. Fill material is subject to approval by the RE.

## ***Installation***

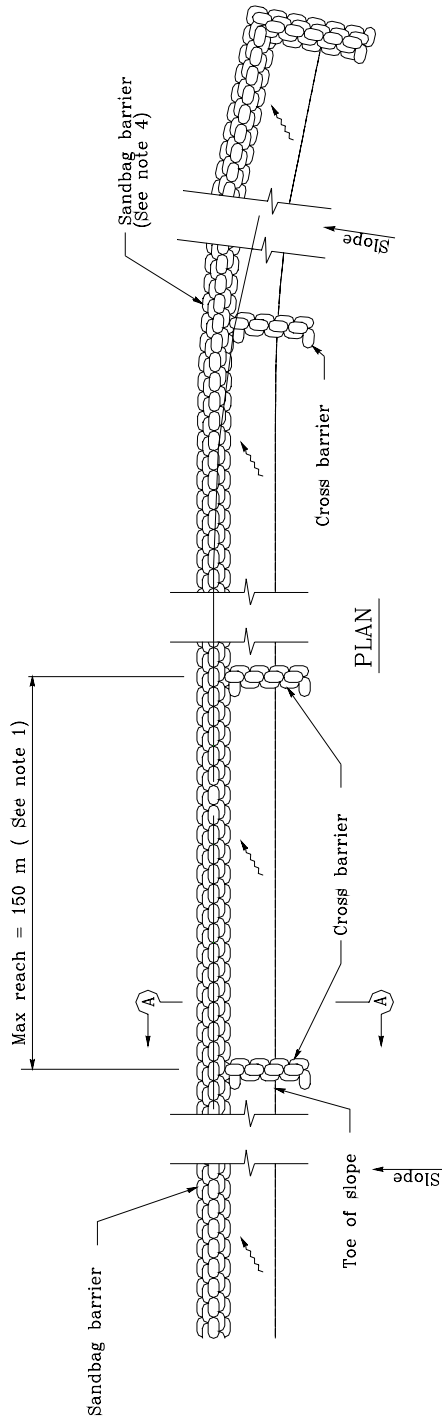
- When used as a linear sediment control:
  - Install along a level contour.
  - Turn ends of sandbag row up slope to prevent flow around the ends.
  - Generally, sandbag barriers shall be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.
  - Install as shown in Pages 4 and 5 of this BMP.
- Construct sandbag barriers with a set-back of at least 1m (3 ft) from the toe of a slope. Where it is determined to be not practical due to specific site conditions, the sandbag barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

## **Maintenance and Inspection**

- Inspect sandbag barriers before and after each rainfall event, and weekly throughout the rainy season.
- Reshape or replace sandbags as needed, or as directed by the RE.
- Repair washouts or other damages as needed, or as directed by the RE.
- Inspect sandbag barriers for sediment accumulations and remove sediments when accumulation reaches one-third the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilized the area.

# Sandbag Barrier

**SC-8**



TEMPORARY LINEAR SEDIMENT BARRIER (TYPE SANDBAG)



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

## TEMPORARY LINEAR SEDIMENT BARRIER (TYPE SANDBAG)

NO SCALE

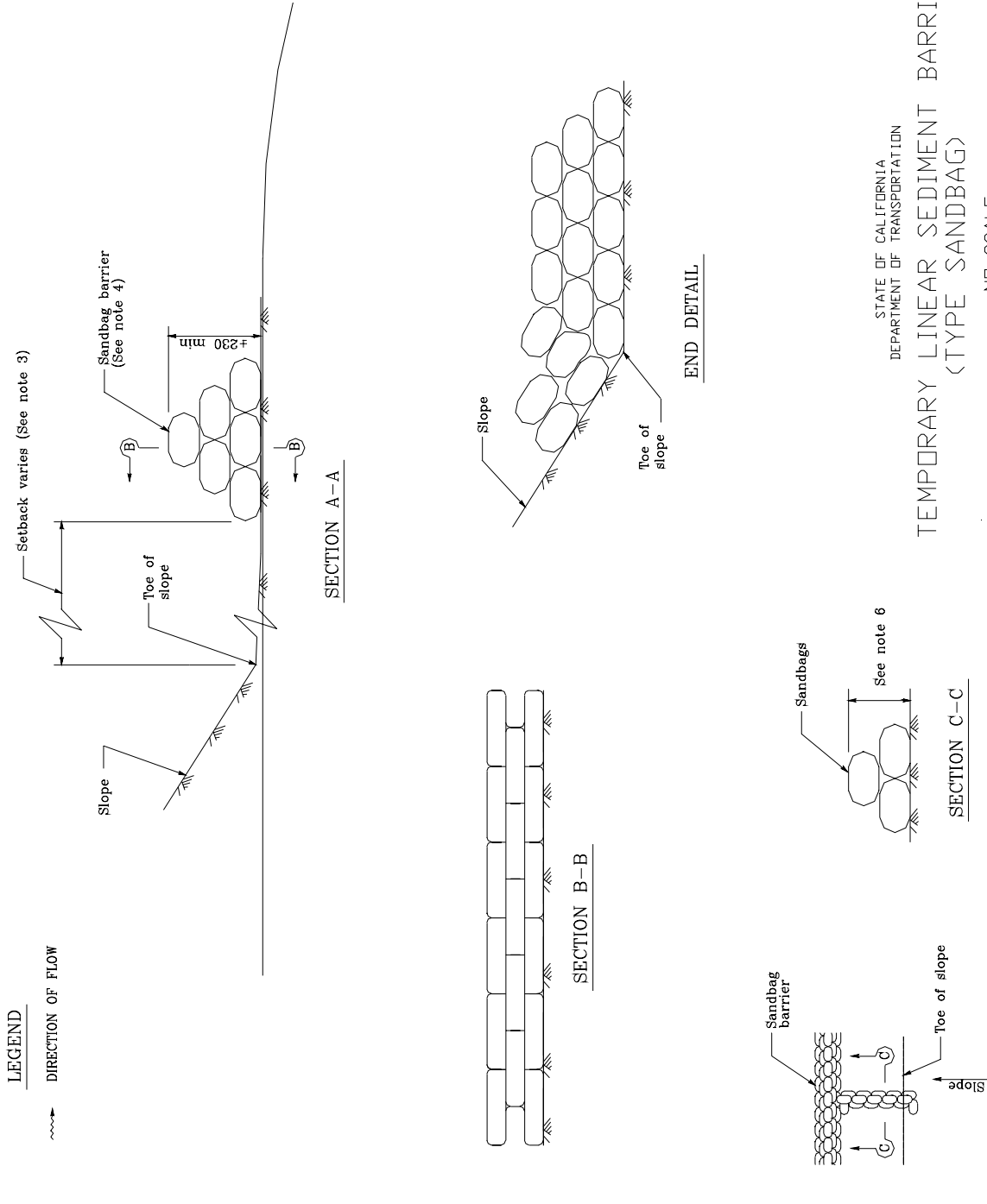
ALL DIMENSIONS ARE IN  
MILLIMETERS UNLESS OTHERWISE SHOWN

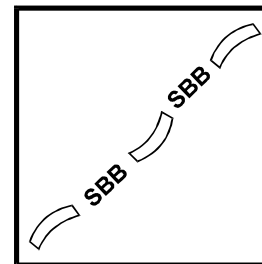
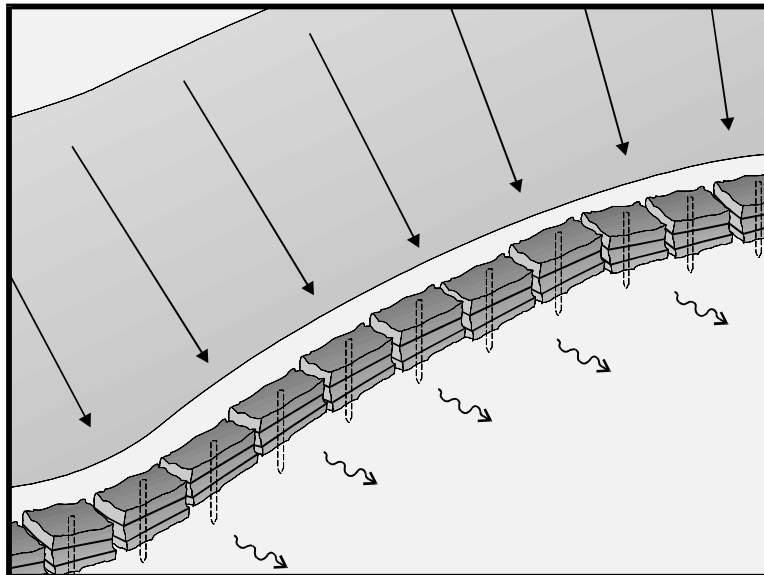
### NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 150 m.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.

# Sandbag Barrier

**SC-8**





Standard Symbol

**BMP Objectives**

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose**

A straw bale barrier is a temporary linear sediment barrier consisting of straw bales, designed to intercept and slow sediment-laden sheet flow runoff. Straw bale barriers allow sediment to settle from runoff before water leaves the construction site.

**Appropriate Applications**

- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).
- Along the perimeter of a site.
- Along streams and channels.
- Below the toe of exposed and erodible slopes.
- Down slope of exposed soil areas.
- Around stockpiles.
- Across minor swales or ditches with small catchments.
- Around above grade type temporary concrete washouts (See BMP WM-8, “Concrete Waste Management”).
- Parallel to a roadway to keep sediment off paved areas.

- Limitations
- Installation can be labor intensive.
  - Straw bale barriers are maintenance intensive.
  - Degraded straw bales may fall apart when removed or left in place for extended periods.
  - Can't be used on paved surfaces.
  - Not to be used for drain inlet protection.
  - Shall not be used in areas of concentrated flow.
  - Can be an attractive food source for some animals.
  - May introduce undesirable non-native plants to the area.

Standards and Specifications

**Materials**

- **Straw Bale Material:** Straw bale materials shall conform to the provisions in Standard Specifications Section 20-2.06, "Straw."
- **Straw Bale Size:** Each straw bale shall be a minimum of 360 mm (14 in) wide, 450 mm (18 in) in height, 900 mm (36 in) in length and shall have a minimum mass of 23 kg (51 lb.) The straw bale shall be composed entirely of vegetative matter, except for the binding material.
- **Bale Bindings:** Bales shall be bound by either steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding shall not be used. Baling wire shall be a minimum diameter of 1.57 mm (0.06 inch). Nylon or polypropylene string shall be approximately 2 mm (0.08 inch) in diameter with a breaking strength of 360 N.
- **Stakes:** Wood stakes shall be commercial quality lumber of the size and shape shown on the plans. Each stake shall be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement shall be equal to a number four designation or greater. End protection shall be provided for any exposed bar reinforcement.

**Installation**

- Limit the drainage area upstream of the barrier to 0.3 ha/100 m (0.25 ac/100ft) or barrier.
- Limit the slope length draining to the straw bale barrier to 30 m (100 ft.)

- Slopes of 2:100 (V:H) (2%) or flatter are preferred. If the slope exceeds 1:10 (V:H) (10%), the length of slope upstream of the barrier must be less than 15 m (50 ft).
- Install straw bale barriers along a level contour, with the last straw bale turned up slope.
- Straw bales must be installed in a trench and tightly abut adjacent bales.
- Construct straw bale barriers with a set-back of at least 1 m (3 ft) from the toe of a slope. Where it is determined to be not practical due to specific site conditions, the straw bale barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practical.
- See pages 4 and 5 of this BMP for installation detail.

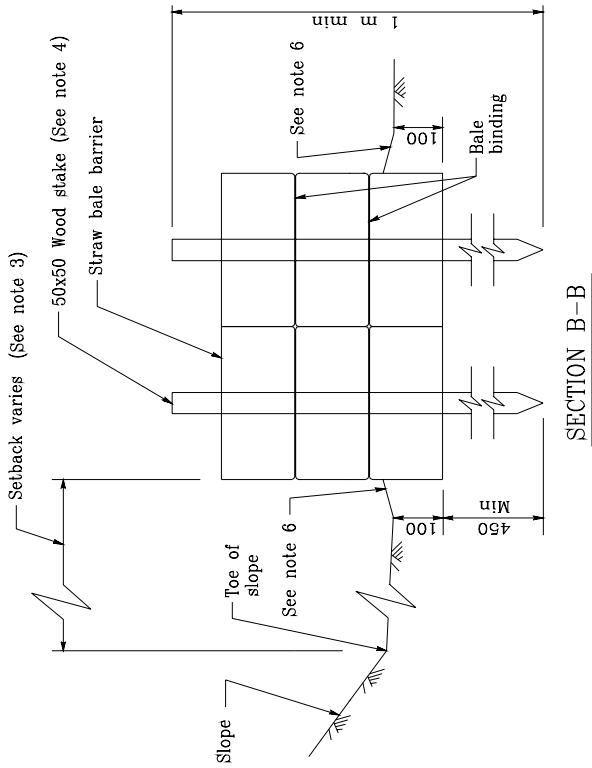
## Maintenance and Inspection

- Inspect straw bale barriers before and after each rainfall event, and weekly throughout the rainy season.
- Inspect straw bale barriers for sediment accumulations and remove sediment when depth reaches one-third the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Replace or repair damage bales as needed or as directed by the RE.
- Repair washouts or other damages as needed or as directed by the RE.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

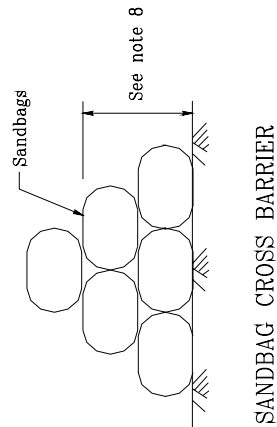


# Straw Bale Barrier

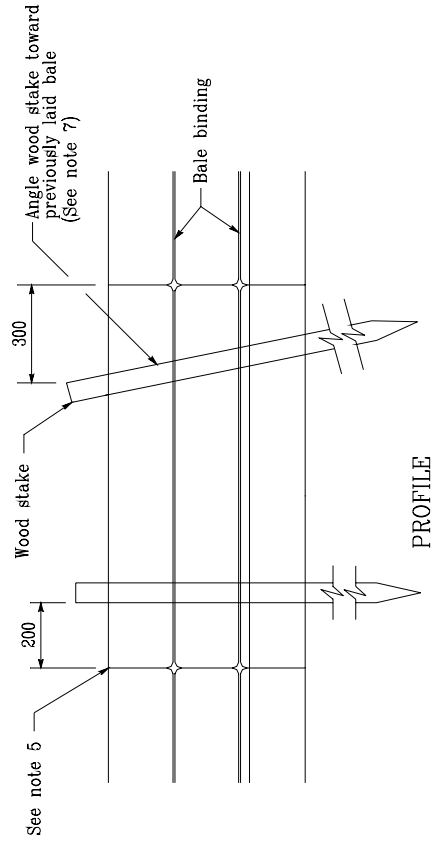
**SC-9**



SECTION B-B



SANDBAG CROSS BARRIER



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION  
TEMPORARY LINEAR SEDIMENT BARRIER  
(TYPE STRAW BALE)  
NO SCALE  
ALL DIMENSIONS ARE IN  
MILLIMETERS UNLESS OTHERWISE SHOWN

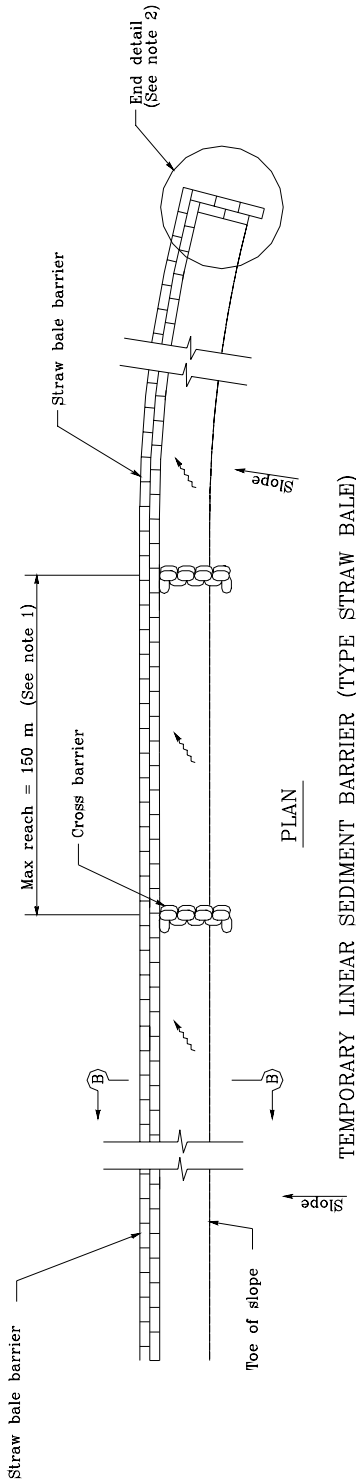
**LEGEND**

DIRECTION OF FLOW



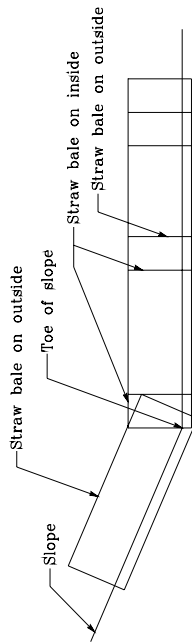
# Straw Bale Barrier

**SC-9**



**NOTES**

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 150 m.
2. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales.
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Cross barriers shall be a min of 1/3 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers shall be offset to eliminate gaps.



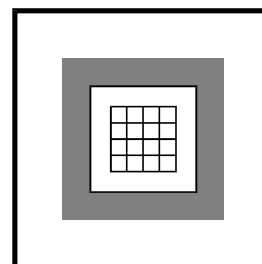
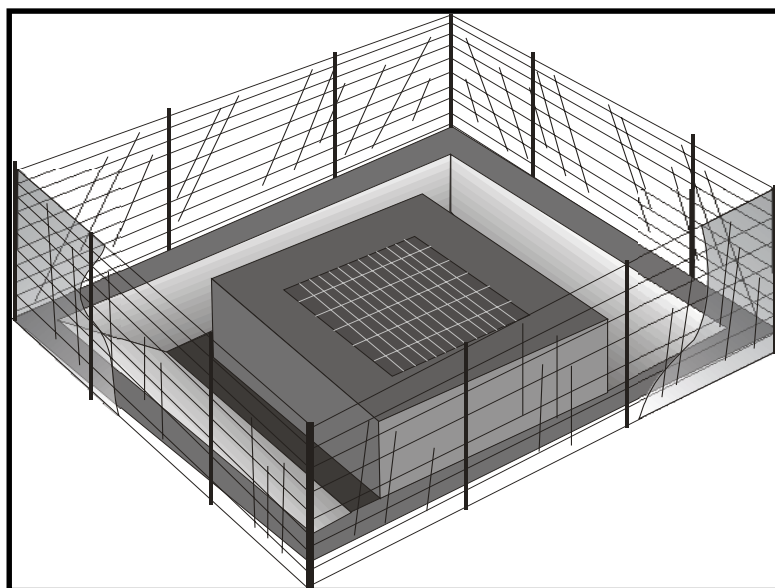
STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

TEMPORARY LINEAR SEDIMENT BARRIER  
(TYPE STRAW BALE)

NO SCALE

ALL DIMENSIONS ARE IN  
MILLIMETERS UNLESS OTHERWISE SHOWN





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

Devices used at storm drain inlets that are subject to runoff from construction activities to detain and/or to filter sediment-laden runoff to allow sediment to settle and/or to filter sediment prior to discharge into storm drainage systems or watercourses.

### Appropriate Applications

- Where ponding will not encroach into highway traffic.
- Where sediment laden surface runoff may enter an inlet.
- Where disturbed drainage areas have not yet been permanently stabilized.
- Where the drainage area is 0.4 ha (1 ac) or less.
- Appropriate during wet and snow-melt seasons.

### Limitations

- Requires an adequate area for water to pond without encroaching upon traveled way and should not present itself to be an obstacle to oncoming traffic.
- May require other methods of temporary protection to prevent sediment-laden storm water and non-storm water discharges from entering the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other on-site sediment trapping techniques (e.g. check dams) in conjunction with inlet protection.
- Frequent maintenance is required.
- For drainage areas larger than 0.4 ha (1 ac), runoff shall be routed to a sediment trapping device designed for larger flows. See BMPs SC-2, “Sediment/Desilting Basin,” and SC-3 “Sediment Trap.”

- Filter fabric fence inlet protection is appropriate in open areas that are subject to sheet flow and for flows not exceeding 0.014 m<sup>3</sup>/s (0.5 cfs).
- Gravel bag barriers for inlet protection are applicable when sheet flows or concentrated flows exceed 0.014 m<sup>3</sup>/s (0.5 cfs), and it is necessary to allow for overtopping to prevent flooding.
- Fiber rolls and foam barriers are not appropriate for locations where they cannot be properly anchored to the surface.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capability is needed.

## Standards and Specifications

Identify existing and/or planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed, and which method to use.

### **Methods and Installation**

- **DI Protection Type 1 - Filter Fabric Fence** - The filter fabric fence (Type 1) protection is illustrated on Page 5. Similar to constructing a silt fence. See BMP SC-1, "Silt Fence." Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
- **DI Protection Type 2 - Excavated Drop Inlet Sediment Trap** - The excavated drop inlet sediment trap (Type 2) is illustrated in Page 6. Similar to constructing a temporary silt fence, See BMP SC-1, "Silt Fence." Size excavated trap to provide a minimum storage capacity calculated at the rate of 130 m<sup>3</sup>/ha (67 yd<sup>3</sup>/ac) of drainage area.
- **DI Protection Type 3 - Gravel bag** - The gravel bag barrier (Type 3) is illustrated in Page 7. Flow from a severe storm shall not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with BMP SC-6, "Gravel Bag Berm." Gravel bags shall be used due to their high permeability.
- **DI Protection Type 4 - Foam Barriers and Fiber Rolls** - Foam barrier or fiber roll (Type 4) is placed around the inlet and keyed and anchored to the surface. Foam barriers and fiber rolls are intended for use as inlet protection where the area around the inlet is unpaved and the foam barrier or fiber roll can be secured to the surface. RE or Construction Storm Water Coordinator approval is required.

## Maintenance and Inspection

### **General**

- Inspect all inlet protection devices before and after every rainfall event, and weekly during the rest of the rainy season. During extended rainfall events, inspect inlet protection devices at least once every 24 hours.

- Inspect the storm drain inlet after severe storms in the rainy season to check for bypassed material.
- Remove all inlet protection devices within thirty days after the site is stabilized, or when the inlet protection is no longer needed.
  - Bring the disturbed area to final grade and smooth and compact it. Appropriately stabilize all bare areas around the inlet.
  - Clean and re-grade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

### ***Requirements by Method***

#### ■ ***Type 1 - Filter Fabric Fence***

- This method shall be used for drain inlets requiring protection in areas where finished grade is established and erosion control seeding has been applied or is pending.
- Make sure the stakes are securely driven in the ground and are structurally sound (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.
- Replace or clean the fabric when the fabric becomes clogged with sediment. Make sure the fabric does not have any holes or tears. Repair or replace fabric as needed or as directed by the RE.
- At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications Section 7-1.13.

#### ■ ***Type 2 – Excavated Drop Inlet Sediment Trap***

- This method may be used for drain inlets requiring protection in areas that have been cleared and grubbed, and where exposed soil areas are subject to grading.
- Remove sediment from basin when the volume of the basin has been reduced by one-half.

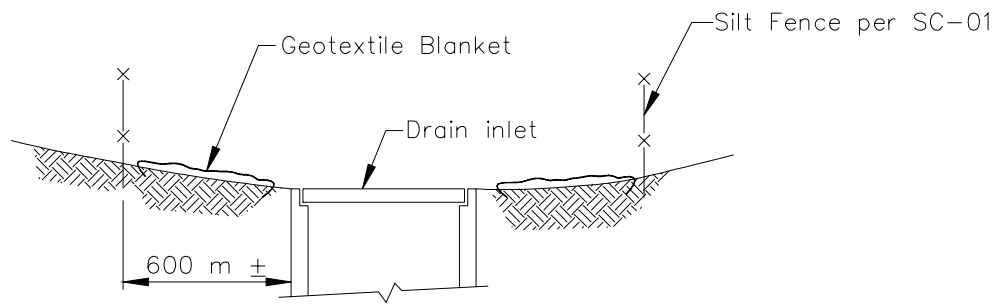
#### ■ ***Type 3 - Gravel Bag Barrier***

- This method may be used for drain inlets surrounded by AC or paved surfaces.
- Inspect bags for holes, gashes, and snags.

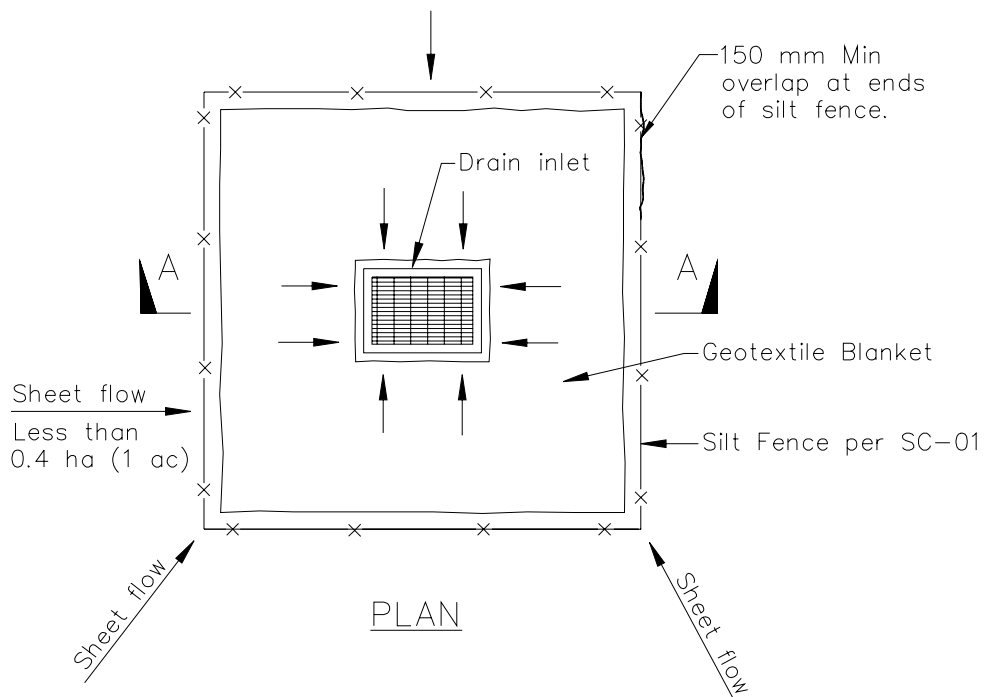
- Check gravel bags for proper arrangement and displacement. Remove the sediment behind the barrier when it reaches one-third the height of the barrier. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications Section 7-1.13.
- ***Type 4 Foam Barriers and Fiber Rolls***
  - This method may be used for drain inlets requiring protection in areas that have been cleared and grubbed, and where exposed soil areas subject to grading. RE or Construction Storm Coordinator approval is required.
  - Check foam barrier or fiber roll for proper arrangement and displacement. Remove the sediment behind the barrier when it reaches one-third the height of the barrier. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.

# Storm Drain Inlet Protection

**SC-10**



SECTION A-A



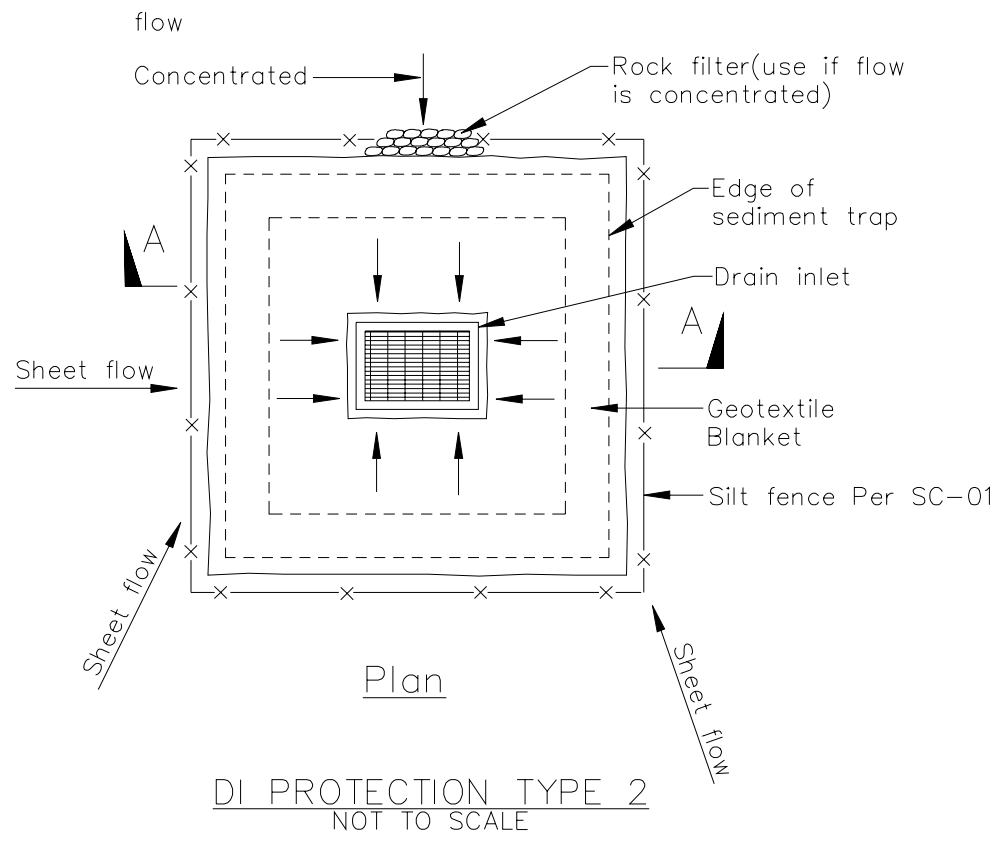
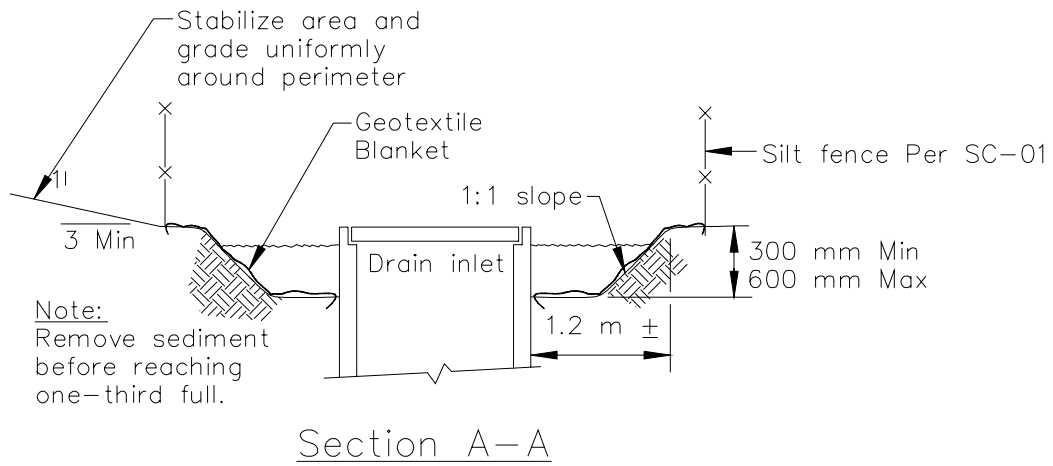
PLAN

DI PROTECTION TYPE 1  
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.

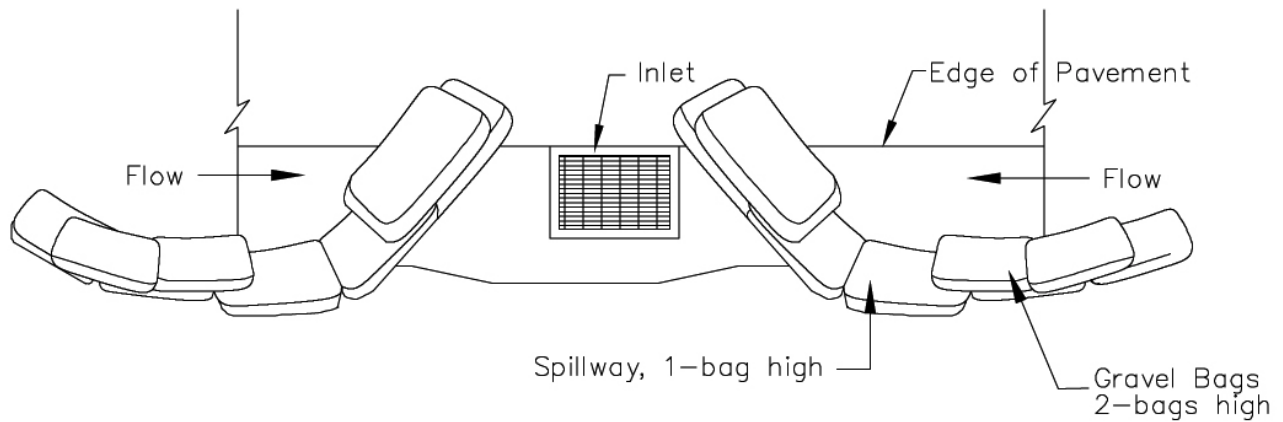
# Storm Drain Inlet Protection



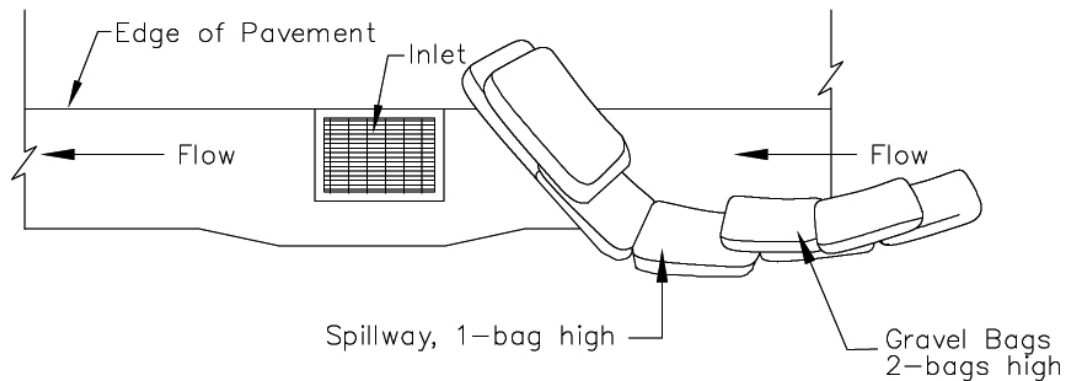
Notes

1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.





**TYPICAL PROTECTION FOR INLET WITH OPPOSING FLOW DIRECTIONS**



**TYPICAL PROTECTION FOR INLET WITH SINGLE FLOW DIRECTION**

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

# Section 5

## Wind Erosion Control

### Best Management Practices

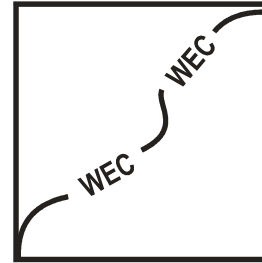
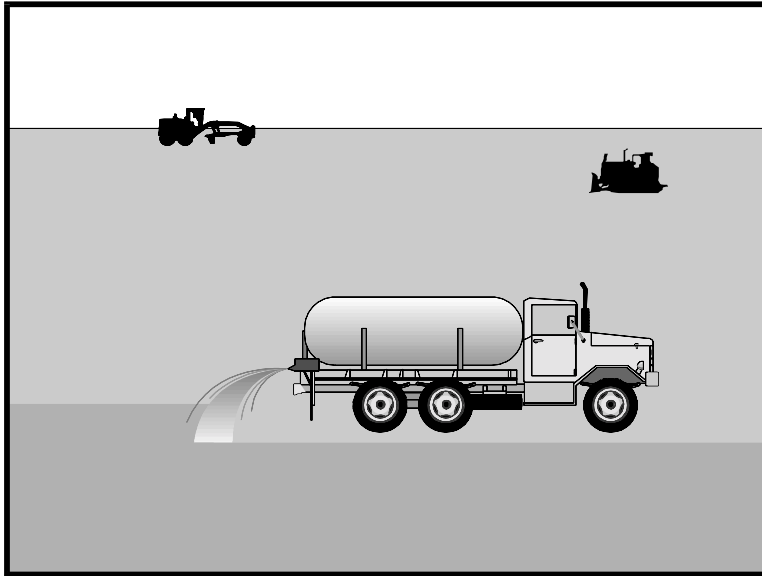
#### 5.1 Wind Erosion Control

Wind erosion control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance. Wind erosion control best management practices (BMPs) are shown in Table 5-1.

*Table 5-1*

WIND EROSION CONTROL BMPs	
ID	BMP NAME
WE-1	Wind Erosion Control

Other BMPs that are sometimes applied to disturbed soil areas to control wind erosion are BMPs SS-3 through SS-7, shown in Section 3 of this Manual; BMP TC-2, shown in Section 6; and BMP NS-7, shown in Section 7. The remainder of this Section shows the working details for the Wind Erosion Control BMP.



Standard Symbol

- BMP Objectives**

  - Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Wind erosion control consists of applying water and/or other dust palliatives as necessary to prevent or alleviate erosion by the forces of wind. Dust control shall be applied in accordance with Caltrans standard practices. Covering of small stockpiles or areas is an alternative to applying water or other dust palliatives.

- Appropriate Applications**
- This practice is implemented on all exposed soils subject to wind erosion.
- Limitations**
- Effectiveness depends on soil, temperature, humidity and wind velocity.

- Standards and Specifications**
- Water shall be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
  - All distribution equipment shall be equipped with a positive means of shutoff.
  - Unless water is applied by means of pipelines, at least one mobile unit shall be available at all times to apply water or dust palliative to the project.
  - If reclaimed water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality Control Board requirements. Non-potable water shall not be conveyed in tanks or drain pipes that will be used to convey potable water and there shall be no connection between potable and non-potable supplies. Non-potable tanks, pipes and other conveyances shall be marked “NON-POTABLE WATER - DO NOT DRINK.”
  - Materials applied as temporary soil stabilizers and soil binders will also provide wind erosion control benefits.

- Maintenance and Inspection**
- Check areas that have been protected to ensure coverage.

# Section 6

## Tracking Control

### Best Management Practices

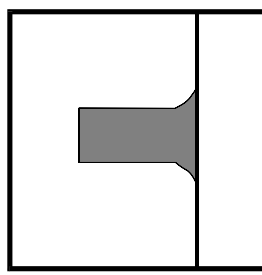
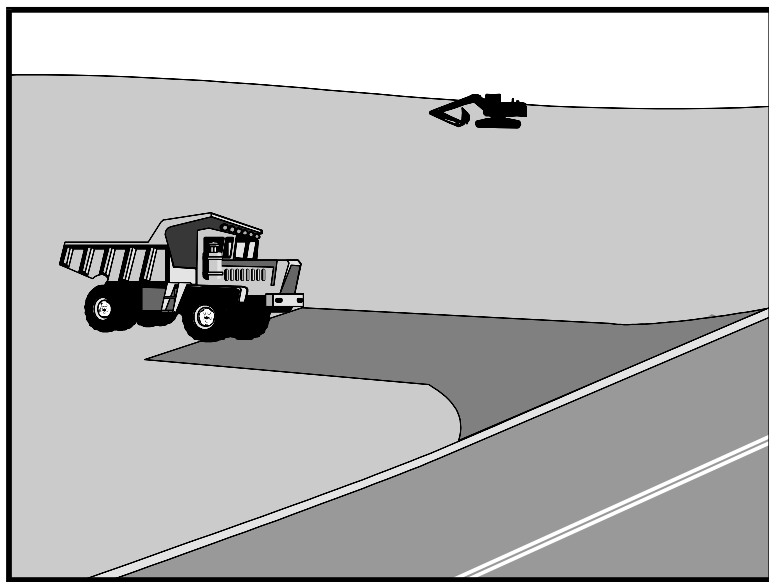
#### 6.1 Tracking Control

Tracking control consists of preventing or reducing vehicle tracking from entering a storm drain or watercourse. Tracking control best management practices (BMPs) are shown in Table 6-1.

*Table 6-1*

TRACKING CONTROL BMPs	
ID	BMP NAME
TC-1	Stabilized Construction Entrance/Exit
TC-2	Stabilized Construction Roadway
TC-3	Entrance/Outlet Tire Wash

The remainder of this Section shows the working details for the tracking control BMPs.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose**

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

**Appropriate Applications**

- Use at construction sites:
  - Where dirt or mud can be tracked onto public roads.
  - Adjacent to water bodies.
  - Where poor soils are encountered.
  - Where dust is a problem during dry weather conditions.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).

**Limitations**

- Site conditions will dictate design and need.

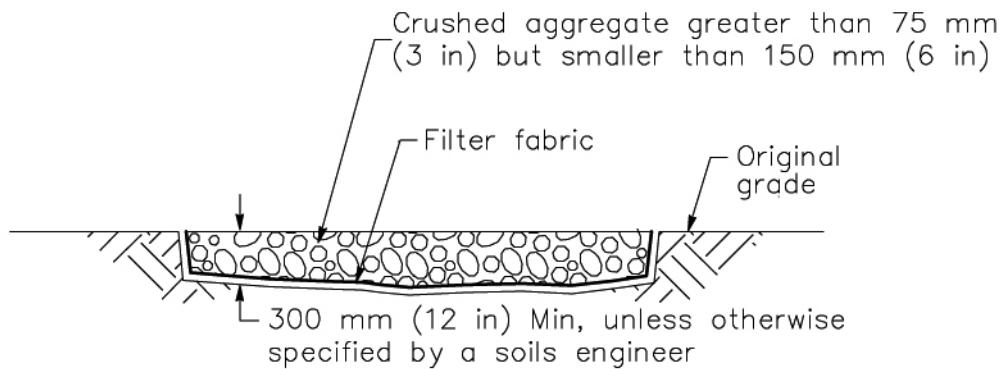
**Standards and Specifications**

- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.
- Design stabilized entrance/exit to support the heaviest vehicles and equipment that will use it.

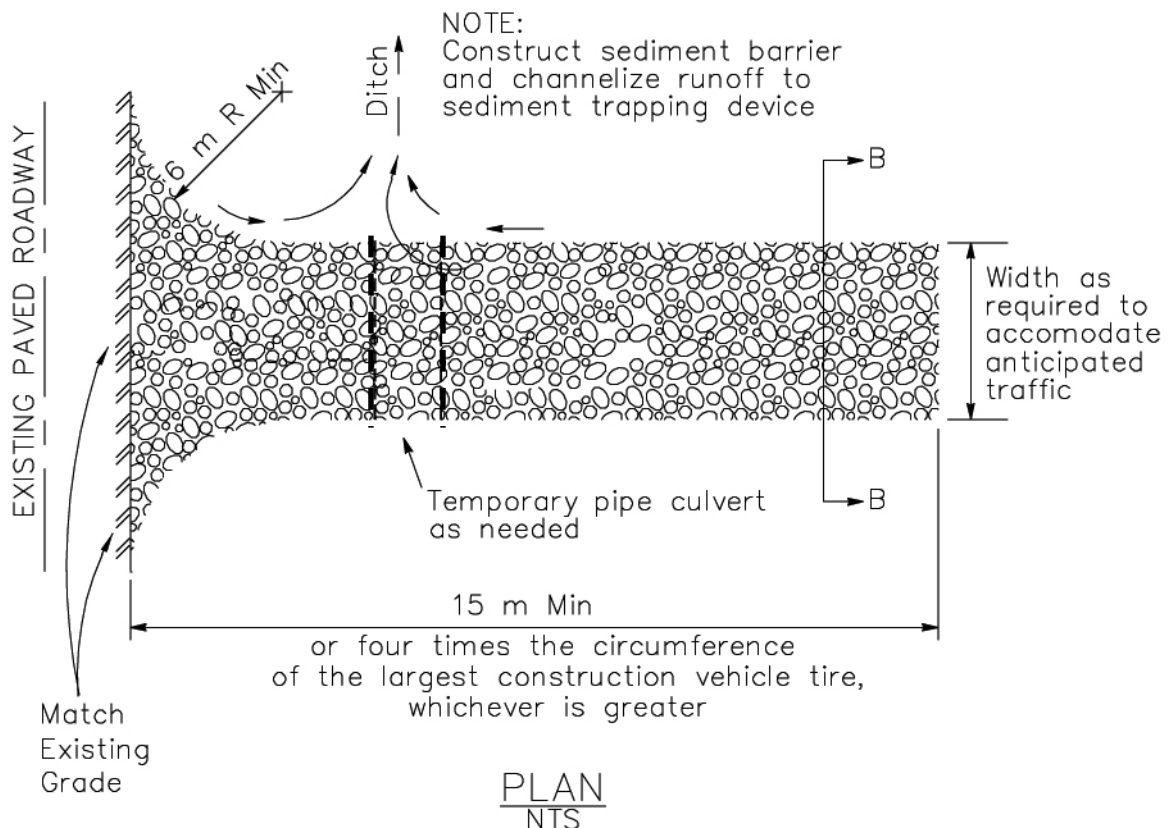
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. The use of asphalt concrete (AC) grindings for stabilized construction access/roadway is not allowed.
  - Use of constructed/manufactured steel plates with ribs for entrance/exit access is allowed with written approval from the RE.
  - If aggregate is selected, place crushed aggregate over geotextile fabric to at least 300 mm (12 in) depth, or place aggregate to a depth recommended by the RE. Crushed aggregate greater than 75 mm (3 inches) and smaller than 150 mm (6 inches) shall be used.
  - Designate combination or single purpose entrances and exits to the construction site.
  - Implement BMP SC-7, “Street Sweeping and Vacuuming” as needed and as required.
  - Require all employees, subcontractors, and suppliers to utilize the stabilized construction access.
  - All exit locations intended to be used continuously and for a period of time shall have stabilized construction entrance/exit BMPs (TC-1 “Stabilized Construction Entrance/Exit” or TC-3 “Entrance/Outlet Tire Wash”).
- Maintenance and Inspection
- Inspect routinely for damage and assess effectiveness of the BMP. Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment or as directed by the RE.
  - Keep all temporary roadway ditches clear.
  - Inspect for damage and repair as needed.

# Stabilized Construction Entrance/Exit

**TC-1**



SECTION B-B  
NTS

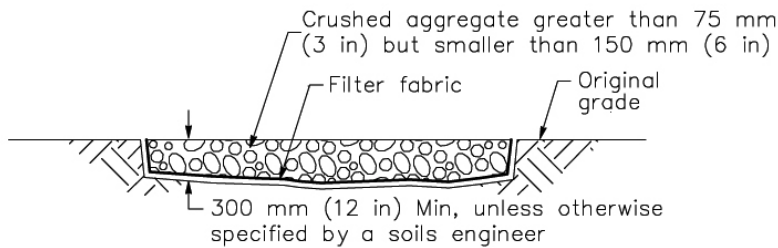


Stabilized Construction Entrance/Exit (Type 1)

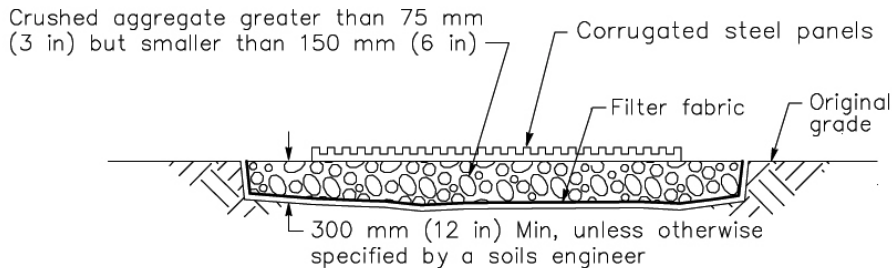


# Stabilized Construction Entrance/Exit

**TC-1**

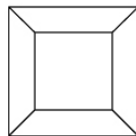


SECTION B-B  
NTS

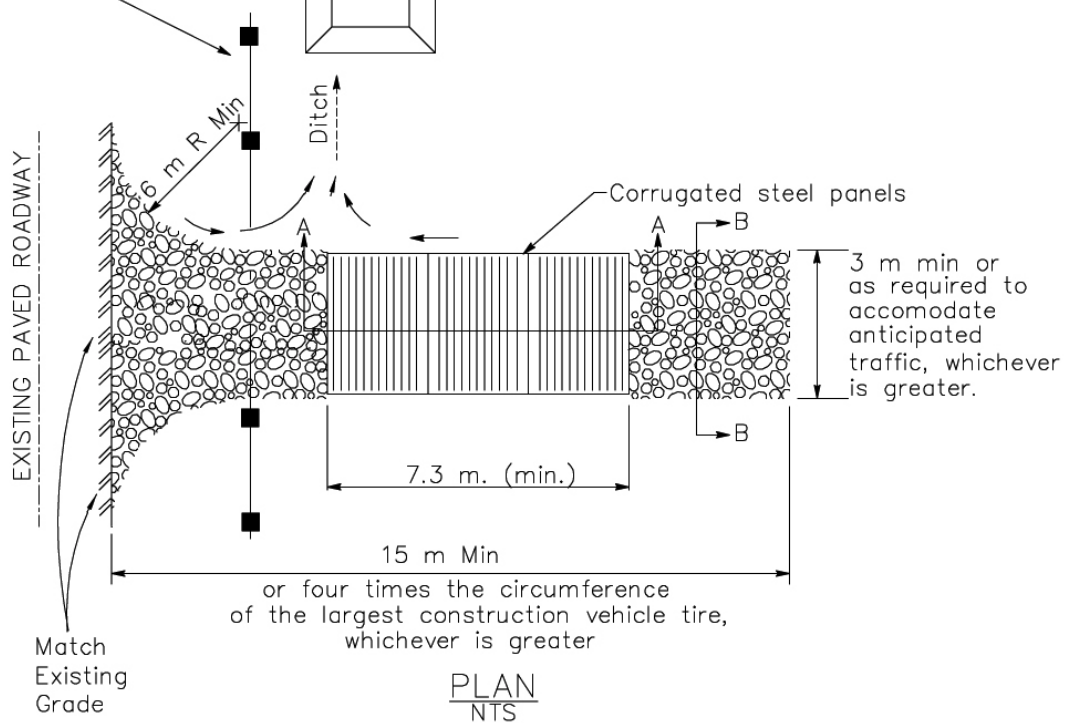


SECTION A-A  
NOT TO SCALE

NOTE:  
Construct sediment barrier  
and channelize runoff to  
sediment trapping device



Sediment trapping  
device

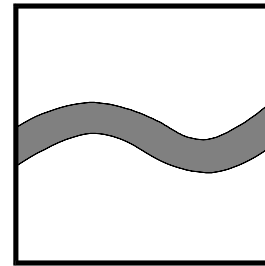
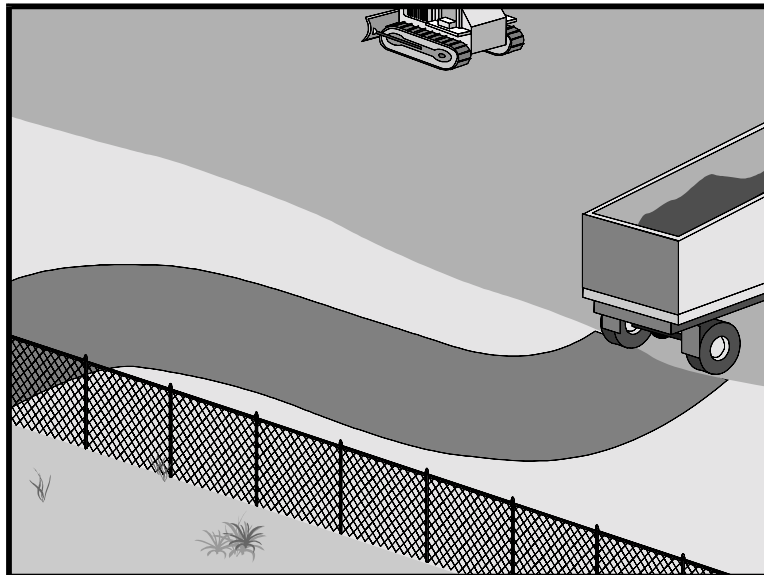


PLAN  
NTS

Stabilized Construction Entrance/Exit (Type 2)







Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A stabilized construction roadway is a temporary access road. It is designed for the control of dust and erosion created by vehicular tracking.

### Appropriate Applications

- Construction roadways and short-term detour roads:
  - Where mud tracking is a problem during wet weather.
  - Where dust is a problem during dry weather.
  - Adjacent to water bodies.
  - Where poor soils are encountered.
  - Where there are steep grades and additional traction is needed.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

### Limitations

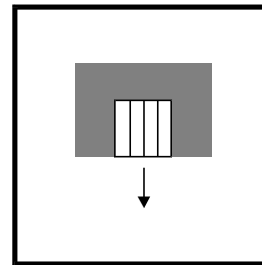
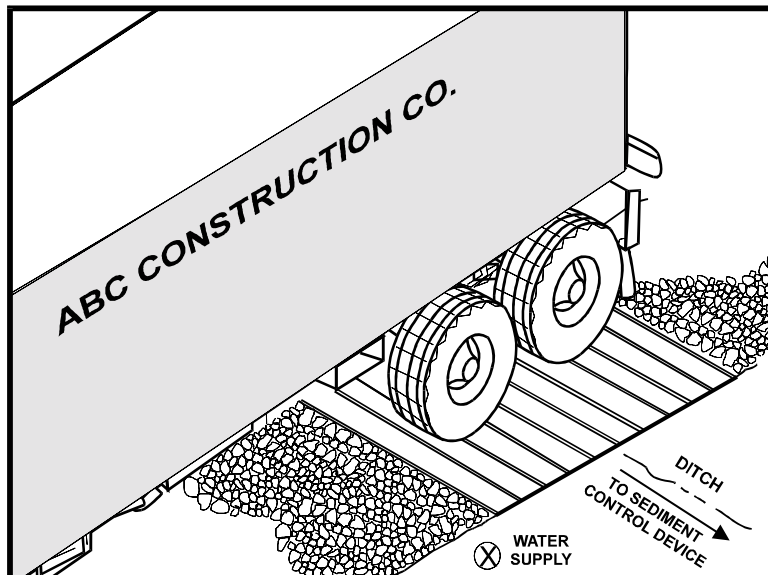
- Materials will likely need to be removed prior to final project grading and stabilization.
- Site conditions will dictate design and need.
- May not be applicable to very short duration projects.
- Limit speed of vehicles to control dust.

## Standards and Specifications

- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support the heaviest vehicles and equipment that will use it.
- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 300 mm (12 in) depth, or place aggregate to a depth recommended by the RE or Construction Storm Water Coordinator. Crushed aggregate greater than 75 mm (3 inches) and smaller than 150 mm (6 inches) shall be used.

## Maintenance and Inspection

- Inspect routinely for damage and repair as needed, or as directed by the RE.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A tire wash is an area located at stabilized construction access points to remove sediment from tires and undercarriages, and to prevent sediment from being transported onto public roadways.

**Appropriate Applications**

- Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

**Limitations**

- Requires a supply of wash water.
- Requires a turnout or doublewide exit to avoid having entering vehicles drive through the wash area.

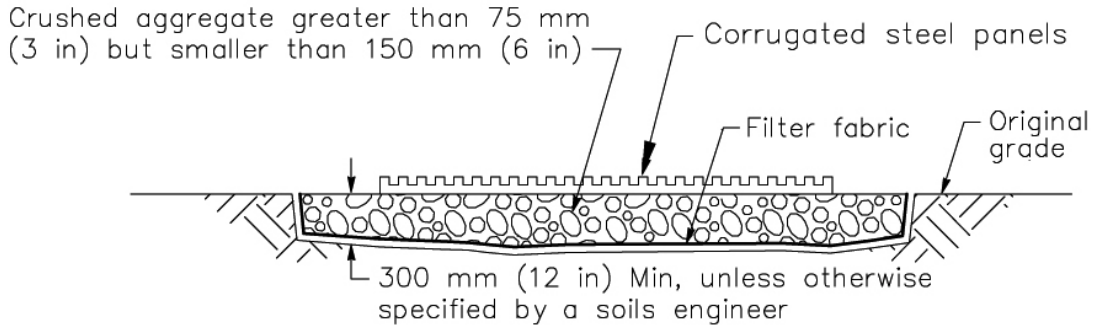
**Standards and Specifications**

- Incorporate with a stabilized construction entrance/exit. See BMP TC-1, “Stabilized Construction Entrance/Exit.”
- Construct on level ground when possible, on a pad of coarse aggregate, greater than 75 mm (3 inches) and smaller than 150 mm (6 inches). A geotextile fabric shall be placed below the aggregate.
- Wash rack shall be designed and constructed/manufactured for anticipated traffic loads.
- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch shall be of sufficient grade, width, and depth to carry the wash runoff.

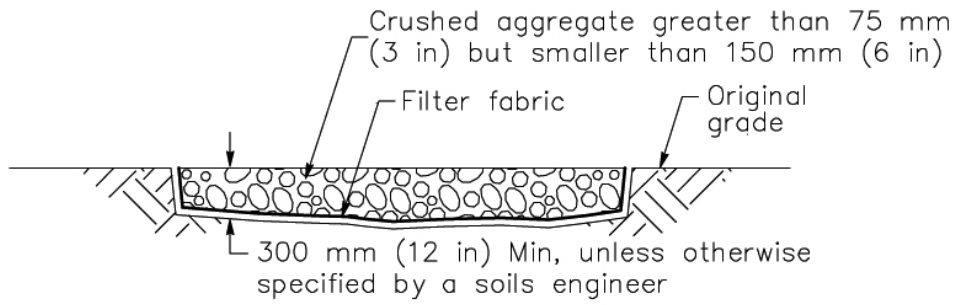
- Require all employees, subcontractors, and others that leave the site with mud-caked tires and/or undercarriages to use the wash facility.
  - Implement BMP SC-7, “Street Sweeping and Vacuuming” as needed.
  - Use of constructed or prefabricated steel plate with ribs for entrance/exit access is allowed with written approval of RE.
- Maintenance and Inspection
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
  - Inspect routinely for damage and repair as needed.

# Entrance/Outlet Tire Wash

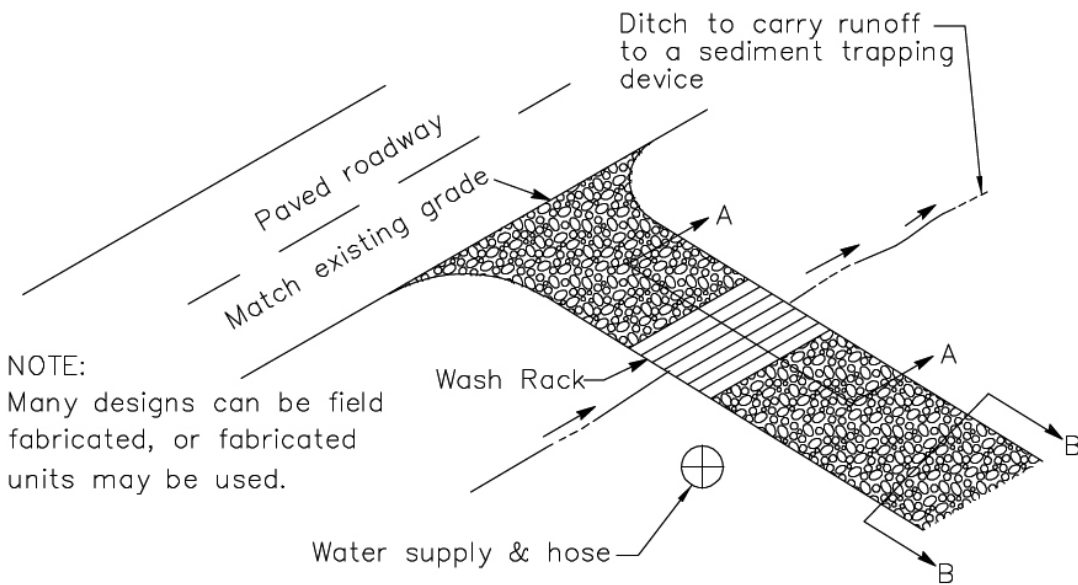
**TC-3**



SECTION A-A  
NOT TO SCALE



SECTION B-B  
NTS



TYPICAL TIRE WASH  
NOT TO SCALE

# Section 7

## Non-Storm Water Management Best Management Practices

### 7.1 Non-Storm Water Management

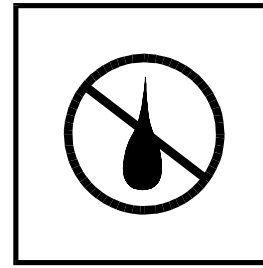
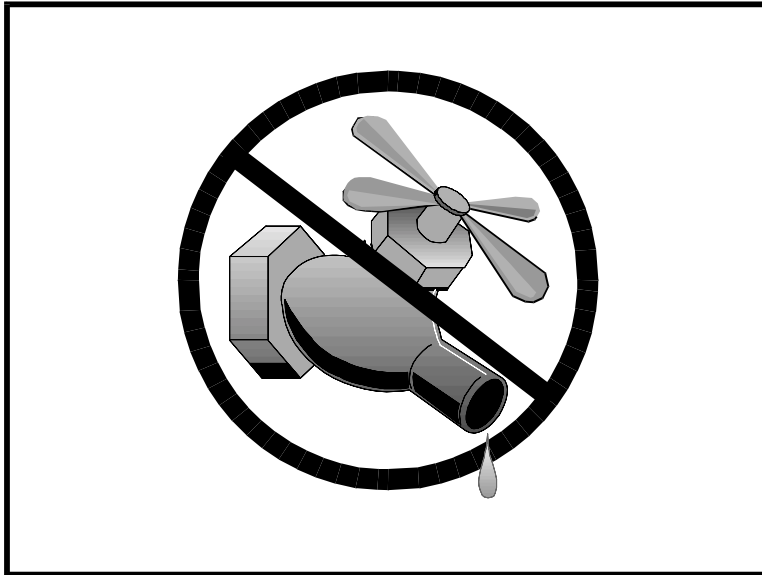
Non-storm water management best management practices (BMPs) are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with storm water. These practices involve day-to-day operations of the construction site and are usually under the control of the Contractor. These BMPs are also referred to as “good housekeeping practices”, which involve keeping a clean, orderly construction site.

Table 7-1 lists the non-storm water management BMPs. It is important to note that all these BMPs have been approved by Caltrans for statewide use and they shall be implemented depending on the conditions/applicability of deployment described as part of the BMP.

**Table 7-1**

<b>NON-STORM WATER MANAGEMENT BMPs</b>	
<b>ID</b>	<b>BMP NAME</b>
NS-1	Water Conservation Practices
NS-2	Dewatering Operations
NS-3	Paving and Grinding Operations
NS-4	Temporary Stream Crossing
NS-5	Clear Water Diversion
NS-6	Illicit Connection/Illegal Discharge Detection and Reporting
NS-7	Potable Water/Irrigation
NS-8	Vehicle and Equipment Cleaning
NS-9	Vehicle and Equipment Fueling
NS-10	Vehicle and Equipment Maintenance
NS-11	Pile Driving Operations
NS-12	Concrete Curing
NS-13	Material and Equipment Use Over Water
NS-14	Concrete Finishing
NS-15	Structure Demolition/Removal Over or Adjacent to Waters

The remainder of this Section shows the working details for each of the non-storm water management BMPs.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and/or the transport of pollutants off site.

**Appropriate Applications**

- Water conservation practices are implemented on all construction sites and wherever water is used.
- Applies to all construction projects.

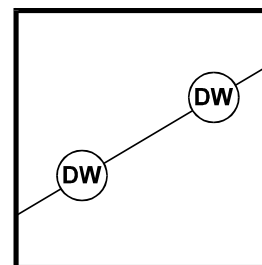
**Limitations** ■ None identified.

**Standards and Specifications**

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Vehicles and equipment washing on the construction site is discouraged.
- Avoid using water to clean construction areas. Do not use water to clean pavement. Paved areas shall be swept and vacuumed.
- Direct construction water runoff to areas where it can infiltrate into the ground.
- Apply water for dust control in accordance with the Standard Specifications Section 10, and WE-1, “Wind Erosion Control.”
- Report discharges to RE immediately.

- Maintenance and Inspection
- Inspect water equipment at least weekly.
  - Repair water equipment as needed.





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

## Definition and Purpose

Dewatering Operations are practices that manage the discharge of pollutants when non-storm water and accumulated precipitation (storm water) must be removed from a work location so that construction work may be accomplished.

## Appropriate Applications

- These practices are implemented for discharges of non-storm water and storm water (accumulated rain water) from construction sites. Non-storm water includes, but is not limited to, groundwater, dewatering of piles, water from cofferdams, water diversions, and water used during construction activities that must be removed from a work area.
- Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (storm water) from depressed areas at a construction site.
- Storm water mixed with non-storm water should be managed as non-storm water.

## Limitations

- Dewatering operations for non-storm water will require, and must comply with, applicable local permits, project-specific permits, and regulations.
- Site conditions will dictate design and use of dewatering operations.
- A dewatering plan shall be submitted as part of the SWPPP/WPCP detailing the location of dewatering activities, equipment, and discharge point.
- The controls discussed in this best management practice (BMP) address sediment only. If the presence of polluted water with hazardous substances is identified in the contract, the contractor shall implement dewatering pollution controls as required by the contract documents. If the quality of water to be removed by dewatering is not identified as polluted in the contract documents, but is later determined by observation or testing to be polluted, the contractor shall notify the Resident Engineer (RE) and comply with Standard Specifications Section 5-1.116, "Differing Site Conditions."

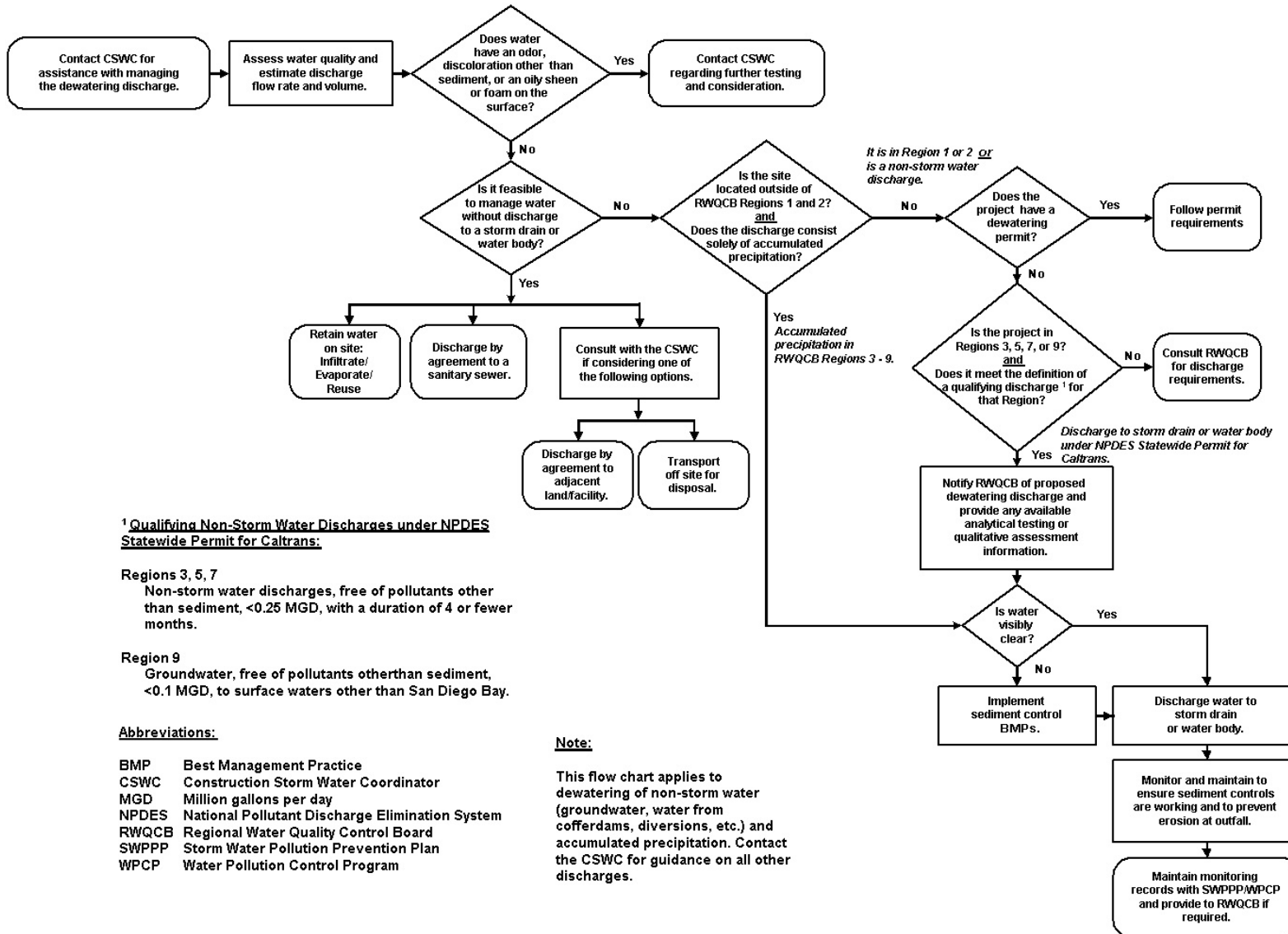
## Standards and Specifications

- Avoid dewatering discharges where possible by using the water for dust control, by infiltration, etc.
- Dewatering shall be conducted in accordance with the Field Guide to Construction Site Dewatering, October 2001, CTSW-RT-01-010.
- Dewatering for accumulated precipitation (storm water) shall follow this BMP and use treatment measures specified herein.
- The RWQCB may require a separate NPDES permit prior to the dewatering discharge of non-storm water. These permits will have specific testing, monitoring, and discharge requirements and can take significant time to obtain.
- Except in RWQCB Regions 1 and 2, the discharge of accumulated precipitation (storm water) to a water body or storm drain is subject to the requirements of Caltrans NPDES permit. Sediment control and other appropriate BMPs (e.g., outlet protection/energy dissipation) must be employed when this water is discharged.
- RWQCB Regions 1 and 2 require notification and approval prior to any discharge of water from construction sites.
- In RWQCB Regions 3, 5, 7, and 9 non-storm water dewatering for discharges meeting certain conditions are allowed under an RWQCB general dewatering NPDES Permit. Notification and approval from the RWQCB is required prior to conducting these operations. This includes storm water that is mixed with groundwater or other non-storm water sources. Once the discharge is allowed, appropriate BMPs must be implemented to ensure that the discharge complies with all permit requirements. Conditions for potential discharge under an RWQCB general dewatering NPDES Permit include:
  - Regions 3, 5, 7: Non-storm water discharges, free of pollutants other than sediment, <0.25 MGD, with a duration of 4 or fewer months.
  - Region 9: Groundwater, free of pollutants other than sediment, <0.10 MGD, to surface waters other than San Diego Bay.
- The flow chart shown on Page 4 shall be utilized to guide dewatering operations.
- The RE will coordinate monitoring and permit compliance.
- Discharges must comply with regional and watershed-specific discharge requirements.
- Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges must not cause erosion at the discharge point.

## Maintenance and Inspection

- Dewatering records shall be maintained for a period of 3 years.
- Inspect all BMPs implemented to comply with permit requirements frequently and repair or replace to ensure the BMPs function as designed.
- Accumulated sediment removed during the maintenance of a dewatering device may be incorporated in the project at locations designated by the RE or disposed of outside the right-of-way in conformance with the Standard Specifications.
- Accumulated sediment that is commingled with other pollutants must be disposed of in accordance with all applicable laws and regulations and as approved by the RE.

# Dewatering Operations



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**Sediment Treatment** A variety of methods can be used to treat water during dewatering operations from the construction site. Several devices are presented in this section that provide options to achieve sediment removal. The size of particles present in the sediment and Permit or receiving water limitations on sediment are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate.

## Category 1: Constructed Settling Technologies

The devices discussed in this category are to be used exclusively for dewatering operations only.

### Sediment/Desilting Basin (SC-2)

Description:

A desilting basin is a temporary basin with a controlled release structure that is formed by excavation and/or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging.

Appropriate Applications:

- Effective for the removal of trash, gravel, sand, and silt and some metals that settle out with the sediment.

Implementation:

- Excavation and construction of related facilities is required.
- Temporary desilting basins must be fenced if safety is a concern.
- Outlet protection is required to prevent erosion at the outfall location.

Maintenance:

- Maintenance is required for safety fencing, vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

### Sediment Trap (SC-3)

Description:

A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging.

## Appropriate Applications:

- Effective for the removal of large and medium sized particles (sand and gravel) and some metals that settle out with the sediment.

## Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets shall be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

## Maintenance:

- Maintenance is required for vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

## Category 2: Mobile Settling Technologies

The devices discussed in this category are typical of tanks that can be used for sediment treatment of dewatering operations. A variety of vendors are available who supply these tanks.

### Weir Tank

#### Description:

A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

#### Appropriate Applications:

- The tank removes trash, some settleable solids (gravel, sand, and silt), some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

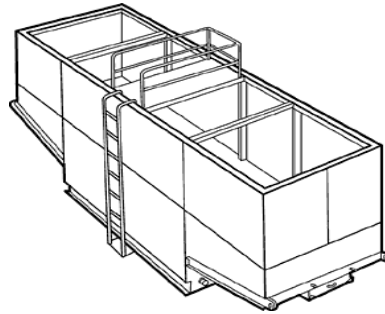
#### Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors shall be consulted to appropriately size tank.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

## Schematic Diagrams:



**Weir Tanks**

## Dewatering Tank

Description:

A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

Appropriate Applications:

- The tank removes trash, gravel, sand, and silt, some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors shall be consulted to appropriately size tank.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

## Schematic Diagrams:



**Dewatering Tanks**

## Category 3: Basic Filtration Technologies

### Gravity Bag Filter

Description:

A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects sand, silt, and fines.

Appropriate Applications:

- Effective for the removal of sediments (gravel, sand, and silt). Some metals are removed with the sediment.

Implementation:

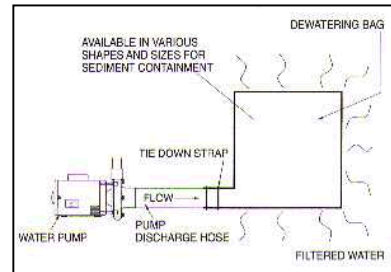
- Water is pumped into one side of the bag and seeps through the bottom and sides of the bag.
- A secondary barrier, such as a rock filter bed or straw/hay bale barrier, is placed beneath and beyond the edges of the bag to capture sediments that escape the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- The bag is disposed off-site, or on-site as directed by the RE.



## Schematic Diagrams:



**Gravity Bag Filter**

## Category 4: Advanced Filtration Technologies

### Sand Media Particulate Filter

#### Description:

Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed.

#### Appropriate Applications:

- Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.
- Sand filters can be used for standalone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

#### Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

#### Maintenance:

- The filters require monthly service to monitor and maintain the sand media.

## Schematic Diagrams:



**Sand Media Particulate Filters**

## Pressurized Bag Filter

### Description:

A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header, allowing for the discharge of flow in series to an additional treatment unit. Vendors provide pressurized bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

### Appropriate Applications:

- Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

### Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

### Maintenance:

- The filter bags require replacement when the pressure differential exceeds the manufacturer's recommendation.

## Schematic Diagrams:



## Pressurized Bag Filter

### Cartridge Filter

#### Description:

Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed. Units come with various cartridge configurations (for use in series with pressurized bag filters) or with a larger single cartridge filtration unit (with multiple filters within).

#### Appropriate Applications:

- Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

#### Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance.

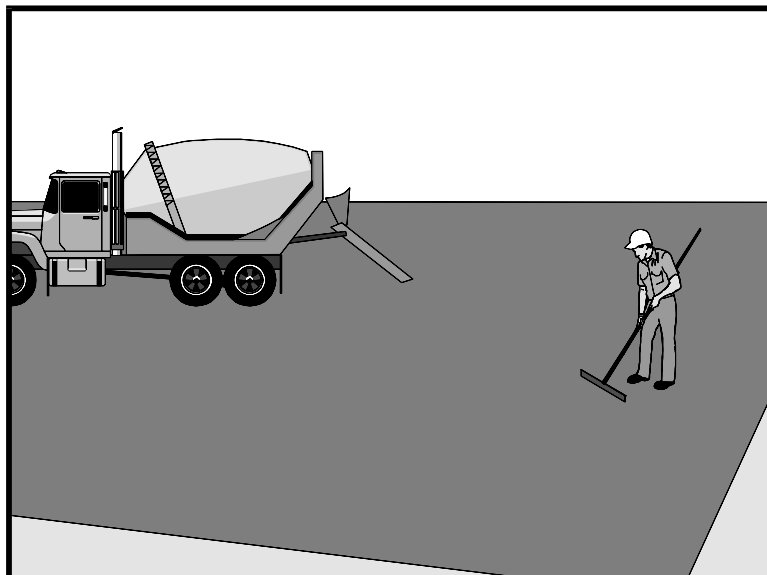
#### Maintenance:

- The cartridges require replacement when the pressure differential exceeds the manufacturer's recommendation.

## Schematic Designs:



## Cartridge Filter



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Procedures and practices for conducting paving, saw cutting, and grinding operations to minimize the transport of pollutants to the storm drain system or receiving water body.

**Appropriate Applications** These procedures are implemented where paving, surfacing, resurfacing, grinding or sawcutting, may pollute storm water runoff or discharge to the storm drain system or watercourses.

- Limitations**
- Finer solids are not effectively removed by filtration systems.
  - Paving opportunities may be limited during wet weather.

- Standards and Specifications**
- Substances used to coat asphalt transport trucks, asphalt trucks, and asphalt spreading equipment shall not contain soap and shall be non-foaming and non-toxic.
  - Place plastic materials under asphaltic concrete (AC) paving equipment while not in use, to catch and/or contain drips and leaks. See also BMP WM-4, "Spill Prevention and Control."
  - When paving involves AC, the following steps shall be implemented to prevent the discharge of uncompacted or loose AC, tack coats, equipment cleaners, or other paving materials:
    - Minimize sand and gravel from new asphalt from getting into storm drains, streets, and creeks by sweeping.
    - Old or spilled asphalt must be recycled or disposed as approved by the Resident Engineer (RE).

- AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drain or watercourses. Install silt fence until structure is stabilized or permanent controls are in place.
- Collect and remove all broken asphalt and recycle when practical; otherwise, dispose in accordance with Standard Specification 7-1.13.
- Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 0.3 m (1 ft) of material.
- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Use silt fence until installation is complete.
- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.
- Drainage inlet structures and manholes shall be covered with filter fabric during application of seal coat, tack coat, slurry seal, and/or fog seal.
- Seal coat, tack coat, slurry seal, or fog seal shall not be applied if rainfall is predicted to occur during the application or curing period.
- Paving equipment parked onsite shall be parked over plastic to prevent soil contamination.
- Clean asphalt-coated equipment off-site whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in BMP WM-5, “Solid Waste Management.” Any cleaning onsite shall follow BMP NS-8, “Vehicle and Equipment Cleaning.”
- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile, or dispose of properly.
- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in BMP WM-8, “Concrete Waste Management,” or dispose in accordance with Standard Specifications Section 7-1.13.
- Do not allow saw-cut Portland Concrete Cement (PCC) slurry to enter storm drains or watercourses.

### ***Pavement Grinding or Removal***

- Residue from PCC grinding operations shall be picked up by means of a vacuum attachment to the grinding machine, shall not be allowed to flow across the pavement, and shall not be left on the surface of the pavement. See also BMP WM-8, “Concrete Waste Management;” and BMP WM-10, “Liquid Waste Management,” and Standard Specifications Section 42-2

“Grindings.”

- Collect pavement digout material by mechanical or manual methods. This material may be recycled if approved by the RE for use as shoulder backing or base material at locations approved by the RE.
- If digout material cannot be recycled, transport the material back to a maintenance facility or approved storage site.
- Digout activities shall not be conducted in the rain.
- When approved by the RE, stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses and stored consistent with BMP WM-3, “Stockpile Management.”
- Disposal or use of AC grindings shall be approved by the RE. See also BMP WM-8, “Concrete Waste Management.”

### ***Thermoplastic Striping***

- All thermoplastic striper and pre-heater equipment shutoff valves shall be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the storm water drainage system, or watercourses.
- The pre-heater shall be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Contractor shall not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible recycle thermoplastic material. Thermoplastic waste shall be disposed of in accordance with Standard Specification 7-1.13.

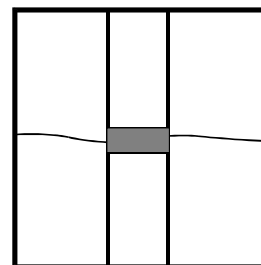
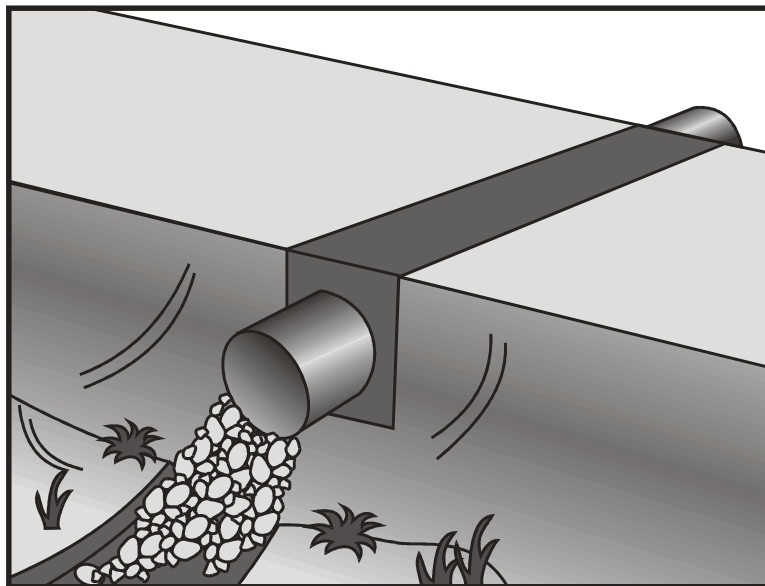
### ***Raised/Recessed Pavement Marker Application and Removal***

- Do not transfer or load bituminous material near drain inlets, the storm water drainage system or watercourses.
- Melting tanks shall be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large scale projects, use mechanical or manual methods to collect excess

bituminous material from the roadway after removal of markers.

- Waste shall be disposed of in accordance with Standard Specification 7-1.13.
- Maintenance and Inspection
- Inspect and maintain machinery regularly to minimize leaks and drips.
  - Ensure that employees and subcontractors are implementing appropriate measures during paving operations.





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** A temporary stream crossing is a structure placed across a waterway that allows vehicles to cross the waterway during construction, minimizing, reducing, or managing erosion and downstream sedimentation caused by the vehicles.

**Appropriate Applications** Temporary stream crossings are installed at sites:

- Where appropriate permits have been secured (1601 Agreements, 404 Permits, and 401 Certification).
- Where construction equipment or vehicles need to frequently cross a waterway.
- When alternate access routes impose significant constraints.
- When crossing perennial streams or waterways causes significant erosion.
- Where construction activities will not last longer than one year.

- Limitations**
- Will usually disturb the waterway during installation and removal.
  - May require Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. If monitoring related to these numerical-based water quality standards is not addressed in the contract documents, contact the Resident Engineer (RE).
  - Installation may require dewatering or temporary diversion of the stream. See BMP NS-2, “Dewatering Operations” and NS-5, “Clear Water Diversion.”
  - May become a constriction in the waterway, which can obstruct flood flow and cause flow backups or washouts. If improperly designed, flow backups can increase the pollutant load through washouts and scouring.

- Use of natural or other gravel in the stream for construction of Cellular Confinement System (CCS) (refer to figure at the end of the section) ford crossing will be contingent upon approval by fisheries agencies.
- Ford crossings may degrade water quality due to contact with vehicles and equipment.
- CCS should not be used in excessively high or fast flows.
- Upon completion of construction activities, CCS blocks must be removed from stream.

## Standards and Specifications

### **General Considerations**

Location of the temporary stream crossing shall address:

- Site selection where erosion potential is low.
- Areas where the side slopes from highway runoff will not spill into the side slopes of the crossing.

The following types of temporary stream crossings shall be considered:

- Culverts - Used on perennial and intermittent streams.
- Fords - Appropriate during the dry season in arid areas. Used on dry washes and ephemeral streams, and low flow perennial streams. CCS, a type of ford crossing is also appropriate for use in streams.
- Bridges - Appropriate for streams with high flow velocities, steep gradients and/or where temporary restrictions in the channel are not allowed.

Design and installation requires knowledge of stream flows and soil strength. Designs shall be prepared under direction of, and approved by, a registered civil and/or structural engineer. Both hydraulic and construction loading requirements shall be considered with the following:

- Comply with the requirements for culvert and bridge crossings, as contained in the Caltrans Highway Design Manual, particularly if the temporary stream crossing will remain through the rainy season.
- Provide stability in the crossing and adjacent areas to withstand the design flow. The design flow and safety factor shall be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
- Avoid oil or other potentially hazardous waste materials for surface treatment.

### **Construction Considerations:**

- Stabilize construction roadways, adjacent work area and stream bottom against erosion.

- Construct during dry periods to minimize stream disturbance and reduce costs.
- Construct at or near the natural elevation of the stream bed to prevent potential flooding upstream of the crossing.
- Install temporary sediment control BMPs in accordance with sediment control BMPs presented in Section 4 to minimize erosion of embankment into flow lines.
- Vehicles and equipment shall not be driven, operated, fueled, cleaned, maintained, or stored in the wet or dry portions of a water body where wetland vegetation, riparian vegetation, or aquatic organisms may be destroyed, except as authorized by the RE, as necessary to complete the work.
- Temporary water body crossings and encroachments shall be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments shall be clean, rounded river cobble.
- The exterior of vehicles and equipment that will encroach on the water body within the project shall be maintained free of grease, oil, fuel, and residues.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation shall be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities.
- Any temporary artificial obstruction placed within flowing water shall only be built from material, such as clean gravel, that will cause little or no siltation.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Conceptual temporary stream crossings are shown in figures at the end of this section.

### ***Specific Considerations:***

- Culverts are relatively easy to construct and able to support heavy equipment loads.
- Fords are the least expensive of the crossings, with maximum load limits.
- Temporary fords are not appropriate if construction will continue through the rainy season, if thunderstorms are likely, or if the stream is perennial.

- CCS crossing structures consist of clean, washed gravel and cellular confinement system blocks. CCS are appropriate for streams that would benefit from an influx of gravel; for example, salmonid streams, streams or rivers below reservoirs, and urban, channelized streams. Many urban stream systems are gravel-deprived due to human influences, such as dams, gravel mines, and concrete channels.
- CCS allow designers to use either angular or naturally-occurring, rounded gravel, because the cells provide the necessary structure and stability. In fact, natural gravel is optimal for this technique, because of the habitat improvement it will provide after removal of the CCS.
- A gravel depth of 152 to 305 mm (6 to 12 inches) for a CCS structure is sufficient to support most construction equipment.
- An advantage of a CCS crossing structure is that relatively little rock or gravel is needed, because the CCS provides the stability.
- Bridges are generally more expensive to design and construct, but provides the least disturbance of the stream bed and constriction of the waterway flows.

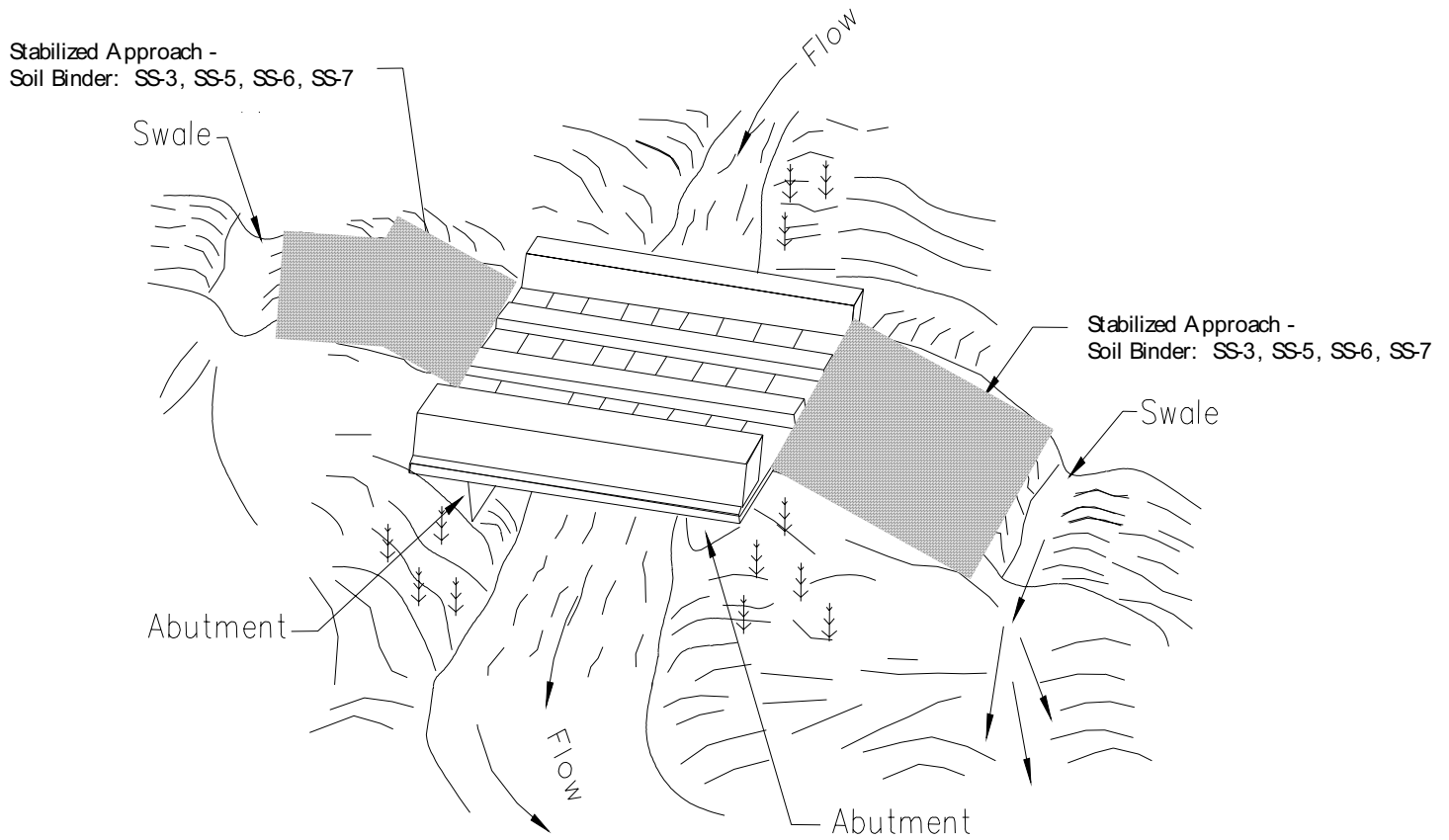
## Maintenance and Inspection

Maintenance provisions shall include:

- Periodic removal of debris behind fords, in culverts, and under bridges.
- Replacement of lost protective aggregate from inlets and outlets of culverts.
- Removal of temporary crossing promptly when it is no longer needed.
- Inspection shall, at a minimum, occur weekly and after each significant rainfall, and include:
  - Checking for blockage in the channel, debris buildup in culverts or behind fords, and under bridges.
  - Checking for erosion of abutments, channel scour, riprap displacement, or piping in the soil.
  - Checking for structural weakening of the temporary crossing, such as cracks, and undermining of foundations and abutments.

# Temporary Stream Crossing

**NS-4**

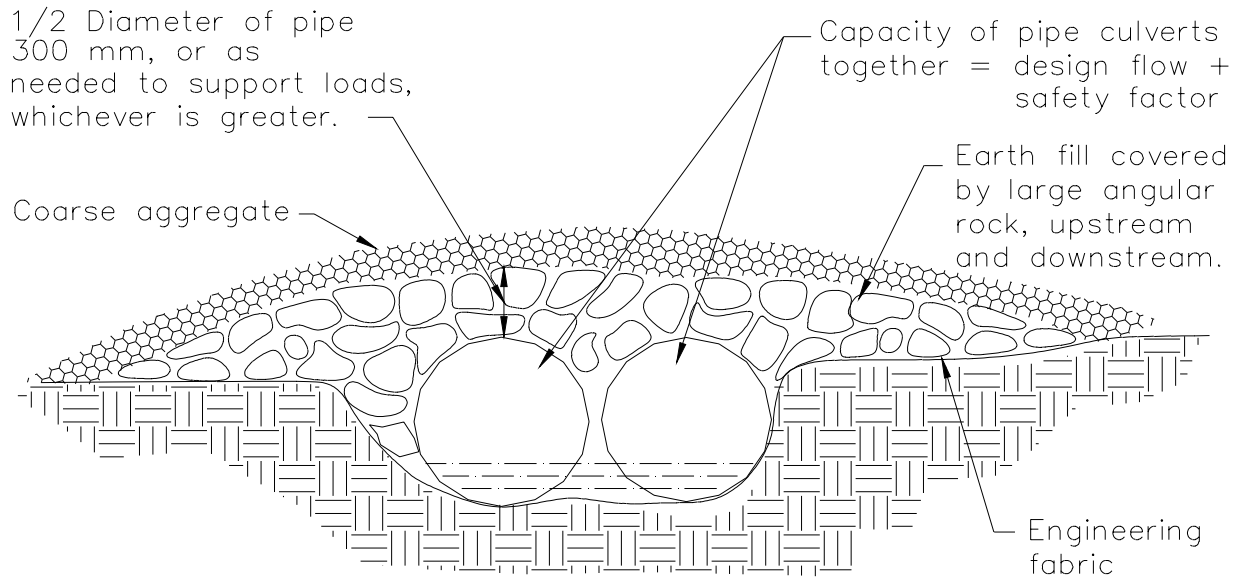


NOTE:  
Surface flow of road diverted  
by swale and/or dike.

TYPICAL BRIDGE CROSSING  
NOT TO SCALE

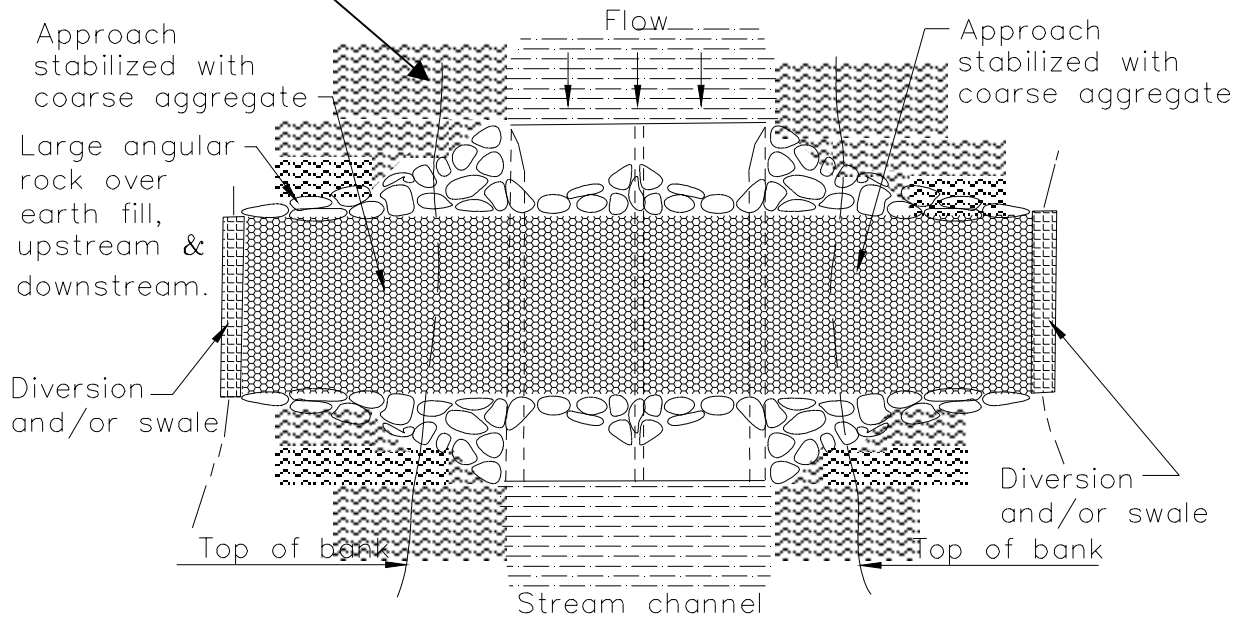
# Temporary Stream Crossing

**NS-4**



Soil Binder: SS-3, SS-5, SS-6, SS-7

## ELEVATION



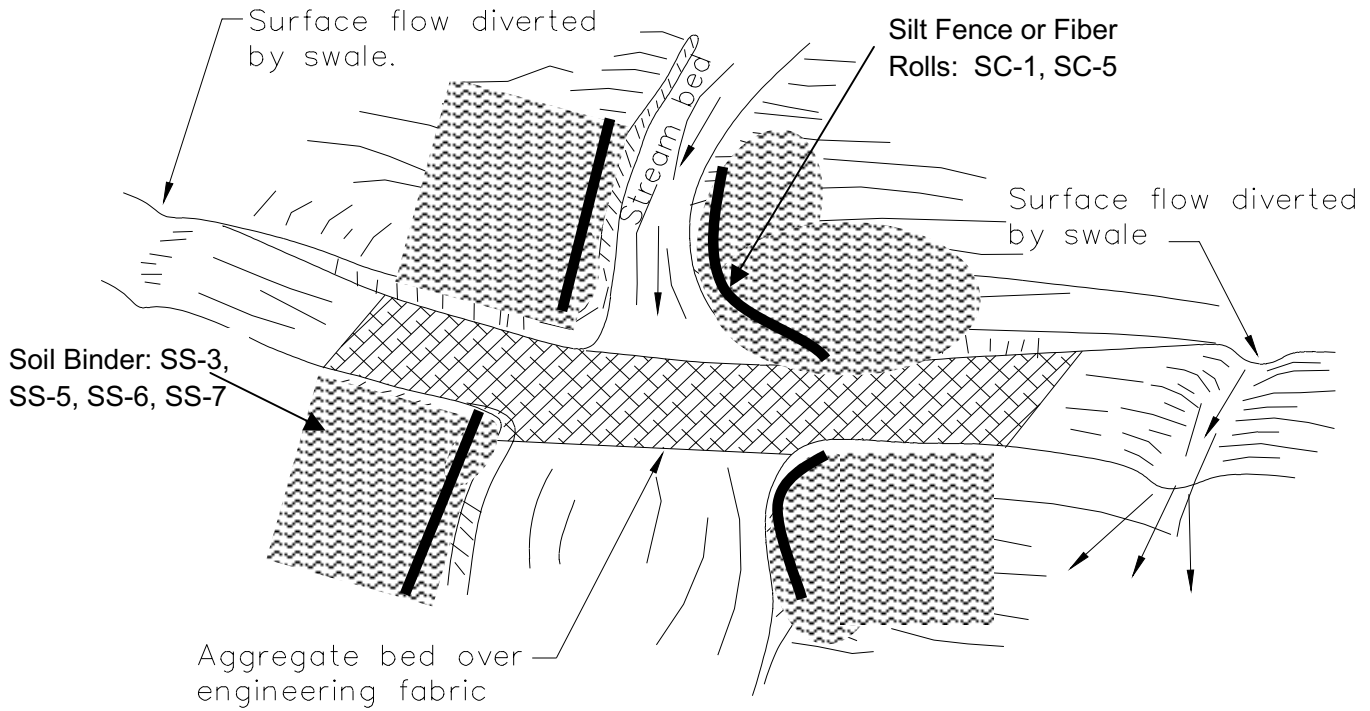
## PLAN VIEW

TYPICAL CULVERT CROSSING  
NOT TO SCALE

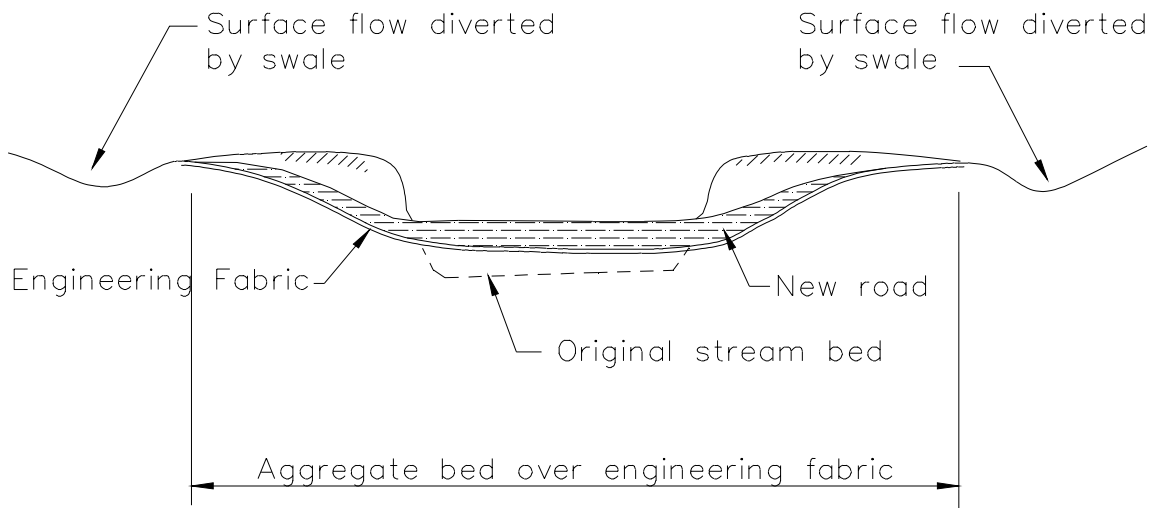


# Temporary Stream Crossing

**NS-4**



Aggregate approach  
1:5 (V:H) Maximum slope on road



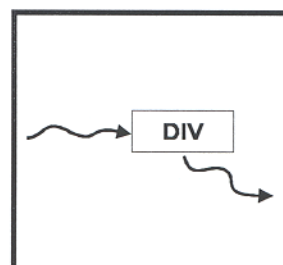
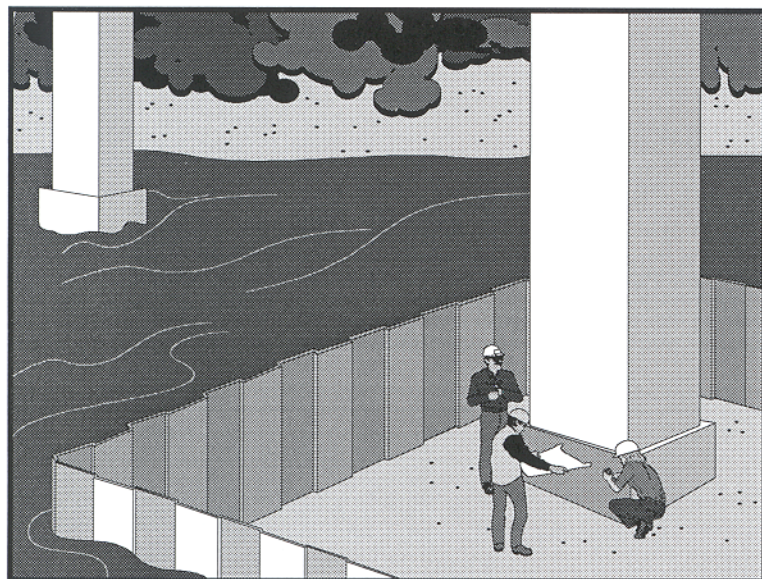
TYPICAL FORD CROSSING  
NOT TO SCALE





CELLULAR CONFINEMENT SYSTEM





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project site, transport it around the work area, and discharge it downstream with minimal water quality degradation for either the project construction operations or the construction of the diversion. Clear water diversions are used in a waterway to enclose a construction area and reduce sediment pollution from construction work occurring in or adjacent to water. Isolation techniques are methods that isolate near shore work from a waterbody. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, sheet piles, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

### Appropriate Applications

- A clear water diversion is typically implemented where appropriate permits (1601 Agreement, 404 Permits, and 401 Water Quality Certifications) have been secured and work must be performed in a live stream or water body.
- Clear water diversions are appropriate for isolating construction activities occurring within or near a water body such as streambank stabilization, or culvert, bridge, pier or abutment installation. They may also be used in combination with other methods, such as clear water bypasses and/or pumps.
- Pumped diversions are suitable for intermittent and low flow streams. Excavation of a temporary bypass channel, or passing the flow through a pipe (called a “flume”) is appropriate for the diversion of streams less than 6 m (20 ft) wide, with flow rates less than 2.8 m<sup>3</sup>/sec (99 ft<sup>3</sup>/sec).
- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmon spawning streams.

- Limitations**
- Diversion/encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
  - Specific permit requirements or mitigation measures, such as the U.S. Army Corps of Engineers, California Department of Fish and Game, Federal Emergency Management Agency (FEMA), Regional Water Quality Control Board (RWQCB), etc. may be included in contract documents because of clear water diversion/encroachment activities.
  - Diversion/encroachment activities may constrict the waterway, which can obstruct flood flows and cause flooding or washouts. Diversion structures should not be installed without identifying potential impacts to the stream channel.
  - Diversion or isolation activities should not completely dam stream flow.
  - Dewatering and removal may require additional sediment control or water treatment (See NS-2, “Dewatering Operations”).

## Standards and Specifications

### **General**

- Implement guidelines presented in NS-17, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on live streams, barriers adequate to prevent the flow of muddy water into streams shall be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams shall be held to a minimum.
- Diversion structures must be adequately designed to accommodate fluctuations in water depth or flow volume due to tides, storms, flash floods, etc.
- Heavy equipment driven in wet portions of a water body to accomplish work shall be completely clean of petroleum residue, and water levels shall be below the gearboxes of the equipment in use, or lubricants and fuels are sealed such that inundation by water shall not result in leaks.
- Mechanical equipment operated in the water shall not be submerged to a point above any axle of said mechanical equipment.
- Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the bucket of the crane/excavator/backhoe may operate in a water body. The main body of the crane/excavator/backhoe shall not enter the water body, except as necessary to cross the stream to access the work site.
- Clear water diversions that require dewatering shall be conducted in accordance with policies and guidelines presented in Field Guide to Construction Site Dewatering, October 2001, CTSW-RT-01-010.

- Stationary equipment such as motors and pumps, located within or adjacent to a water body, shall be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall, at all times, be allowed to pass downstream to maintain aquatic life downstream.
- The exterior of vehicles and equipment that will encroach on a water body within the project shall be maintained free of grease, oil, fuel, and residues.
- Equipment shall not be parked below the high water mark unless allowed by a permit.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation shall be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run rock to prevent damage to the underlying soil and root structure. The rock shall be removed upon completion of project activities.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Where possible, avoid or minimize diversion/encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. See also the project special provisions for scheduling requirements. Scheduling shall also consider seasonal releases of water from dams, fish migration and spawning seasons, and water demands due to crop irrigation.
- Construct diversion structures with materials free of potential pollutants such as soil, silt, sand, clay, grease, or oil.

### ***Temporary Diversions/Encroachments***

- Construct diversion channels in accordance with BMP SS-9, “Earth Dikes/Drainage Swales, and Ditches.”
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with BMP SS-7, “Geotextiles, Plastic Covers & Erosion Control Blankets/Mats”, or use rock slope protection, as described in Standard Specifications Section 72-2, “Rock Slope Protection.”

- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment/slope protection, or other temporary soil stabilization methods.
- Provide for velocity dissipation at transitions in the diversion, such as the point where the stream is diverted to the channel and the point where the diverted stream is returned to its natural channel. See also BMP SS-10, “Outlet Protection/Velocity Dissipation Devices.”

### **Temporary Dry Construction Areas**

- When dewatering behind temporary structures to create a temporary dry construction area, such as coffer dams, pass pumped water through a sediment settling device, such as a portable tank or settling basin, before returning water to the water body; See also BMP NS-2, “Dewatering Operations.”
- If the presence of polluted water or sediment is identified in the contract, the contractor shall implement dewatering pollution controls as required by the contract documents. If the quality of water or sediment to be removed while dewatering is not identified as polluted in the contract documents, but is later determined by observation or testing to be polluted, the contractor shall notify the Resident Engineer (RE) and comply with Standard Specifications Section 5-1.116 “Differing Site Conditions.”
- Any substance used to assemble or maintain diversion structures, such as form oil, shall be non-toxic and non-hazardous.
- Any material used to minimize seepage underneath diversion structures, such as grout, shall be non-toxic, non-hazardous, and as close to a neutral pH as possible.

### **Isolation Techniques:**

Isolation techniques are methods that isolate near shore work from a waterbody. Techniques include sheet pile enclosures, water-filled geotextile (Aqua Dam) , gravel berm with impermeable membrane, gravel bags, coffer dams, and K-rail.

### **Filter Fabric Isolation Technique**

#### *Definition and Purpose:*

A filter fabric isolation structure (See Figure 1-C) is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution from construction work in or adjacent to water. This structure is composed of filter fabric, gravel bags, and steel t-posts.

#### *Appropriate Applications:*

- Filter fabric may be used for construction activities such as streambank stabilization, or culvert, bridge, pier or abutment installation. It may also be

used in combination with other methods, such as clean water bypasses and/or pumps.

- This method involves placement of gravel bags or continuous berms to “key-in” the fabric, and subsequently staking the fabric in place.
- If spawning gravel (gravel between 25 and 100 mm [1 and 4 inches]) is used, all other components of the isolation can be removed from the stream, and the gravel can be spread out and left as salmon spawning habitat. Whether spawning gravel or other types of gravel are used, only clean washed gravel should be used as infill for the gravel bags or continuous berm.
- This is a method that should be used in relatively calm water, and can be used in smaller streams.

### *Limitations*

- Do not use if the installation, maintenance and removal of the structures will disturb sensitive aquatic species of concern.
- Not appropriate for projects where dewatering is necessary.
- Not appropriate to completely dam streamflow.

### *Standards and Specifications:*

- For the filter fabric isolation method, a non-woven or heavy-duty fabric (refer to Standard Specifications Section 88) is recommended over standard silt fence. Using rolled geotextiles allows non-standard widths to be used.
- Anchor filter fabric with gravel bags filled with clean, washed gravel. Do not use sand. If a bag should split open, the gravel can be left in the stream, where it can provide aquatic habitat benefits.
- Another anchor alternative is a continuous berm, made with the Continuous Berm Machine. This is a gravel-filled bag that can be made in very long segments. The length of the berms is usually limited to 6 m (20 ft) for ease of handling.

### *Installation*

- Place the fabric on the bottom of the stream, and place either a bag of clean, washed gravel or a continuous berm over the bottom of the fabric, such that a bag-width of fabric lies on the stream bottom. The bag should be placed on what will be the outside of the isolation area.
- Pull the fabric up, and place a metal t-post immediately behind the fabric, on the inside of the isolation area; attach the fabric to the post with three diagonal nylon ties.

- Continue placing fabric as described above until the entire work area has been isolated, staking the fabric at least every 1.8 m (6 ft).

### *Maintenance and Inspection:*

- During construction, inspect daily during the workweek.
- Schedule additional inspections during storm events.
- Immediately repair any gaps, holes or scour.
- Remove sediment buildup.
- Remove BMP upon completion of construction activity. Recycle or re-use if applicable.
- Re-vegetate areas disturbed by BMP removal if needed.

### ***Turbidity Curtain Isolation Technique***

#### *Definition and purpose:*

A turbidity curtain (refer to Figures 1A through 1D) is a fabric barrier used to isolate the near shore work area. The barriers are intended to confine the suspended sediment. The curtain is a floating barrier, and thus does not prevent water from entering the isolated area; rather, it prevents suspended sediment from getting out.

#### *Appropriate applications:*

Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They are used when construction activities adjoin quiescent waters, such as lakes, ponds, lagoons, bays, and slow flowing rivers. The curtains are designed to deflect and contain sediment within a limited area and provide sufficient retention time so that the soil particles will fall out of suspension.

#### *Limitations:*

- Turbidity curtains should not be used in flowing water; they are best suited for use in ponds, lakes, lagoons, bays, and very slow-moving rivers.
- Turbidity curtains should not be placed across the width of a channel.
- Removing sediment that has been deflected and settled out by the curtain may create a discharge problem through the re-suspension of particles and by accidental dumping by the removal equipment.

#### *Standards and Specifications:*

- Turbidity curtains should be oriented parallel to the direction of flow.

- The curtain should extend the entire depth of the watercourse in calm-water situations.
- In wave conditions, the curtain should extend to within 0.3 m (1 ft) of the bottom of the watercourse, such that the curtain does not stir up sediment by hitting the bottom repeatedly. If it is desirable for the curtain to reach the bottom in an active-water situation, a pervious filter fabric may be used for the bottom 0.3 m (1 ft).
- The top of the curtain should consist of flexible flotation buoys, and the bottom shall be held down by a load line incorporated into the curtain fabric. The fabric shall be a brightly colored impervious mesh.
- The curtain shall be held in place by anchors placed at least every 30 m (100 ft).
- First place the anchors, then tow the fabric out in a furling condition, and connect to the anchors. The anchors should be connected to the flotation devices, and not to the bottom of the curtain. Once in place, cut the furling lines, and allow the bottom of the curtain to sink.
- Sediment that has been deflected and settled out by the curtain may be removed if so directed by the on-site inspector or the RE. Consideration must be given to the probable outcome of the removal procedure. It must be asked if it will create more of a sediment problem through re-suspension of the particles or by accidental dumping of material during removal. It is recommended that the soil particles trapped by the turbidity curtain only be removed if there has been a significant change in the original contours of the affected area in the watercourse.
- Particles should always be allowed to settle for a minimum of 6 to 12 hours prior to their removal or prior to removal of the turbidity curtain.

### *Maintenance and Inspection:*

- The curtain should be inspected daily for holes or other problems, and any repairs needed should be made promptly.
- Allow sediment to settle for 6 to 12 hours prior to removal of sediment or curtain. This means that after removing sediment, wait an additional 6 to 12 hours before removing the curtain.
- To remove, install furling lines along the curtain, detach from anchors, and tow out of the water.

### ***K-rail River Isolation***

#### *Definition and Purpose:*

This is temporary sediment control, or stream isolation method that uses K-rails

(refer to Figure 2) to form the sediment deposition area, or to isolate the in-stream or near-bank construction area.

Barriers are placed end-to-end in a pre-designed configuration and gravel-filled bags are used at the toe of the barrier and also at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

### *Appropriate Applications:*

- The K-rail isolation can be used in streams with higher water velocities than many other isolation techniques.

### *Limitations:*

- The K-rail method does not allow for full dewatering.

### *Standards and Specifications:*

- To create a floor for the K-rail, move large rocks and obstructions. Place washed gravel and gravel-filled bags to create a level surface for K-rail to sit.
- Place the bottom two K-rails adjacent to each other, and parallel to the direction of flow; fill the center portion with gravel bags. Then place the third K-rail on top of the bottom two; there should be sufficient gravel bags between the bottom K-rails such that the top one is supported by the gravel. Place plastic sheeting around the K-rails, and secure at the bottom with gravel bags.
- Further support can be added by pinning and cabling the K-rails together. Also, large riprap and boulders can be used to support either side of the K-rail, especially where there is strong current.

### *Maintenance and Inspection:*

- The barrier should be inspected at least once daily, and any damage, movement or other problems should be addressed immediately.
- Sediment should be allowed to settle for at least 6 to 12 hours prior to removal of sediment, and for 6 to 12 hours prior to removal of the barrier.

## **Stream Diversions**

### *Definition and Purpose:*

Stream diversions consist of a system of structures and measures that intercept an existing stream upstream of the project and, transports it around the work area, and discharges it downstream (refer to Figure 3). The selection of which stream diversion technique to use depends upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.



### *Appropriate Applications:*

- Pumped diversions are appropriate in areas where de-watering is necessary.
- Dam-type diversions may serve as temporary access to the site.
- Where work areas require isolation from flows.

### *Limitations:*

- Pumped diversions have limited flow capacity.
- Pumped diversion require frequent monitoring of pumps.
- Large flows during storm events can overtop dams.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

### *Standards and Specifications:*

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Diversions shall be sized to convey design flood flows.
- Pump capacity must be sufficient for design flow; the upper limit is approximately 0.3 m<sup>3</sup>/sec (10 cfs) (the capacity of two 200 mm [8 inch] pumps).
- Adequate energy dissipation must be provided at the outlet to minimize erosion.
- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant; materials such as steel plate, sheetpile, sandbags, continuous berms, inflatable water bladders, etc. would be acceptable.
- When constructing a diversion channel, begin excavation of the channel at the proposed downstream end, and work upstream. Once the watercourse to be diverted is reached, and the excavated channel is stable, breach the upstream end, and allow water to flow down the new channel. Once flow has been established in the diversion channel, install the diversion weir in the main channel; this will force all water to be diverted from the main channel.

### *Maintenance and Inspection:*

- Inspect diversion/encroachment structures before and after significant storms, and at least once per week while in service. Inspect daily during the construction.
- Pumped diversions require frequent monitoring of pumps.

- Inspect embankments and diversion channels before and after significant storms, and at least once per week while in service for damage to the linings, accumulating debris, sediment buildup, and adequacy of the slope protection. Remove debris and repair linings and slope protection as required. Repair holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed and flow should be re-directed through the new culvert or back into the original stream channel. Recycle or re-use if applicable.

### ***Instream Construction Sediment Control***

There are three different options currently available for reducing turbidity while working in a stream or river. The stream can be isolated from the area in which work is occurring by means of a water barrier, the stream can be diverted around the work site through a pipe or temporary channel, or one can employ construction practices that minimize sediment suspension.

Whatever technique is implemented, an important thing to remember is that dilution can sometimes be the solution. A probable “worst time” to release high TSS into a stream system might be when the stream is very low; summer low flow, for example. During these times, the flow may be low while the biological activity in the stream is very high. Conversely, the addition of high TSS or sediment during a big storm discharge might have a relatively low impact, because the stream is already turbid, and the stream energy is capable of transporting both suspended solids, and large quantities of bedload through the system. The optimum time to remove in-stream structures may be during the rising limb of a storm hydrograph.

### **Techniques to minimize Total Suspended Solids (TSS)**

- Padding - Padding laid in the stream below the work site may trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream, and placed on the bank to assist in revegetation.
- Clean, washed gravel - Using clean, washed gravel decreases solid suspension, as there are fewer small particles deposited in the stream.
- Excavation using a large bucket -Each time a bucket of soil is placed in the stream, a portion is suspended. Approximately the same amount is suspended whether a small amount of soil is placed in the stream, or a large amount. Therefore, using a large excavator bucket instead of a small one, will reduce the total amount of soil that washes downstream.
- Use of dozer for backfilling - Using a dozer for backfilling instead of a backhoe follows the same principles – the fewer times soil is deposited in the stream, the less soil will be suspended.
- Partial dewatering with a pump - Partially dewatering a stream with a pump reduces the amount of water, and thus the amount of water that can suspend sediment.

## ***Washing Fines***

### *Definition and Purpose:*

Washing fines is an “in-channel” sediment control method, which uses water, either from a water truck or hydrant, to wash any stream fines that were brought to the surface of the channel bed during restoration, back into the interstitial spaces of the gravel and cobbles.

The purpose of this technique is to reduce or eliminate the discharge of sediment from the channel bottom during the first seasonal flows, or “first flush.” Sediment should not be allowed into stream channels; however, occasionally in-channel restoration work will involve moving or otherwise disturbing fines (sand and silt-sized particles) that are already in the stream, usually below bankfull discharge elevation. Subsequent re-watering of the channel can result in a plume of turbidity and sedimentation.

This technique washes the fines back into the channel bed. Bedload materials, including gravel cobbles, boulders and those fines, are naturally mobilized during higher storm flows. This technique is intended to delay the discharge until the fines would naturally be mobilized.

### *Appropriate Applications:*

- This technique should be used when construction work is required in channels. It is especially useful in intermittent or ephemeral streams in which work is performed “in the dry”, and which subsequently become re-watered.

### *Limitations:*

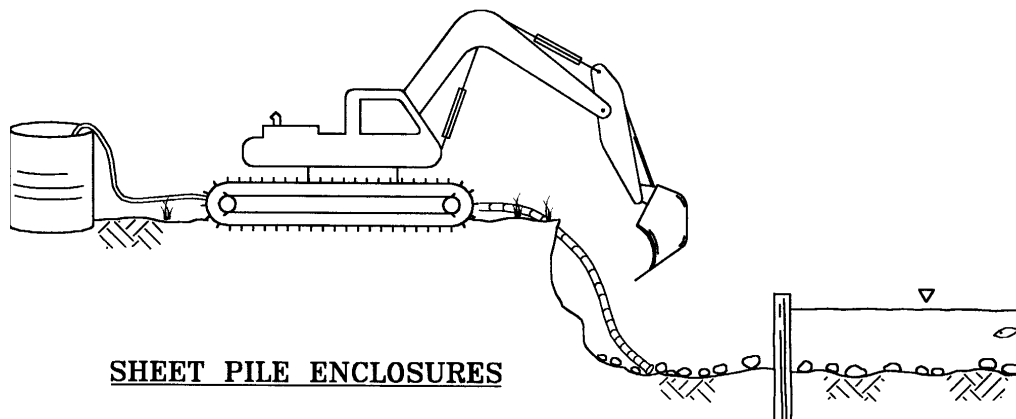
- The stream must have sufficient gravel and cobble substrate composition.
- The use of this technique requires consideration of time of year and timing of expected stream flows.
- The optimum time for the use of this technique is in the fall, prior to winter flows.
- Consultation with, and approval from the Department of Fish and Game and the Regional Water Quality Control Board may be required.

### *Standards and Specifications:*

- Apply sufficient water to wash fines, but not cause further erosion or runoff.
- Apply water slowly and evenly to prevent runoff and erosion.
- Consult with Department of Fish and Game and the Regional Water Quality Control Board for specific water quality requirements of applied water (e.g. chlorine).

### BENEFITS/LIMITATIONS

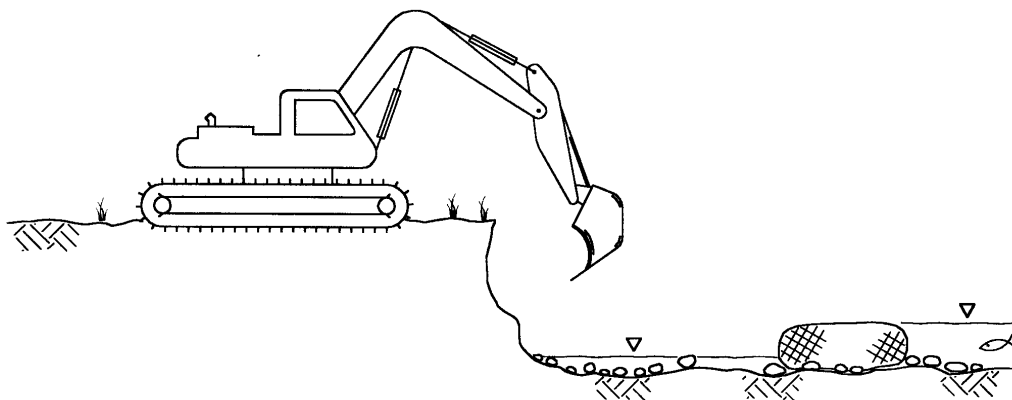
- Allows full dewatering
- Relatively expensive
- Useful in large rivers, lakes, high velocity
- Not really appropriate for small streams
- Requires staging and heavy equipment access areas



SHEET PILE ENCLOSURES

### BENEFITS/LIMITATIONS

- Allows partial dewatering
- Moderately expensive
- Ease of installation and removal unknown
- Can be designed for small streams to large rivers



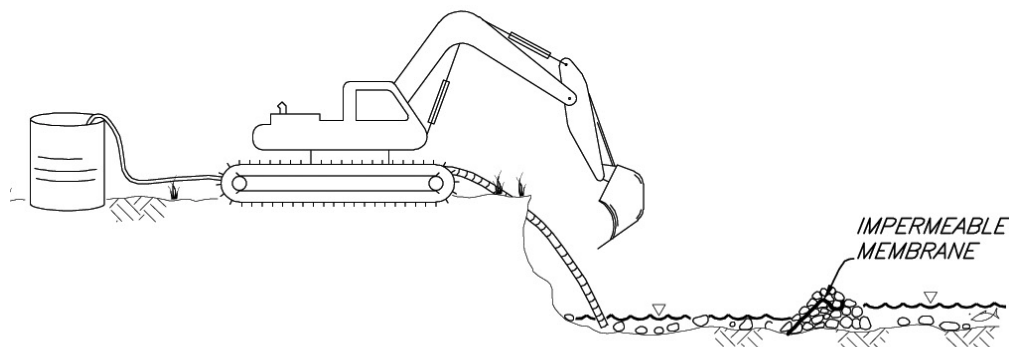
WATER-FILLED GEOTEXTILE (AQUA DAM)

## INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

Figure 1A

*BENEFITS/LIMITATIONS*

- .Allows partial dewatering*
- .Relatively inexpensive*
- .Useful for small streams*
- .Minimal TSS when removed*



*NOTES:*

- Step 1. Install clean gravel with impermeable membrane*
- Step 2. Do work*
- Step 3. Decommission berm by removing impermeable membrane*
- Step 4. Pump work area. Head differential will cause water to flow into work area through gravel*
- Step 5. Remove or spread gravel*

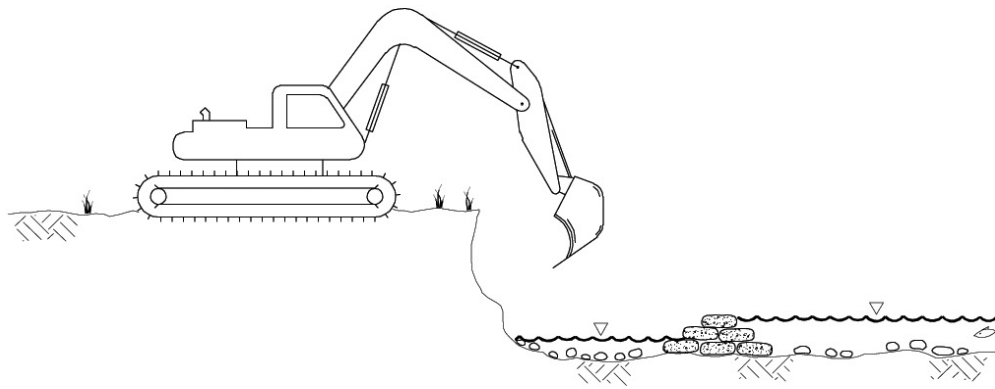
**GRAVEL BERM WITH IMPERMEABLE MEMBRANE**

**INSTREAM EROSION AND SEDIMENT  
CONTROL ISOLATION TECHNIQUES**

**Figure 1B**

BENEFITS/LIMITATIONS

- .Difficult to dewater*
- .Inexpensive*
- .Labor intensive to install and remove*
- .Use clean gravel*



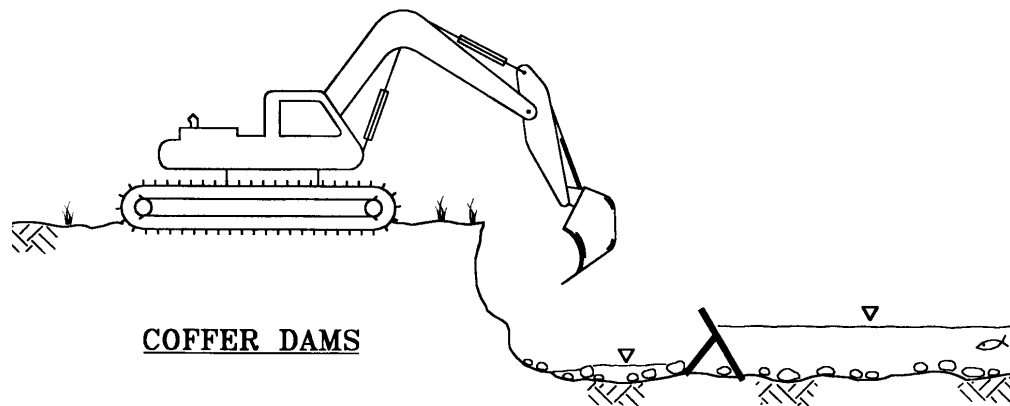
GRAVEL BAG TECHNIQUE

INSTREAM EROSION AND SEDIMENT  
CONTROL ISOLATION TECHNIQUES

Figure 1C

*BENEFITS/LIMITATIONS*

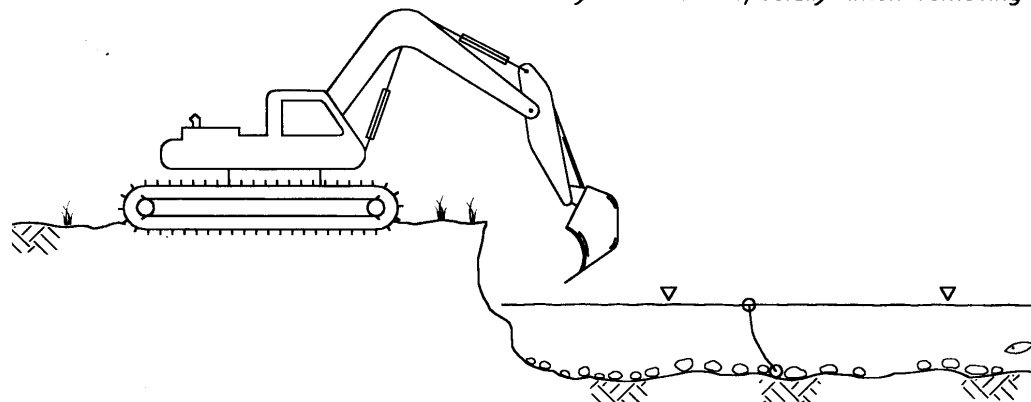
- Allows partial dewatering*
- Many different types available*
- Relatively expensive*
- Can be designed for large and small streams*
- Ease of installation and removal unknown*



**COFFER DAMS**

*BENEFITS/LIMITATIONS*

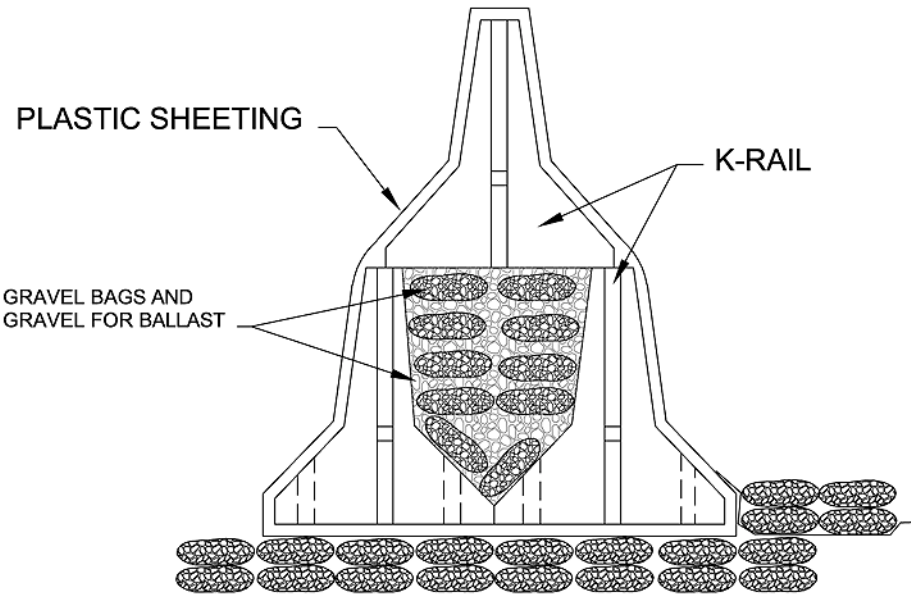
- Does not allow dewatering*
- Inexpensive*
- Used in slow water lakes only*
- Not very effective especially when removing*



**GEOTEXTILES, SILT BARRIERS, CURTAINS**

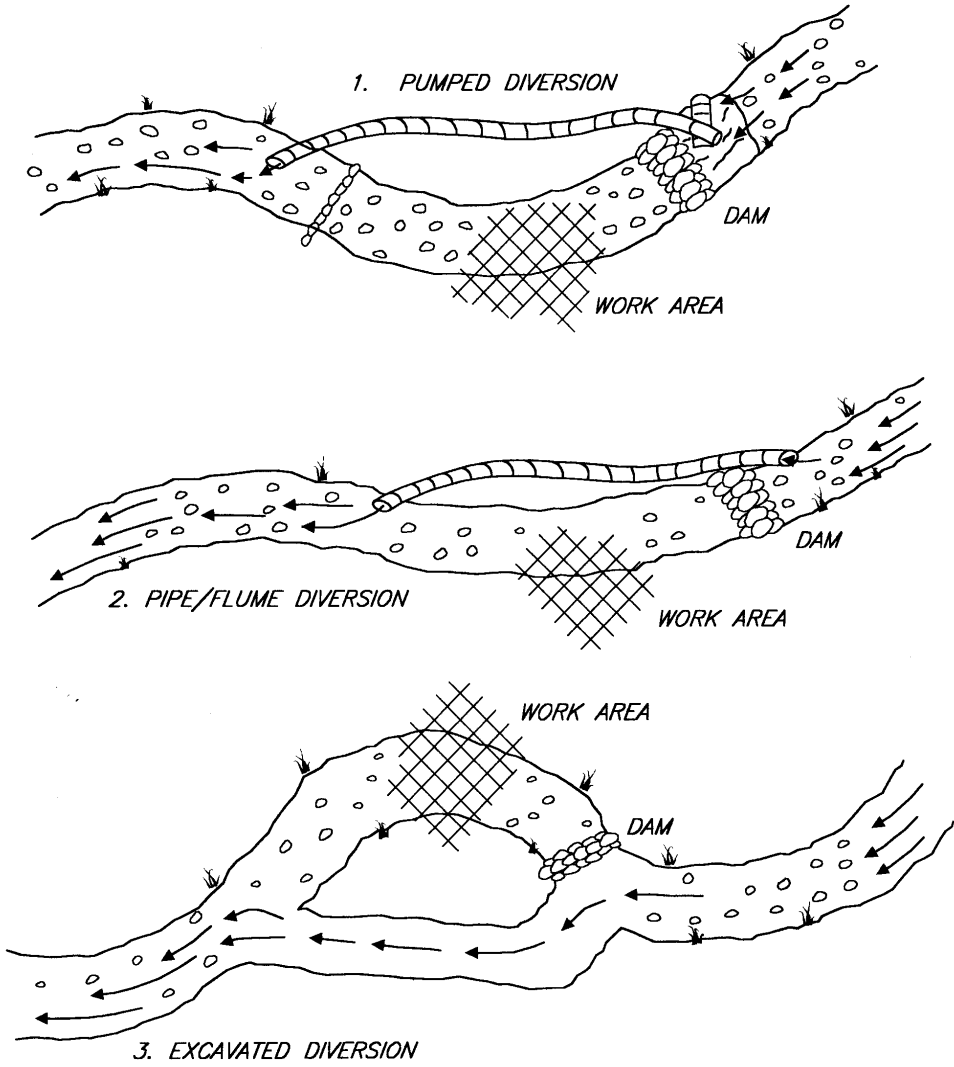
**INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES**

**Figure 1D**



**K-Rail Isolation  
Figure 2**



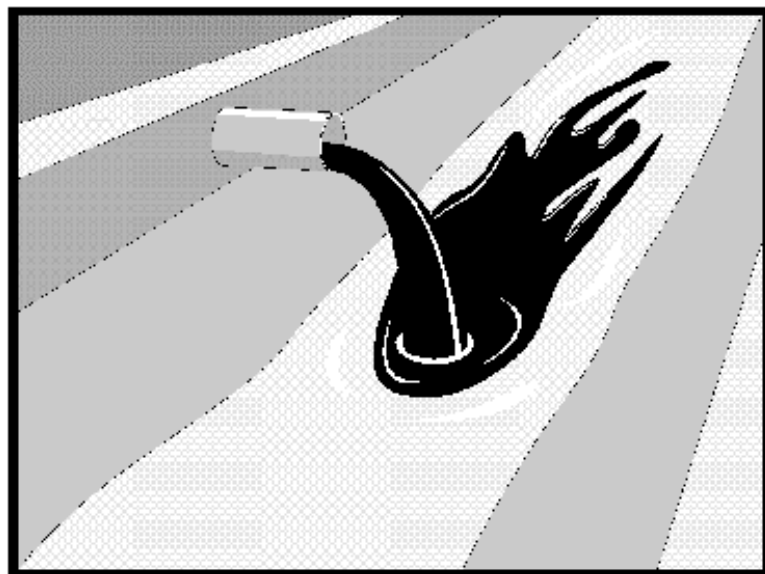


**TYPICAL STREAM  
DIVERSION TECHNIQUES**

**Figure 3**

# Illicit Connection/Illegal Discharge Detection and Reporting

**NS-6**



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents to the Resident Engineer (RE).

**Appropriate Applications**

- Illicit connection/illegal discharge detection and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

- This best management practice (BMP) applies to all construction projects.

**Limitations**

- Unlabeled or non-identifiable material shall be assumed to be hazardous.
- Illicit connections and illegal discharges or dumping, for the purposes of this BMP, refer to discharges and dumping caused by parties other than the contractor.

- Procedures and practices presented in this BMP are general. Contractor shall use extreme caution, immediately notify the RE when illicit connections or illegal dumping or discharges are discovered, and take no further action unless directed by the RE.

- If pre-existing hazardous materials or wastes are known to exist onsite, the contractor's responsibility will be detailed in separate special provisions.

# Illicit Connection/Illegal Discharge Detection and Reporting

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**NS-6**

## Standards and Specifications *Planning*

- Inspect site before beginning the job for evidence of illicit connections or illegal dumping or discharges.
- Inspect site regularly during project execution for evidence of illicit connections or illegal dumping or discharges.
- Observe site perimeter for evidence or potential of illicitly discharged or illegally dumped material, which may enter the job site.

### *Identification of illicit connections and illegal dumping or discharges.*

- Solids - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.
- Liquids – signs of illegal liquid dumping or discharge can include:
  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils.
  - Pungent odors coming from the drainage systems.
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes.
  - Abnormal water flow during the dry weather season.
- Urban Areas - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:
  - Abnormal water flow during the dry weather season.
  - Unusual flows in subdrain systems used for dewatering.
  - Pungent odors coming from the drainage systems.
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes.
  - Excessive sediment deposits, particularly adjacent to or near active off-site construction projects.

# Illicit Connection/Illegal Discharge Detection and Reporting

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**NS-6**

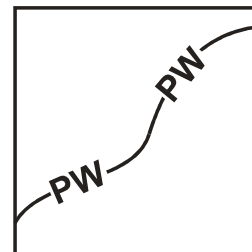
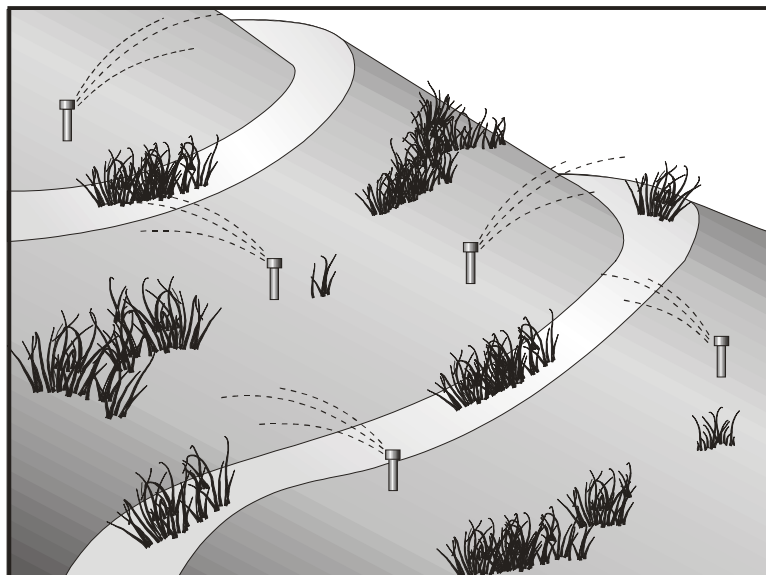
- Rural Areas - Illicit connections or illegal discharges involving irrigation drainage ditches are detected by visual inspections. Signs of an illicit discharge can include:
  - Abnormal water flow during the dry weather season.
  - Non-standard junction structures.
  - Broken concrete or other disturbances at or near junction structures.

### ***Reporting***

- Notify the RE of any illicit connections and illegal dumping or discharge incidents at the time of discovery. The RE will notify the District Construction Storm Water Coordinator and the Construction Hazmat Coordinator for reporting.

**Cleanup and Removal** The contractor is not responsible for investigation and clean up of illicit or illegal dumping or discharges not generated by the contractor. Caltrans may direct contractor to clean up non-hazardous dumped or discharged material on the construction site.





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

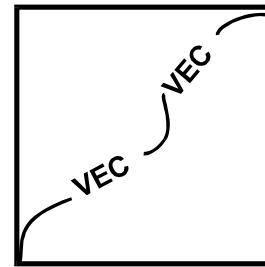
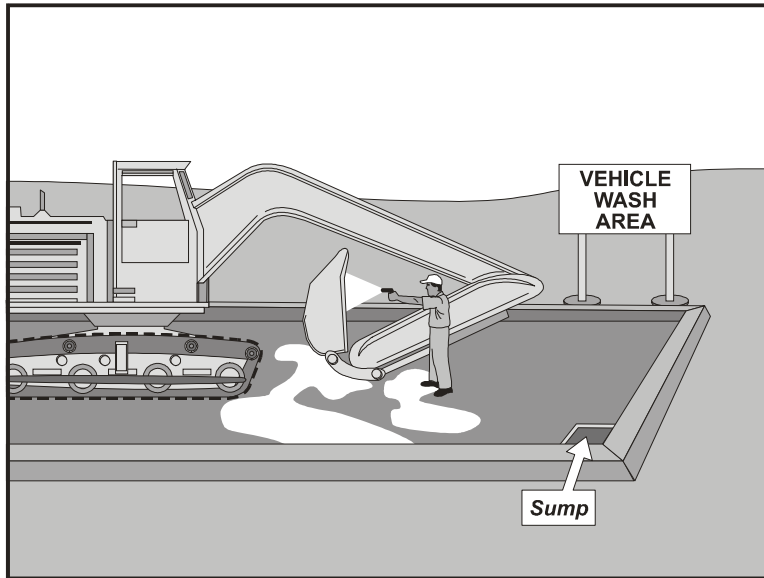
**Definition and Purpose** Potable Water/Irrigation management consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

**Appropriate Applications** Implement this BMP whenever the above activities or discharges occur at or enter a construction site.

**Limitations** ■ None identified.

- Standards and Specifications**
- Inspect irrigated areas within the construction limits for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used and to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.
  - RE approval is required prior to commencing any washing activities that could discharge to the storm drain or receiving waterbody.
  - Where possible, direct water from off-site sources around or through a construction site in a way that minimizes contact with the construction site.
  - When possible, discharges from water line flushing shall be reused for landscaping purposes.
  - Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.

- Protect downstream storm water drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.
- Maintenance and Inspection
- Repair broken water lines as soon as possible or as directed by the RE.
  - Inspect irrigated areas regularly for signs of erosion and/or discharge.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Vehicle and equipment cleaning procedures and practices are used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drain system or to watercourses.

**Appropriate Applications** These procedures are applied on all construction sites where vehicle and equipment cleaning is performed.

**Limitations** ■ None.

- Standards and Specifications**
- On-site vehicle and equipment washing is discouraged.
  - Cleaning of vehicles and equipment with soap, solvents or steam shall not occur on the project site unless the Resident Engineer (RE) has been notified in advance and the resulting wastes are fully contained and disposed of outside the highway right-of-way in conformance with the provisions in the Standard Specifications Section 7-1.13. Resulting wastes and by-products shall not be discharged or buried within the highway right-of-way, and must be captured and recycled or disposed according to the requirements of WM-10, "Liquid Waste Management" or WM-6, "Hazardous Waste Management," depending on the waste characteristics. Minimize use of solvents. The use of diesel for vehicle and equipment cleaning is prohibited.
  - Vehicle and equipment wash water shall be contained for percolation or evaporative drying away from storm drain inlets or watercourses and shall not be discharged within the highway right-of-way. Apply sediment control BMPs if applicable.
  - All vehicles/equipment that regularly enter and leave the construction site must be cleaned off-site.
  - When vehicle/equipment washing/cleaning must occur onsite, and the

operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area shall have the following characteristics, and shall be arranged with the construction storm water coordinator:

- Located away from storm drain inlets, drainage facilities, or watercourses.
- Paved with concrete or asphalt and bermed to contain wash waters and to prevent run-on and runoff.
- Configured with a sump to allow collection and disposal of wash water.
- Wash waters shall not be discharged to storm drains or watercourses.
- Used only when necessary.

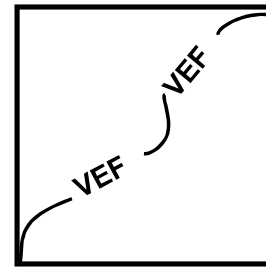
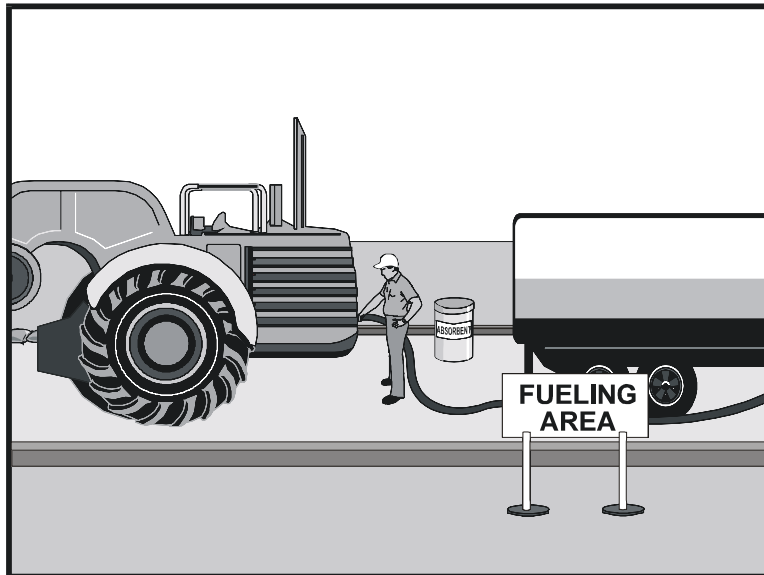
■ When cleaning vehicles/equipment with water:

- Use as little water as possible. High pressure sprayers may use less water than a hose, and shall be considered.
- Use positive shutoff valve to minimize water usage.
- Facility wash racks shall discharge to a sanitary sewer, recycle system or other approved discharge system and shall not discharge to the storm drainage system or watercourses.

## Maintenance and Inspection

- The control measure shall be inspected at a minimum of once a week.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed or as directed by the RE.





Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Vehicle and equipment fueling procedures and practices are designed to minimize or eliminate the discharge of fuel spills and leaks into storm drain systems or to watercourses.

**Appropriate Applications** These procedures are applied on all construction sites where vehicle and equipment fueling takes place.

**Limitations**

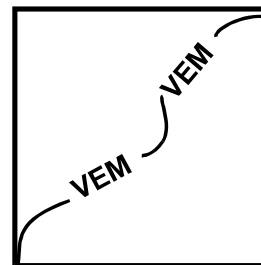
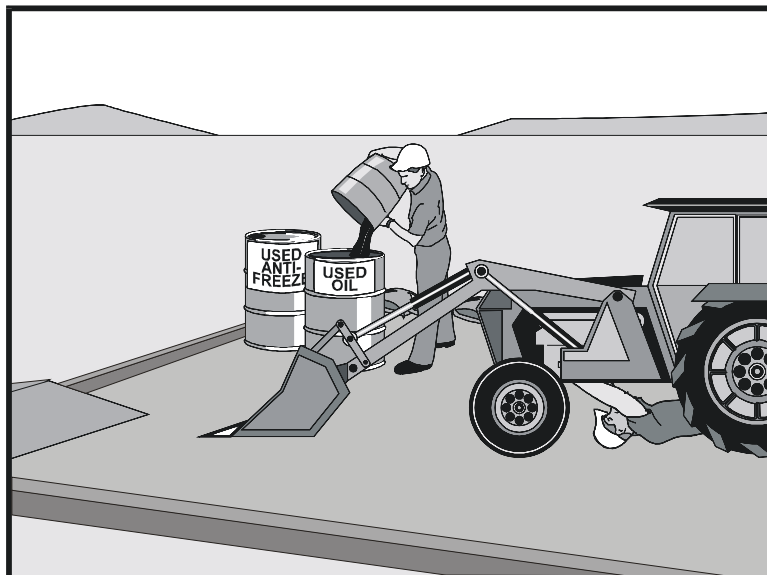
- Onsite vehicle and equipment fueling shall only be used where it's impractical to send vehicles and equipment off-site for fueling.

- Standards and Specifications**
- When fueling must occur onsite, the contractor shall select and designate an area to be used, subject to approval of the Resident Engineer (RE).
  - Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on fueling trucks and shall be disposed of properly after use.
  - Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
  - Dedicated fueling areas shall be protected from storm water run-on and runoff, and shall be located at least 15 m (50 ft) from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
  - Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut-off to control drips. Fueling operations shall not be left unattended.
  - Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills.

- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD). Ensure the nozzle is secured upright when not in use.
- Fuel tanks shall not be "topped-off."
- Vehicles and equipment shall be inspected on each day of use for leaks. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.
- Absorbent spill clean-up materials shall be available in fueling and maintenance areas and used on small spills instead of hosing down or burying techniques. The spent absorbent material shall be removed promptly and disposed of properly.
- Federal, state, and local requirements shall be observed for any stationary above ground storage tanks. Refer to WM-1, "Material Delivery and Storage."
- Mobile fueling of construction equipment throughout the site shall be minimized. Whenever practical, equipment shall be transported to the designated fueling area.

## Maintenance and Inspection

- Fueling areas and storage tanks shall be inspected regularly.
- Keep an ample supply of spill cleanup material on the site.
- Immediately cleanup spills and properly dispose of contaminated soil and cleanup materials.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

Procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain systems or to watercourses from vehicle and equipment maintenance procedures.

### Appropriate Applications

These procedures are applied on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

### Limitations

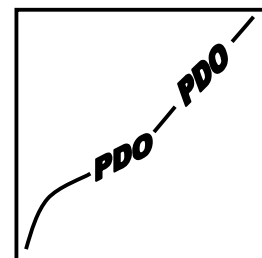
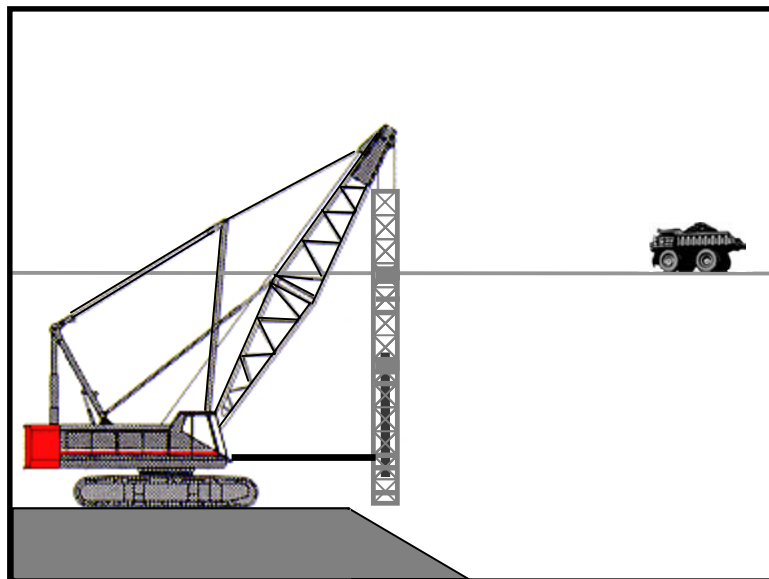
- None identified.

### Standards and Specifications

- Drip pans or absorbent pads shall be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- All maintenance areas are required to have spill kits and/or use other spill protection devices.
- Dedicated maintenance areas shall be protected from storm water run-on and runoff, and shall be located at least 15 m (50 ft) from downstream drainage facilities and watercourses.
- Drip Pans or plastic sheeting shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Absorbent spill clean-up materials shall be available in maintenance areas and shall be disposed of properly after use. Substances used to coat asphalt transport trucks and asphalt-spreading equipment shall be non-toxic.
- Use off-site maintenance facilities whenever practical.

- For long-term projects, consider constructing roofs or using portable tents over maintenance areas.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not dump fuels and lubricants onto the ground.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose or recycle used batteries.
- Do not bury used tires.
- Repair of fluid and oil leaks immediately.
- Provide spill containment dikes or secondary containment around stored oil and chemical drums.
- Maintain waste fluid containers in leak proof condition.
- Vehicle and equipment maintenance areas shall be inspected regularly.
- Vehicles and equipment shall be inspected on each day of use. Leaks shall be repaired immediately or the problem vehicle(s) or equipment shall be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

## Maintenance and Inspection



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

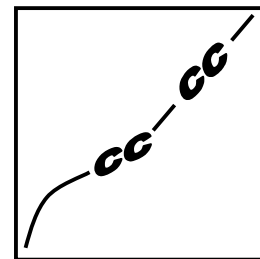
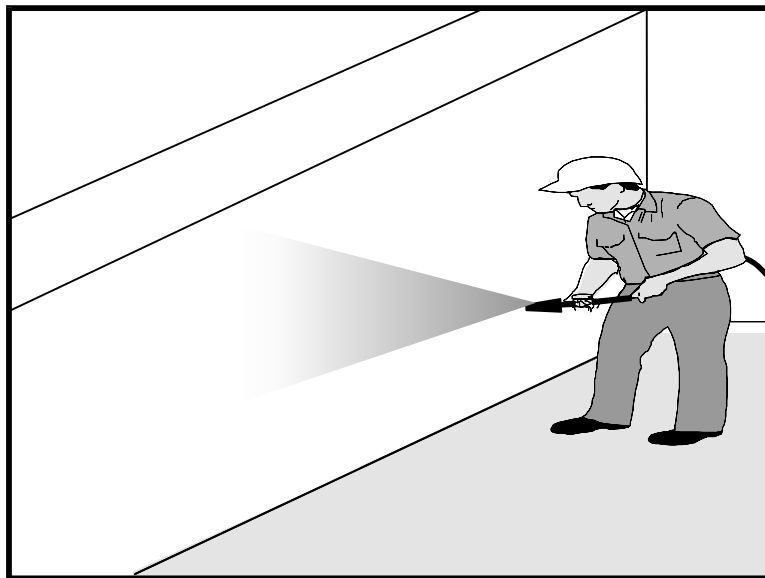
**Definition and Purpose** The construction and retrofit of bridges and retaining walls often include driving piles for foundation support and shoring operations. Driven piles are typically constructed of concrete, steel, or timber. Driven sheet piles are used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce the discharge of potential pollutants to the storm drain system or watercourses.

**Appropriate Applications** These procedures apply to construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving operations (impact and vibratory) take place, including operations using pile shells for construction of cast-in-steel-shell and cast-in-drilled-hole piles.

**Limitations** ■ None identified.

- Standards and Specifications**
- Use drip pans or absorbent pads during vehicle and equipment maintenance, cleaning, fueling, and storage. Refer to BMPs NS-9 “Vehicle and Equipment Fueling” and NS-10 “Vehicle and Equipment Maintenance.”
  - Have spill kits and cleanup materials available at all locations of pile driving. Refer to BMP WM-4 “Spill Prevention and Control.”
  - Keep equipment that is in use in streambeds; or on docks, barges, or other structures over water bodies, leak free.
  - Park equipment over plastic sheeting or equivalent where possible. Plastic sheeting is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water shall comply with all applicable permits.
  - Implement other BMPs as applicable, such as NS-2 “Dewatering Operations,” WM-5 “Solid Waste Management,” WM-6 “Hazardous Waste Management,” and WM-10 “Liquid Waste Management.”

- When not in use, store pile driving equipment away from concentrated flows of storm water, drainage courses, and inlets. Protect hammers and other hydraulic attachments from run-on by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain.
  - Use less hazardous products, e.g. vegetable oil instead of hydraulic fluid, when practicable.
- Maintenance and Inspection
- Inspect pile driving areas and equipment for leaks and spills on a daily basis.
  - Inspect equipment routinely and repair equipment as needed (e.g., worn or damaged hoses, fittings, gaskets).



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Concrete curing is used in the construction of structures such as bridges, retaining walls, and pump houses. Concrete curing includes the use of both chemical and water methods. Proper procedures minimize pollution of runoff during concrete curing.

**Appropriate Applications** All concrete elements of a structure (e.g., footings, columns, abutments, stems, soffit, deck) are subject to curing requirements.

**Limitations** ■ None identified.

**Standards and Specifications** **Chemical Curing**

- Avoid over-spray of curing compounds.
- Minimize the drift of chemical cure as much as possible by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.
- Use proper storage and handling techniques for concrete curing compounds. Refer to BMP WM-1, “Material Delivery and Storage.”
- Protect drain inlets prior to the application of curing compounds.
- Refer to WM-4, “Spill Prevention and Control.”

**Water Curing for Bridge Decks, Retaining Walls, and other Structures**

- Direct cure water away from inlets and watercourses to collection areas for removal as approved by the RE and in accordance with all applicable permits.

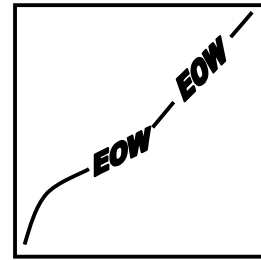
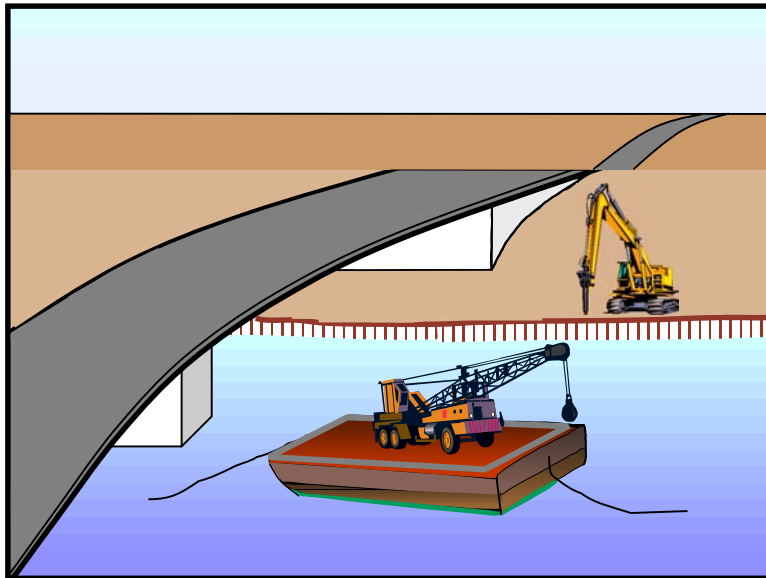
## Maintenance and Inspection

- Collect cure water and transport or dispose of water in a non-erodible manner. See BMPs SS-9, “Earth Dikes/Drainage Swales & Lined Ditches,” SS-10, “Outlet Protection/Velocity Dissipation Devices,” and SS-11, “Slope Drains.”
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect any temporary diversion devices, lined channels, or swales for washouts, erosion, or debris. Replace lining and remove debris as necessary.
- Inspect cure containers and spraying equipment for leaks.



# Material and Equipment Use Over Water

**NS-13**



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

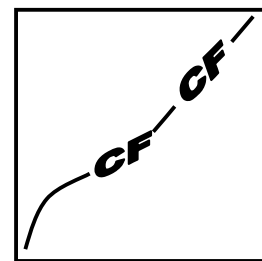
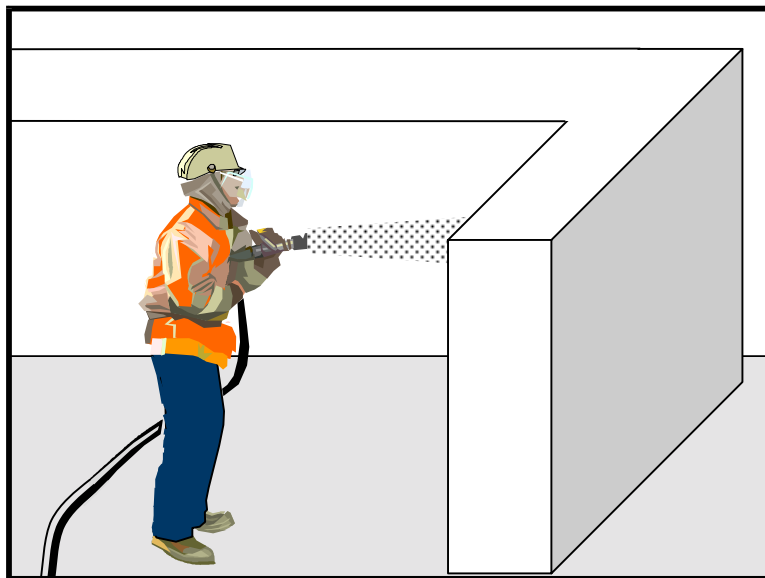
<b>Definition and Purpose</b>	Procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations that minimize or eliminate the discharge of potential pollutants to a watercourse.
<b>Appropriate Applications</b>	These procedures shall be implemented for construction materials and wastes (solid and liquid) and any other materials that may be detrimental if released. Applies where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse.
<b>Limitations</b>	<ul style="list-style-type: none"> <li>■ None identified.</li> </ul>
<b>Standards and Specifications</b>	<ul style="list-style-type: none"> <li>■ Refer to BMPs WM-1, “Material Delivery and Storage” and WM-4, “Spill Prevention and Control.”</li> <li>■ Use drip pans and absorbent materials for equipment and vehicles and ensure that an adequate supply of spill cleanup materials is available.</li> <li>■ Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is expected to be idle for more than one hour.</li> <li>■ Maintain equipment in accordance with BMP NS-10, “Vehicle and Equipment Maintenance.” If a leaking line cannot be repaired, remove equipment from over the water.</li> <li>■ Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc.</li> <li>■ Secure all materials to prevent discharges to receiving waters via wind.</li> </ul>

# Material and Equipment Use Over Water

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**NS-13**

- Identify types of spill control measures to be employed, including the storage of such materials and equipment. Ensure that staff are trained regarding the deployment and access of control measures and that measures are being used.
  - Ensure the timely and proper removal of accumulated wastes. Refer to BMPs WM-5, “Solid Waste Management” (non-hazardous) and WM-6, “Hazardous Waste Management.”
  - Comply with all necessary permits required for construction within or near the watercourse, such as RWQCB, U.S. Army Corps of Engineers, Department of Fish and Game and other local permitting agencies.
  - Discharges to waterways shall be reported to the RE immediately upon discovery. A written discharge notification must follow within 7 days.
  - Refer to BMP NS-15, “Structure Demolition/Removal Over or Adjacent to Water.”
- Maintenance and Inspection
- Inspect equipment for leaks and spills on a daily basis, and make necessary repairs.
  - Ensure that employees and subcontractors implement appropriate measures for storage and use of materials and equipment.
  - Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the watercourse.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

<b>Definition and Purpose</b>	Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high pressure water blasting. Proper procedures minimize the impact that concrete finishing methods may have on runoff.
<b>Appropriate Applications</b>	These procedures apply to all construction locations where concrete finishing operations are performed.
<b>Limitations</b>	<ul style="list-style-type: none"> <li>■ Specific permit requirements may be included in the contract documents for certain concrete finishing operations.</li> </ul>
<b>Standards and Specifications</b>	<ul style="list-style-type: none"> <li>■ Follow containment requirements stated in the project special provisions, if any.</li> <li>■ Collect and properly dispose of water and solid waste from high-pressure water blasting operations.</li> <li>■ Collect water from blasting operations and transport or dispose of water in a non-erodible manner. Refer to BMPs SS-9, “Earth Dikes/Drainage Swales &amp; Lined Ditches,” SS-10, “Outlet Protection/Velocity Dissipation Devices,” and SS-11, “Slope Drains.”</li> <li>■ Direct water from blasting operations away from inlets and watercourses to collection areas for removal (e.g., dewatering) as approved in advance by the RE and in accordance with applicable permits.</li> <li>■ Protect inlets during sandblasting operations. Refer to BMP SC-10, “Storm Drain Inlet Protection.”</li> </ul>

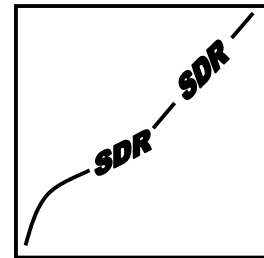
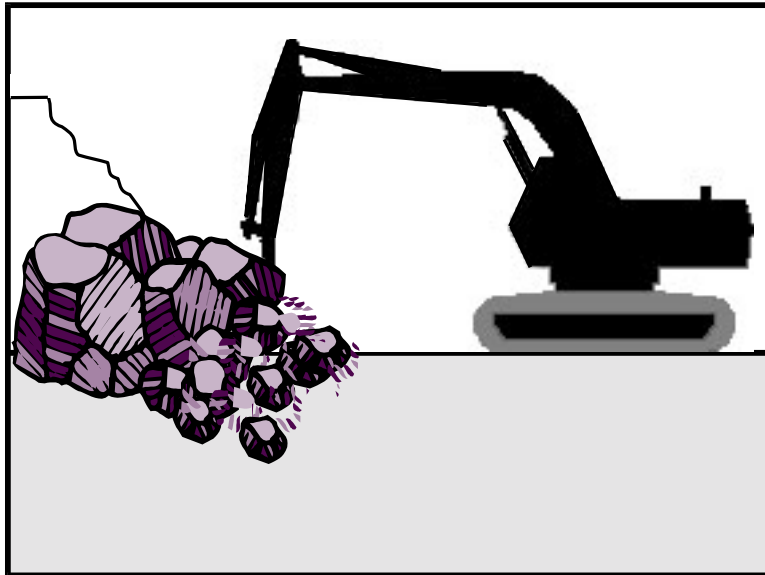
- Refer to BMP WM-8, “Concrete Waste Management.”
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to BMP WM-6, “Hazardous Waste Management.”

## Maintenance and Inspection

- Follow inspection procedure as required in the project special provisions.
- At a minimum, inspect containment structures, if any, for damage or voids prior to use each day and prior to the onset of rain.
- At the end of each work shift, remove and contain the liquid and solid wastes from containment structures, if any, and from the general work area.
- Discharges to waterways shall be reported to RE immediately upon discovery. A written discharge notification must follow within 7 days or as required by special provisions.

# Structure Demolition/Removal Over or Adjacent to Water

**NS-15**



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

### Definition and Purpose

Procedures to protect water bodies from debris and wastes associated with structure demolition or removal over or adjacent to watercourses.

### Appropriate Applications

Full bridge demolition and removal, partial bridge removal (e.g., barrier rail, edge of deck) associated with bridge widening projects, concrete channel removal, or any other structure removal that could potentially affect water quality.

### Limitations

- Specific permit requirements may be included in the contract documents.

### Standards and Specifications

- Do not allow demolished material to enter waterway.
- Refer to BMP NS-5, “Clear Water Diversion” to direct water away from work areas.
- Use attachments on construction equipment such as backhoes to catch debris from small demolition operations.
- Use covers or platforms to collect debris.
- Platforms and covers are to be approved by the RE.
- Stockpile accumulated debris and waste generated during demolition away from watercourses and in accordance with BMP WM-3, “Stockpile Management.”
- Ensure safe passage of wildlife, as necessary.
- Discharges to waterways shall be reported to the RE immediately upon discovery. A written discharge notification must follow within 7 days.

# Structure Demolition/Removal Over or Adjacent to Water

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**NS-15**

- For structures containing hazardous materials (e.g., lead paint or asbestos) refer to BMP WM-6, “Hazardous Waste Management.” For demolition work involving soil excavation around lead-painted structures, refer to BMP WM-7, “Contaminated Soil Management.”
- Maintenance and Inspection
- Contractor must inspect demolition areas over or near adjacent watercourses on a daily basis.
  - Any debris-catching devices shall be emptied regularly. Collected debris shall be removed and stored away from the watercourse and protected from run-on and runoff.



# Section 8

## Waste Management and Materials Pollution Control Best Management Practices

### 8.1 Waste Management and Materials Pollution Control

Waste management and materials pollution control best management practices (BMPs), like non-storm water management BMPs, are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with storm water. These BMPs also involve day-to-day operations of the construction site and are under the control of the Contractor, and are additional “good housekeeping practices”, which involve keeping a clean, orderly construction site.

#### 8.1.1 Waste Management BMPs

Waste management consists of implementing procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project to prevent the release of waste materials into storm water discharges. Waste management includes the following BMPs:

- Spill Prevention and Control
- Solid Waste Management
- Hazardous Waste Management
- Contaminated Soil Management
- Concrete Waste Management
- Sanitary/Septic Waste Management
- Liquid Waste Management

#### 8.1.2 Materials Pollution Control BMPs

Materials pollution control (also called materials handling) consists of implementing procedural and structural BMPs for handling, storing, and using construction materials to prevent the release of those materials into storm water discharges. The objective is to reduce the opportunity for rainfall to come in contact with these materials. These controls shall be implemented for all applicable activities, material usage and site conditions. Materials handling practices include the following BMPs:

- Material Delivery and Storage
- Material Use
- Stockpile Management

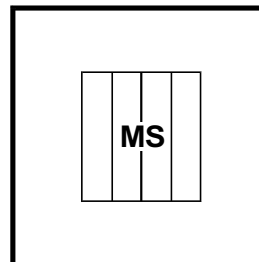
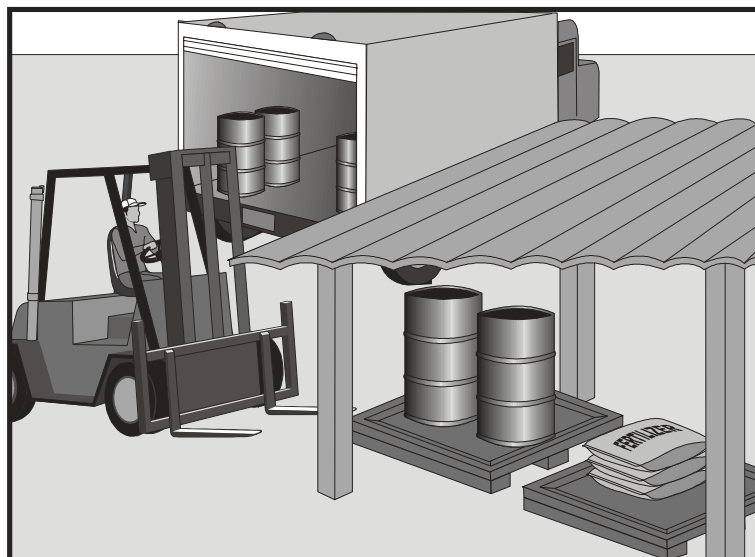
Table 8-1 lists the waste management and materials pollution control BMPs. It is important to note that all these BMPs have been approved by Caltrans for statewide use and they shall be implemented depending on the conditions/applicability of deployment described as part of the BMP.

**Table 8-1**

<b>WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs</b>	
<b>ID</b>	<b>BMP NAME</b>
WM-1	Material Delivery and Storage
WM-2	Material Use
WM-3	Stockpile Management
WM-4	Spill Prevention and Control
WM-5	Solid Waste Management
WM-6	Hazardous Waste Management
WM-7	Contaminated Soil Management
WM-8	Concrete Waste Management
WM-9	Sanitary/Septic Waste Management
WM-10	Liquid Waste Management

The remainder of this Section shows the working details for each of the waste management and materials pollution control BMPs.





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

**Appropriate Applications** These procedures are implemented at all construction sites with delivery and storage of the following:

- Hazardous chemicals such as:
  - Acids,
  - lime,
  - glues,
  - adhesives,
  - paints,
  - solvents, and
  - curing compounds.
- Soil stabilizers and binders.
- Fertilizers.
- Detergents.
- Plaster.
- Petroleum products such as fuel, oil, and grease.
- Asphalt and concrete components.
- Pesticides and herbicides.

- Other materials that may be detrimental if released to the environment.
- Limitations
- Space limitation may preclude indoor storage.
  - Storage sheds must meet building & fire code requirements.

## Standards and Specifications

### **General**

- Train employees and subcontractors on the proper material delivery and storage practices.
- Temporary storage area shall be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) shall be supplied to the Resident Engineer (RE) for all materials stored.

### **Material Storage Areas and Practices**

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall be placed in temporary containment facilities for storage.
- Throughout the rainy season, each temporary containment facility shall have a permanent cover and side wind protection or be covered during non-working days and prior to and during rain events.
- A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.
- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.

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- Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground. To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during non-working days and prior to rain events.
- Stockpiles shall be protected in accordance with BMP WM-3, “Stockpile Management.”
- Minimize the material inventory stored on-site (e.g., only a few days supply).
- Have proper storage instructions posted at all times in an open and conspicuous location.
- Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, under cover in secondary containment.
- Keep hazardous chemicals well labeled and in their original containers.
- Keep ample supply of appropriate spill clean up material near storage areas.
- Also see BMP WM-6, “Hazardous Waste Management”, for storing of hazardous materials.

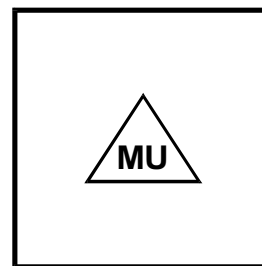
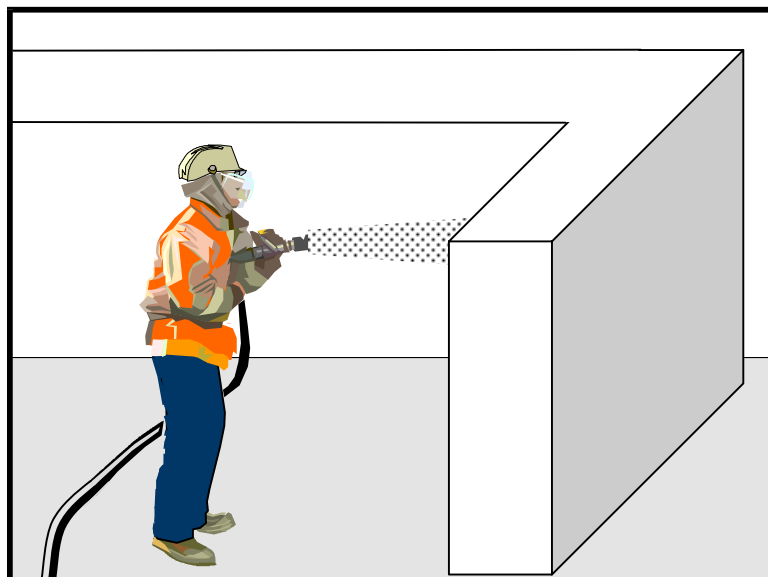
### ***Material Delivery Practices***

- Keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Employees trained in emergency spill clean-up procedures shall be present when dangerous materials or liquid chemicals are unloaded.

### ***Spill Clean-up***

- Contain and clean up any spill immediately.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous materials or contaminated soil.
- See BMP WM-4, “Spill Prevention and Control”, for spills of chemicals and/or hazardous materials.

- Maintenance and Inspection
- Storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.
  - Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
  - Inspect storage areas before and after rainfall events, and at least weekly during other times. Collect and place into drums any spills or accumulated rainwater.



Standard Symbol

### BMP Objectives

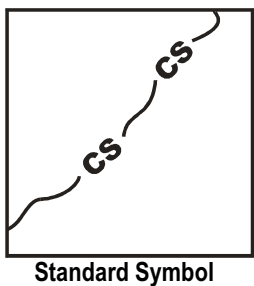
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** These are procedures and practices for use of construction material in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

**Appropriate Applications** This BMP applies to all construction projects. These procedures apply when the following materials are used or prepared on site:

- Hazardous chemicals such as:
  - Acids,
  - lime,
  - glues,
  - adhesives,
  - paints,
  - solvents, and
  - curing compounds.
- Soil stabilizers and binders.
- Fertilizers.
- Detergents.
- Plaster.
- Petroleum products such as fuel, oil, and grease.
- Asphalt and concrete components.
- Pesticides and herbicides.
- Other materials that may be detrimental if released to the environment.

- Limitations** ■ Safer alternative building and construction products may not be available or suitable in every instance.
- Standards and Specifications** ■ Material Safety Data Sheets (MSDS) shall be supplied to the Resident Engineer (RE) for all materials.
- Latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, may be disposed of with other construction debris.
  - Do not remove the original product label, it contains important safety and disposal information. Use the entire product before disposing of the container.
  - Mix paint indoors, or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain or watercourse. Dispose of any paint thinners, residue and sludge(s), that cannot be recycled, as hazardous waste.
  - For water-based paint, clean brushes to the extent practical, and rinse to a drain leading to a sanitary sewer where permitted, or into a concrete washout pit. For oil-based paints, clean brushes to the extent practical and filter and reuse thinners and solvents.
  - Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
  - Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials on-site when practical.
  - Do not over-apply fertilizers and pesticides. Prepare only the amount needed. Strictly follow the recommended usage instructions. Apply surface dressings in smaller applications, as opposed to large applications, to allow time for it to work in and to avoid excess materials being carried off-site by runoff.
  - Application of herbicides and pesticides shall be performed by a licensed applicator.
  - Contractors are required to complete the “Report of Chemical Spray Forms” when spraying herbicides and pesticides.
  - Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
  - Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Maintenance and Inspections** ■ Spot check employees and subcontractors monthly throughout the job to ensure appropriate practices are being employed.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose** Stockpile management procedures and practices are designed to reduce or eliminate air and storm water pollution from stockpiles of soil, and paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate subbase or pre-mixed aggregate, asphalt binder (so called “cold mix” asphalt) and pressure treated wood.

**Appropriate Applications** Implemented in all projects that stockpile soil and other materials.

**Limitations** ■ None identified

- Standards and Specifications**
- Protection of stockpiles is a year-round requirement.
  - Locate stockpiles a minimum of 15 m (50 ft) away from concentrated flows of storm water, drainage courses, and inlets.
  - Implement wind erosion control practices as appropriate on all stockpiled material. For specific information see BMP WE-1, “Wind Erosion Control.”
  - Stockpiles of contaminated soil shall be managed in accordance with BMP WM-7, “Contaminated Soil Management.”
  - Bagged materials should be placed on pallets and under cover.

***Protection of Non-Active Stockpiles***

Non-active stockpiles of the identified materials shall be protected further as follows:

- ***Soil stockpiles:***

- During the rainy seasons, soil stockpiles shall be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- During the non-rainy season, soil stockpiles shall be covered and protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

- ***Stockpiles of portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate subbase:***

- During the rainy season, the stockpiles shall be covered or protected with a temporary perimeter sediment barrier at all times.
- During the non-rainy season, the stockpiles shall be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

- ***Stockpiles of “cold mix”:***

- During the rainy season, cold mix stockpiles shall be placed on and covered with plastic or comparable material at all times.
- During the non-rainy season, cold mix stockpiles shall be placed on and covered with plastic or comparable material prior to the onset of precipitation.

- ***Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammonical, copper, zinc, and arsenate:***

- During the rainy season, treated wood shall be covered with plastic or comparable material at all times.
- During the non-rainy season, treated wood shall be covered with plastic or comparable material and shall be placed on pallets prior to the onset of precipitation.

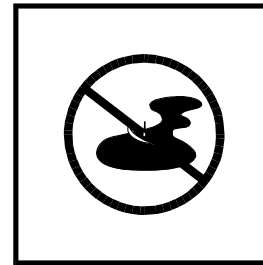
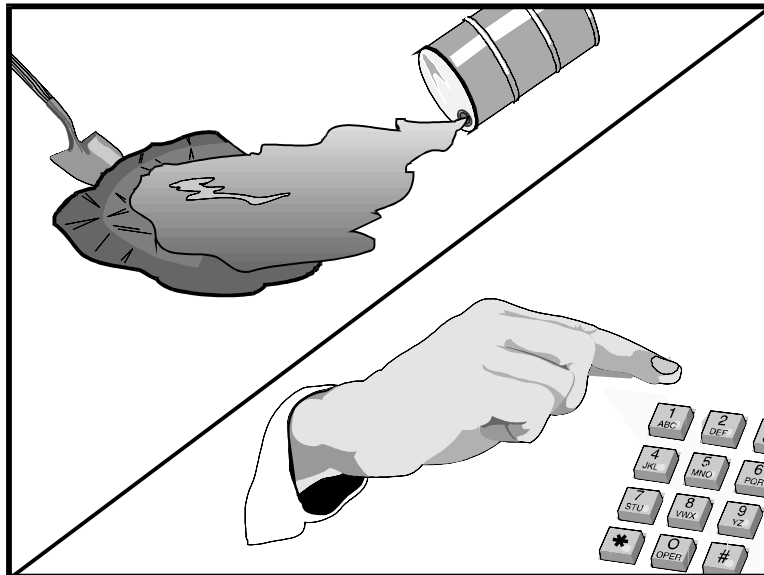
### ***Protection of Active Stockpiles***

Active stockpiles of the identified materials shall be protected further as follows:

- All stockpiles shall be covered, stabilized, or protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of “cold mix” shall be placed on and covered with plastic or comparable material prior to the onset of precipitation.



- Maintenance and Inspections
- Repair and/or replace perimeter controls and covers as needed, or as directed by the RE, to keep them functioning properly. Sediment shall be removed when sediment accumulation reaches one-third (1/3) of the barrier height.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** These procedures and practices are implemented to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to the drainage system or watercourses.

**Appropriate Application** This best management practice (BMP) applies to all construction projects. Spill control procedures are implemented anytime chemicals and/or hazardous substances are stored. Substances may include, but are not limited to:

- Soil stabilizers/binders.
- Dust Palliatives.
- Herbicides.
- Growth inhibitors.
- Fertilizers.
- Deicing/anti-icing chemicals.
- Fuels.
- Lubricants.
- Other petroleum distillates.

To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110, 117, and 302, and sanitary and septic wastes shall be contained and cleaned up immediately.

**Limitations** ■ This BMP only applies to spills caused by the contractor.

■ Procedures and practices presented in this BMP are general. Contractor shall identify appropriate practices for the specific materials used or stored on-site.

**Standards and Specifications** ■ To the extent that it doesn't compromise clean up activities, spills shall be covered and protected from storm water run-on during rainfall.

■ Spills shall not be buried or washed with water.

■ Used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose shall be stored and disposed of in conformance with the special provisions.

■ Water used for cleaning and decontamination shall not be allowed to enter storm drains or watercourses and shall be collected and disposed of in accordance with BMP WM-10, "Liquid Waste Management."

■ Water overflow or minor water spillage shall be contained and shall not be allowed to discharge into drainage facilities or watercourses.

■ Proper storage, clean-up and spill reporting instruction for hazardous materials stored or used on the project site shall be posted at all times in an open, conspicuous and accessible location.

■ Waste storage areas shall be kept clean, well organized and equipped with ample clean-up supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners shall be repaired or replaced as needed to maintain proper function.

### ***Education***

■ Educate employees and subcontractors on what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.

■ Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.

■ Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).

■ Establish a continuing education program to indoctrinate new employees.

■ The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce proper spill prevention and control measures.

## *Cleanup and Storage Procedures*

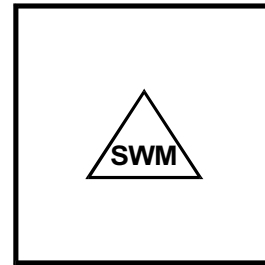
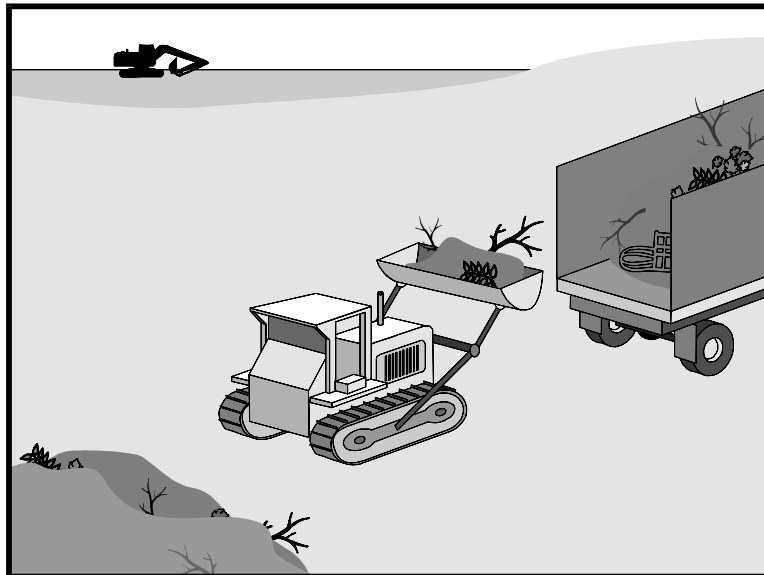
- Minor Spills
  - Minor spills typically involve small quantities of oil, gasoline, paint, etc., which can be controlled by the first responder at the discovery of the spill.
  - Use absorbent materials on small spills rather than hosing down or burying the spill.
  - Remove the absorbent materials promptly and dispose of properly.
  - The practice commonly followed for a minor spill is:
    - Contain the spread of the spill.
    - Recover spilled materials.
    - Clean the contaminated area and/or properly dispose of contaminated materials.
- Semi-Significant Spills
  - Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.
  - Clean up spills immediately:
    - Notify the project foreman immediately. The foreman shall notify the Resident Engineer (RE).
    - Contain spread of the spill.
    - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
    - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
    - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

- Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps shall be taken:
  - Notify the RE immediately and follow up with a written report.
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (805) 852-7550.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor shall notify the National Response Center at (800) 424-8802.
  - Notification shall first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team shall be obtained immediately. Construction personnel shall not attempt to clean up the spill until the appropriate and qualified staff have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, RWQCB, etc.

**Maintenance and Inspection**

- Verify weekly that spill control clean up materials are located near material storage, unloading, and use areas.
- Update spill prevention and control plans and stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored onsite.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to the drainage system or to watercourses as a result of the creation, stockpiling, or removal of construction site wastes.

**Appropriate Applications** Solid waste management procedures and practices are implemented on all construction projects that generate solid wastes.

Solid wastes include but are not limited to:

- Construction wastes including brick, mortar, timber, steel and metal scraps, sawdust, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials.
- Highway planting wastes, including vegetative material, plant containers, and packaging materials.
- Litter, including food containers, beverage cans, coffee cups, paper bags, plastic wrappers, and smoking materials, including litter generated by the public.

**Limitations** ■ Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

## Standards and Specifications

### **Education**

- The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce proper solid waste procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Wherever possible, minimize production of solid waste materials.

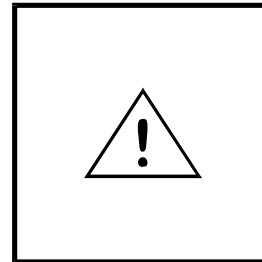
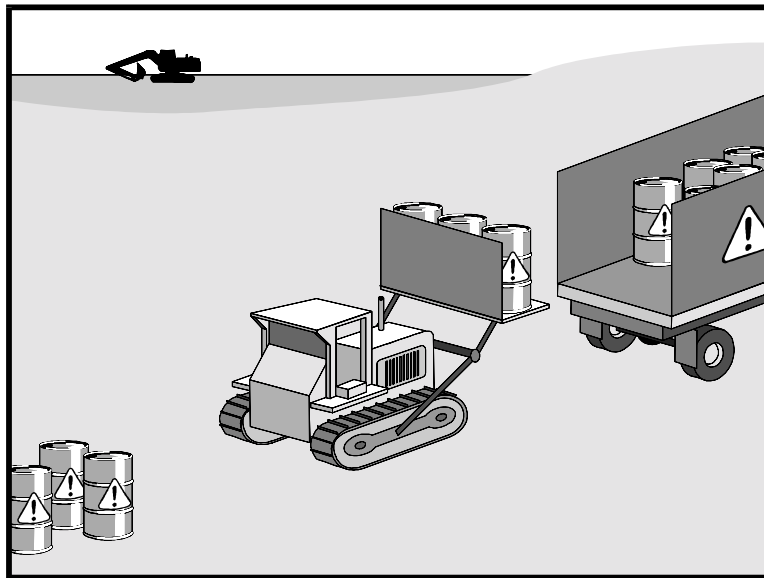
### **Collection, Storage, and Disposal**

- Dumpsters of sufficient size and number shall be provided to contain the solid waste generated by the project and properly serviced.
- Littering on the project site shall be prohibited.
- To prevent clogging of the storm drainage system litter and debris removal from drainage grates, trash racks, and ditch lines shall be a priority.
- Trash receptacles shall be provided in the Contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Construction debris and litter from work areas within the construction limits of the project site shall be collected and placed in watertight dumpsters at least weekly regardless of whether the litter was generated by the Contractor, the public, or others. Collected litter and debris shall not be placed in or next to drain inlets, storm water drainage systems or watercourses.
- Full dumpsters shall be removed from the project site and the contents shall be disposed of outside the highway right-of-way in conformance with the provisions in the Standard Specifications Section 7-1.13.
- Litter stored in collection areas and containers shall be handled and disposed of by trash hauling contractors.
- Construction debris and waste shall be removed from the site every two weeks or as directed by the RE.

- Construction material visible to the public shall be stored or stacked in an orderly manner to the satisfaction of the RE.
- Storm water run-on shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas shall be located at least 15 m (50 ft) from drainage facilities and watercourses and shall not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters shall be securely covered from wind and rain by covering the waste with tarps or plastic sheeting or protected in conformance with the applicable Disturbed Soil Area protection section.
- Dumpster washout on the project site is not allowed.
- Notify trash hauling contractors that only watertight dumpsters are acceptable for use on-site.
- Plan for additional containers during the demolition phase of construction.
- Plan for more frequent pickup during the demolition phase of construction.
- Construction waste shall be stored in a designated area approved by the RE.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Keep the site clean of litter debris.
- Make sure that toxic liquid wastes (e.g., used oils, solvents, and paints) and chemicals (e.g., acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Dispose of non-hazardous waste in accordance with Standard Specification 7-1.13, Disposal of Material Outside the Highway Right of Way.
- For disposal of hazardous waste, see BMP WM-6, “Hazardous Waste Management.” Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
- Salvage or recycle useful vegetation debris, packaging and/or surplus building materials when practical. For example, trees and shrubs from land clearing can be converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.



- Maintenance and Inspection
- The WPCM shall monitor onsite solid waste storage and disposal procedures.
  - Police site for litter and debris.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** These are procedures and practices to minimize or eliminate the discharge of pollutants from construction site hazardous waste to the storm drain systems or to watercourses.

- Appropriate Applications**
- This best management practice (BMP) applies to all construction projects.
  - Hazardous waste management practices are implemented on construction projects that generate waste from the use of:
    - Petroleum Products,
    - Asphalt Products,
    - Concrete Curing Compounds,
    - Pesticides,
    - Acids,
    - Paints,
    - Stains,
    - Solvents,
    - Wood Preservatives,
    - Roofing Tar, or
    - Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302.

- Limitations**
- Nothing in this BMP relieves the Contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
  - This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to BMP WM-7, “Contaminated Soil Management,” and the project special provisions.

## Standards and Specifications

### **Education**

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The Contractor’s Water Pollution Control Manager (WPCM) shall oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

### **Storage Procedures**

- Wastes shall be stored in sealed containers constructed of a suitable material and shall be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172,173, 178, and 179.
- All hazardous waste shall be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers shall be stored in temporary containment facilities that shall comply with the following requirements:
  - Temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.

- Temporary containment facility shall be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks accumulated rainwater and spills shall be placed into drums after each rainfall. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids shall be sent to an approved disposal site.
  - Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
  - Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
  - Throughout the rainy season, temporary containment facilities shall be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs. A storage facility having a solid cover and sides is preferred to a temporary tarp. Storage facilities shall be equipped with adequate ventilation.
- Drums shall not be overfilled and wastes shall not be mixed.
  - Unless watertight, containers of dry waste shall be stored on pallets.
  - Paint brushes and equipment for water and oil based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused shall be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths shall be disposed of as solid waste.
  - Ensure that adequate hazardous waste storage volume is available.
  - Ensure that hazardous waste collection containers are conveniently located.
  - Designate hazardous waste storage areas on site away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.
  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.

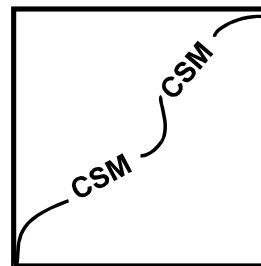
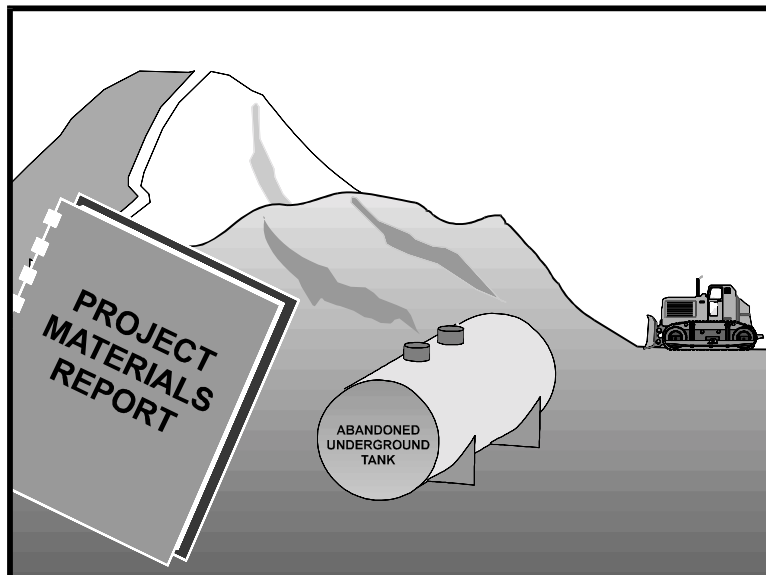
- Segregate potentially hazardous waste from non-hazardous construction site debris.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.
- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.

### ***Disposal Procedures***

- Waste shall be disposed of outside the highway right-of-way within 90 days of being generated, or as directed by the Resident Engineer (RE). In no case shall hazardous waste storage exceed requirements in Title 22 CCR, Section 66262.34.
- Waste shall be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services (DHS) certified laboratory shall sample waste and classify it to determine the appropriate disposal facility.
- Make sure that toxic liquid wastes (e.g., used oils, solvents, and paints) and chemicals (e.g., acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for solid waste construction debris.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Recycle any useful material such as used oil or water-based paint when practical.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

## Maintenance and Inspection

- A foreman and/or construction supervisor shall monitor on-site hazardous waste storage and disposal procedures.
- Waste storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.
- Storage areas shall be inspected in conformance with the provisions in the contract documents.
- Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
- Hazardous spills shall be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
- The National Response Center, at (800) 424-8802, shall be notified of spills of Federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302.
- Copy of the hazardous waste manifests shall be provided to the RE.



Standard Symbol

- BMP Objectives**
- Soil Stabilization
  - Sediment Control
  - Tracking Control
  - Wind Erosion Control
  - Non-Storm Water Management
  - Materials and Waste Management

**Definition and Purpose**

These are procedures and practices to minimize or eliminate the discharges of pollutants to the drainage system or to watercourses from contaminated soil.

**Appropriate Applications**

- Contaminated soil management is implemented on construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, and leaks from underground storage tanks.
- It may also apply to highway widening projects in older areas where median and shoulder soils may have been contaminated by aerially deposited lead (ADL).

**Limitations**

- The procedures and practices presented in this best management practice (BMP) are general. The contractor shall identify appropriate practices and procedures for the specific contaminants known to exist or discovered on site.

**Standards and Specifications**

**Identifying Contaminated Areas**

- Contaminated soils are often identified during project planning and development with known locations identified in the plans and specifications. The contractor shall review applicable reports and investigate appropriate call-outs in the plans and specifications.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities.
  - Detected or undetected spills and leaks.
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements.

- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris. Test suspected soils at a certified laboratory.

## ***Education***

- Prior to performing any excavation work at the locations containing material classified as hazardous, employees and subcontractors shall complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

## ***Handling Procedures for Material with Aerially Deposited Lead (ADL)***

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations shall result in no visible dust.
- Use caution to prevent spillage of lead containing material during transport.
- Monitor the air quality during excavation of soils contaminated with lead.

## ***Handling Procedures for Contaminated Soils***

- To minimize on-site storage, contaminated soil shall be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 6626.250 to 66265.260.
- Test suspected soils at a DHS approved certified laboratory.
- If the soil is contaminated, work with the local regulatory agencies to develop options for treatment and/or disposal.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- If temporary stockpiling is necessary:
  - (1) Cover the stockpile with plastic sheeting or tarps.
  - (2) Install a berm around the stockpile to prevent runoff from leaving the area.
  - (3) Do not stockpile in or near storm drains or watercourses.



- Contaminated material and hazardous material on exteriors of transport vehicles shall be removed and placed either into the current transport vehicle or the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat and/or dispose of it at an appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavation, transport, and disposal of contaminated material and hazardous material shall be in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT).
  - United States Environmental Protection Agency (USEPA).
  - California Environmental Protection Agency (CAL-EPA).
  - California Division of Occupation Safety and Health Administration (CAL-OSHA).
  - Local regulatory agencies.

### ***Procedures for Underground Storage Tank Removals***

- Prior to commencing tank removal operations, obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies, which have jurisdiction over such work.
- Arrange to have tested, as directed by the Resident Engineer (RE), any liquid or sludge found in the underground tank prior to its removal to determine if it contains hazardous substances.
- Following the tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s).

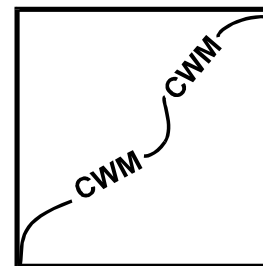
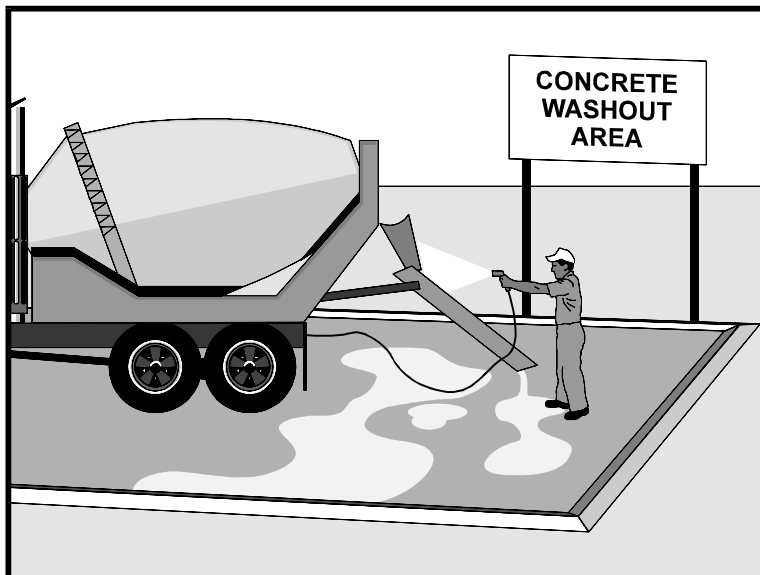
- The underground storage tank, any liquid and/or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal shall be transported to disposal facilities permitted to accept such waste.

### **Water Control**

- Take all necessary precautions and preventive measures to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to: berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, shall be dewatered consistent with BMP NS-2, "Dewatering Operations."

### **Maintenance and Inspection**

- The Contractor's Water Pollution Control Manager, foreman, and/or construction supervisor shall monitor on-site contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.
- Inspect hazardous waste receptacles and areas regularly.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** These are procedures and practices that are designed to minimize or eliminate the discharge of concrete waste materials to the storm drain systems or watercourses.

- Appropriate Applications**
- Concrete waste management procedures and practices are implemented on construction projects where concrete is used as a construction material or where concrete dust and debris result from demolition activities.
  - Where slurries containing portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from sawcutting, coring, grinding, grooving, and hydro-concrete demolition.
  - Where concrete trucks and other concrete-coated equipment are washed on site, when approved by the Resident Engineer (RE). See also NS-8, "Vehicle and Equipment Cleaning."
  - Where mortar-mixing stations exist.

**Limitations** ■ None identified.

**Standards and Specifications** **Education**

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce concrete waste management procedures.

### Concrete Slurry Wastes

- PCC and AC waste shall not be allowed to enter storm drains or watercourses.

- PCC and AC waste shall be collected and properly disposed of outside the highway right-of-way in conformance with Standard Specifications Section 7-1.13 or placed in a temporary concrete washout facility as shown in the figures on Pages 5 and 6.
- Disposal of hardened PCC and AC waste shall be in conformance with Standard Specifications Section 15-3.02.
- A sign shall be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities as shown on Page 6.
- A foreman and/or construction supervisor shall monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Do not allow saw-cut PCC slurry to enter storm drains or watercourses. See also BMP NS-3, "Paving and Grinding Operations;" and BMP WM-10, "Liquid Waste Management." Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine. Saw cutting residue shall not be allowed to flow across the pavement, and shall not be left on the surface of the pavement.
- Vacuum slurry residue and dispose in a temporary facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allow slurry to dry. Dispose of dry slurry residue in accordance with BMP WM-5, "Solid Waste Management", or, for on-site disposal, in accordance with Standard Specification 15-3.02, Removal Methods.
- Collect and dispose of residue from grooving and grinding operations in accordance with Standard Specifications Section 42-1.02 and 42-2.02.

### ***Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures***

- Temporary concrete washout facilities shall be located a minimum of 15 m (50 ft) from storm drain inlets, open drainage facilities, and watercourses, unless determined infeasible by the RE. Each facility shall be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign shall be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities. The sign shall be installed as shown on the plans and in conformance with the provisions in Standard Specifications Section 56-2, Roadside Signs.

- Temporary concrete washout facilities shall be constructed above grade or below grade at the option of the Contractor. Temporary concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities shall have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Perform washout of concrete mixer trucks in designated areas only.
- Wash concrete only from mixer truck chutes into approved concrete washout facility. Washout may be collected in an impermeable bag for disposal.
- Pump excess concrete in concrete pump bin back into concrete mixer truck.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per BMP WM-5, "Solid Waste Management", and in conformance with the provisions in Standard Specifications Section 15-3.02, "Removal Methods."

### ***Temporary Concrete Washout Facility Type "Above Grade"***

- Temporary concrete washout facility Type "Above Grade" shall be constructed as shown on Page 5 or 6, with a recommended minimum length and minimum width of 3 m (10 ft), but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. The length and width of a facility may be increased, at the Contractor's expense, upon approval from the RE.
- Straw bales, wood stakes, and sandbag materials shall conform to the provisions in BMP SC-9, "Straw Bale Barrier."
- Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- Portable delineators shall conform to the provisions in Standard Specifications Section 12-3.04, "Portable Delineators.". The delineator bases shall be cemented to the pavement in the same manner as provided for cementing pavement markers to pavement in Standard Specifications Section 85-1.06, "Placement." Portable delineators shall be applied only to a clean, dry surface.

## ***Temporary Concrete Washout Facility (Type Below Grade)***

- Temporary concrete washout facility Type “Below Grade” shall be constructed as shown on page 6, with a recommended minimum length and minimum width of 3m (10 ft). The quantity and volume shall be sufficient to contain all liquid and concrete waste generated by washout operations. The length and width of a facility may be increased, at the Contractor’s expense, upon approval of the RE. Lath and flagging shall be commercial type.
- Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

## ***Removal of Temporary Concrete Washout Facilities***

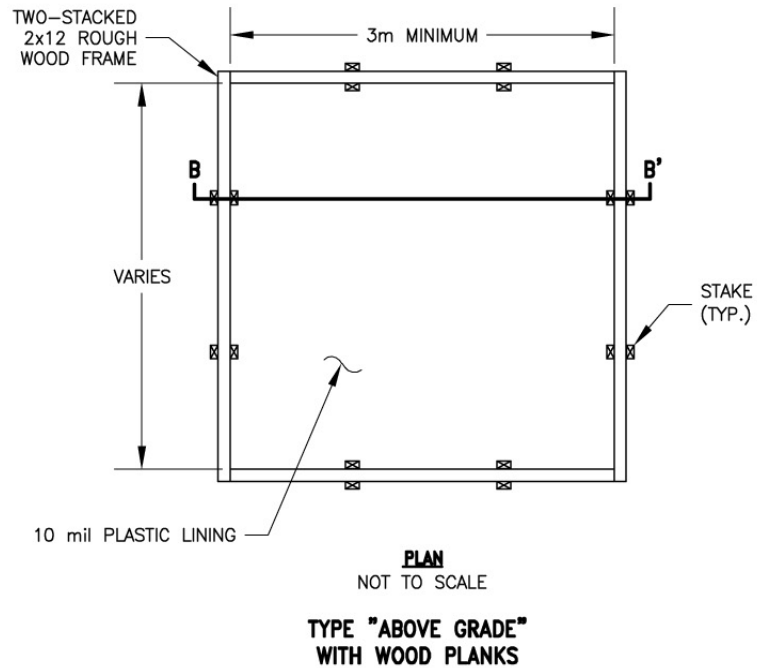
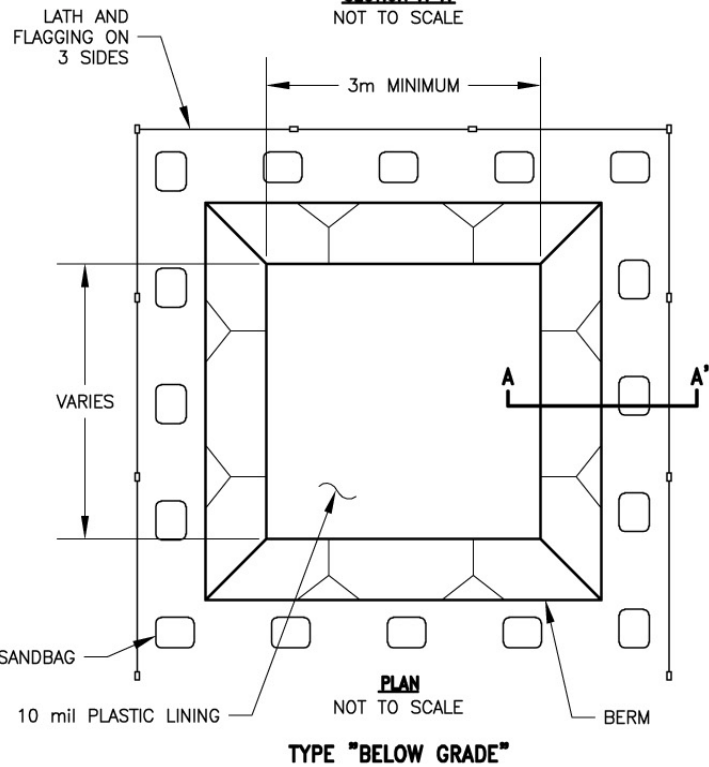
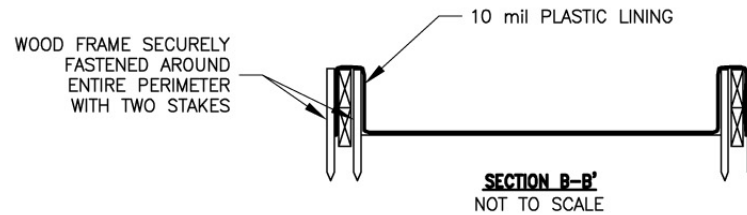
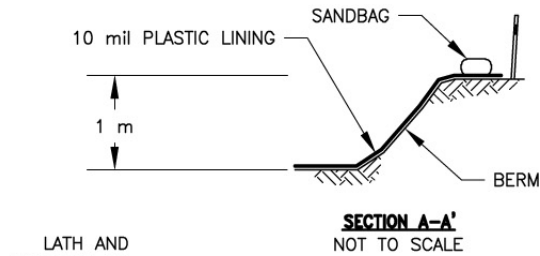
- When temporary concrete washout facilities are no longer required for the work, as determined by the RE, the hardened concrete shall be removed and disposed of in conformance with the provisions in Standard Specifications Section 15-3.02. Disposal of PCC slurries or liquid waste shall be disposed of outside the highway right-of-way in conformance with provisions of Standard Specifications Section 7-1-13. Materials used to construct temporary concrete washout facilities shall become the property of the Contractor, shall be removed from the site of the work, and shall be disposed of outside the highway right-of-way in conformance with the provisions of the Standard Specifications, Section 7-1.13.
- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and repaired in conformance with the provisions in Standard Specifications Section 15-1.02, "Preservation of Property."

## **Maintenance and Inspection**

- The Contractor’s Water Pollution Control Manager (WPCM) shall monitor on site concrete waste storage and disposal procedures at least weekly or as directed by the RE.
- The WPCM shall monitor concrete working tasks, such as saw cutting, coring, grinding and grooving daily to ensure proper methods are employed or as directed by the RE.

- Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials shall be removed and disposed of in conformance with the provisions in Standard Specifications Section 15-3.02, "Removal Methods."
- Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.). Damaged facilities shall be repaired.

# Concrete Waste Management

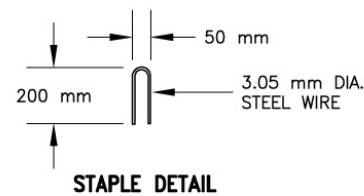
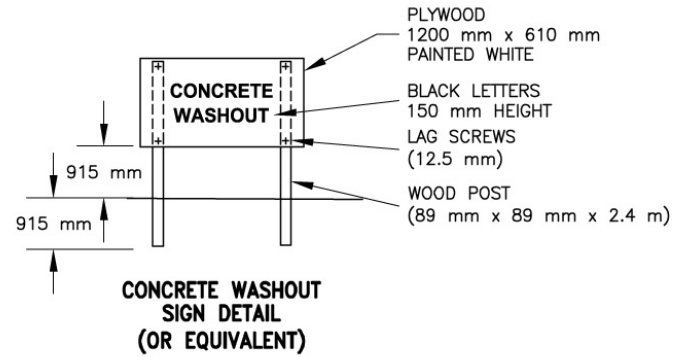
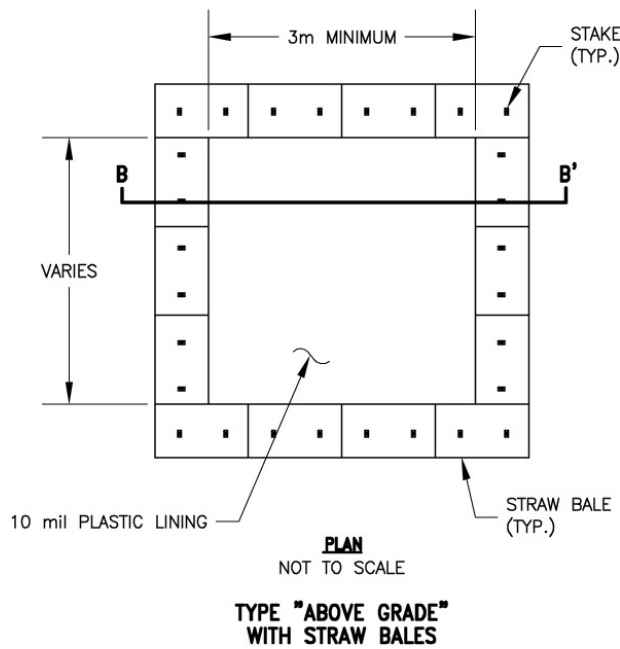
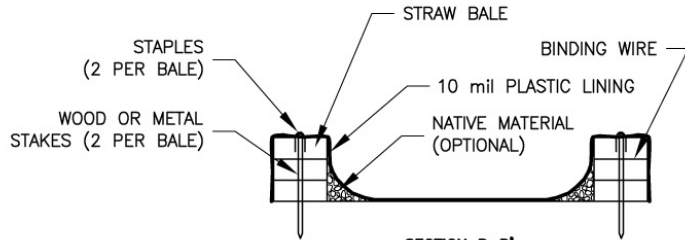


**NOTES:**

1. ACTUAL LAYOUT DETERMINED IN THE FIELD.
2. THE CONCRETE WASHOUT SIGN (SEE PAGE 6) SHALL BE INSTALLED WITHIN 10 m OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



# Concrete Waste Management

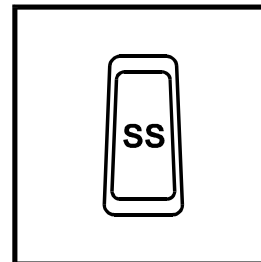
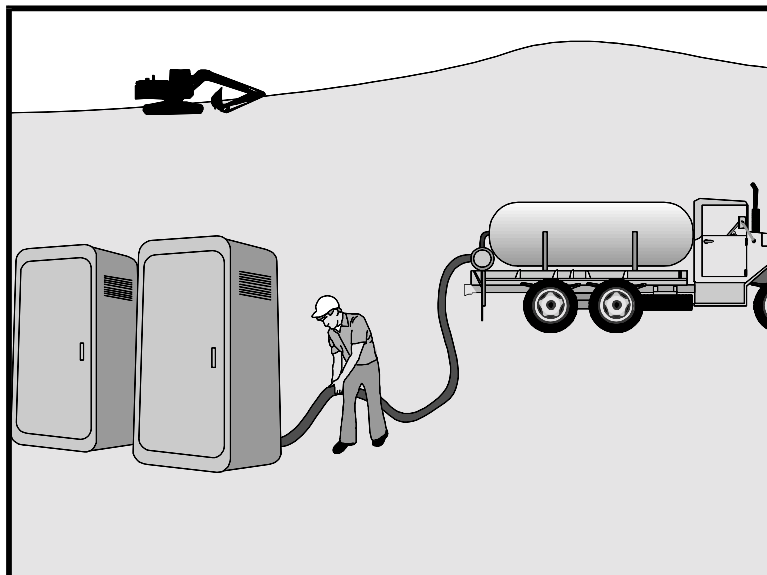


**NOTES:**

1. ACTUAL LAYOUT DETERMINED IN THE FIELD.
2. THE CONCRETE WASHOUT SIGN (SEE FIG. 4-15) SHALL BE INSTALLED WITHIN 10 m OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

CALTRANS/FIG4-14.DWG SAC 8-14-02





Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Procedures and practices to minimize or eliminate the discharge of construction site sanitary/septic waste materials to the storm drain system or to watercourses.

**Appropriate Applications** Sanitary/septic waste management practices are implemented on all construction sites that use temporary or portable sanitary/septic waste systems.

**Limitations** ■ None identified.

### Standards and Specifications

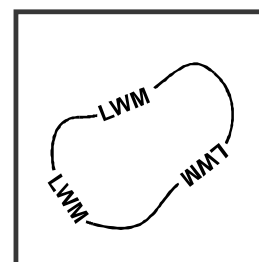
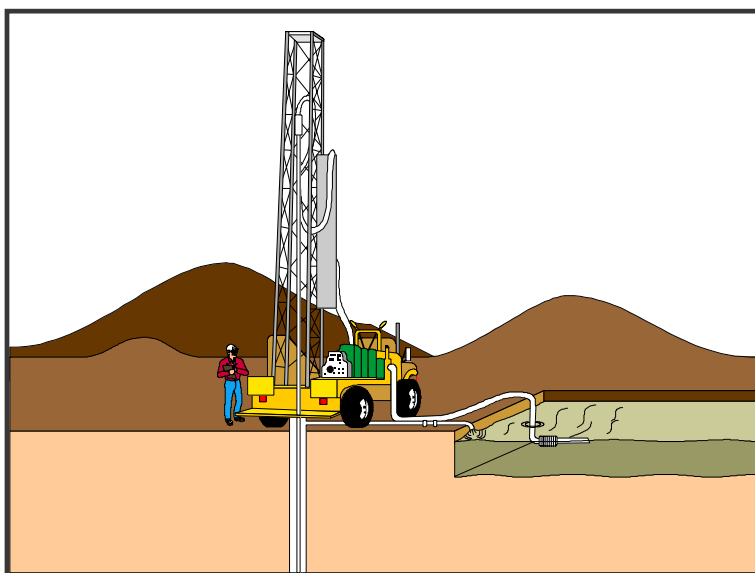
#### **Education**

- Educate employees, subcontractors, and suppliers on sanitary/septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary/septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary/septic waste.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

#### **Storage and Disposal Procedures**

- Temporary sanitary facilities shall be located away from drainage facilities, watercourses, and from traffic circulation. When subjected to high winds or risk.

- Wastewater shall not be discharged or buried within the highway right-of-way.
  - Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, shall comply with the local health agency, city, county, and sewer district requirements.
  - If using an on site disposal system, such as a septic system, comply with local health agency requirements.
  - Properly connect temporary sanitary facilities that discharge to the sanitary sewer system to avoid illicit discharges.
  - Ensure that sanitary/septic facilities are maintained in good working order by a licensed service.
  - Use only reputable, licensed sanitary/septic waste haulers.
- Maintenance and Inspection
- The Contractor's Water Pollution Control Manager (WPCM) shall monitor onsite sanitary/septic waste storage and disposal procedures at least weekly.



Standard Symbol

### BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

**Definition and Purpose** Procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

**Appropriate Applications** Liquid waste management is applicable to construction projects that generate any of the following non-hazardous byproducts, residuals, or wastes:

- Drilling slurries and drilling fluids.
- Grease-free and oil-free wastewater and rinse water.
- Dredgings.
- Other non-storm water liquid discharges not permitted by separate permits.

**Limitations**

- Disposal of some liquid wastes may be subject to specific laws and regulations, or to requirements of other permits secured for the construction project (e.g., National Pollutant Discharge Elimination System [NPDES] permits, Army Corps permits, Coastal Commission permits, etc.).
- Does not apply to dewatering operations (see BMP NS-2, “Dewatering Operations”), solid waste management (see BMP WM-5, “Solid Waste Management”), hazardous wastes (see BMP WM-6, “Hazardous Waste Management”), or concrete slurry residue (see BMP WM-8, “Concrete Waste Management”).
- Does not apply to non-stormwater discharges permitted by any NPDES permit held by the pertinent Caltrans District, unless the discharge is determined by Caltrans to be a source of pollutants. Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground

water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and, discharges or flows from emergency fire fighting activities.

## Standards and Specifications

### **General Practices**

- The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce proper liquid waste management procedures and practices.
- Instruct employees and subcontractors how to safely differentiate between non-hazardous liquid waste and potential or known hazardous liquid waste.
- Instruct employees, subcontractors, and suppliers that it is unacceptable for any liquid waste to enter any storm drainage structure, waterway, or receiving water.
- Educate employees and subcontractors on liquid waste generating activities, and liquid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Verify which non-stormwater discharges are permitted by the Caltrans Statewide NPDES permit; different regions might have different requirements not outlined in this permit. Some listed discharges may be prohibited if Caltrans determines the discharge to be a source of pollutants.
- Apply the NS-8, "Vehicle and Equipment Cleaning" BMP for managing wash water and rinse water from vehicle and equipment cleaning operations.

### **Containing Liquid Wastes**

- Drilling residue and drilling fluids shall not be allowed to enter storm drains and watercourses and shall be disposed of outside the highway right-of-way in conformance with the provisions in Standard Specifications Section 7-1.13.
- If an appropriate location is available, as determined by the Resident Engineer (RE), drilling residue and drilling fluids that are exempt under California Code of Regulations (CCR) Title 23 §2511(g) may be dried by infiltration and evaporation in a containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in BMP WM-08, "Concrete Waste Management."
- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, shall be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.

- Contain liquid wastes in a controlled area, such as a holding pit, sediment basin, roll-off bin, or portable tank.
- Containment devices must be structurally sound and leak free.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.
- Take precautions to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in BMP WM-4, “Spill Prevention and Control.”
- Do not locate containment areas or devices where accidental release of the contained liquid can threaten health or safety, or discharge to water bodies, channels, or storm drains.

### ***Capturing Liquid Wastes***

- Capture all liquid wastes running off a surface, which has the potential to affect the storm drainage system, such as wash water and rinse water from cleaning walls or pavement.
- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.
- If the liquid waste is sediment laden, use a sediment trap (see BMP SC-3, “Sediment Trap”) for capturing and treating the liquid waste stream, or capture in a containment device and allow sediment to settle.

### ***Disposing of Liquid Wastes***

- Typical method is to dewater the contained liquid waste, using procedures such as described in BMP NS-2, “Dewatering Operations”, and BMP SC-2, “Sediment/Desilting Basin”; and dispose of resulting solids per BMP WM-5, “Solid Waste Management”, or per Standard Specifications Section 7-1.13, “Disposal of Material Outside the Highway Right of Way”, for off-site disposal.
- Method of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 Water Quality Certifications or 404 permits, local agency discharge permits, etc., and may be defined elsewhere in the special provisions.
- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined.

- For disposal of hazardous waste, see BMP WM-6, “Hazardous Waste Management.”
  - If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.
- Maintenance and Inspection
- Spot check employees and subcontractors at least monthly throughout the job to ensure appropriate practices are being employed.
  - Remove deposited solids in containment areas and capturing devices as needed, and at the completion of the task. Dispose of any solids as described in BMP WM-5, “Solid Waste Management.”
  - Inspect containment areas and capturing devices frequently for damage, and repair as needed.

# Appendix A

## Abbreviations, Acronyms, and Definition of Terms

### Abbreviations

ac	acre
°C	Degrees Celsius
cfs	cubic feet per second
cy	cubic yards
°F	Degrees Fahrenheit
ft	feet
g	gram
gal	gallon
gpm	gallons per minute
ha	hectares
hr	hour
in	inches
kg	kilogram
kN	Kilo-Newton
kPa	Kilo-Pascal
l	liter
lbs	pound
lf	linear feet
m	meter
m <sup>2</sup>	square meters
m <sup>3</sup>	cubic meters
mm	millimeter
N	Newton
psi	pounds per square inch
s	second
yd	yard
y <sup>2</sup>	square yards
y <sup>3</sup>	cubic yards

### Acronyms

AC	Asphalt Concrete
ABS	Acrylonitrile Butadiene Styrene
ADL	Aerially Deposited Lead
AQMD	Air Quality Management District
ASTM	American Society of Testing Materials
BAT	Best Available Technology
BCT	Best Conventional Technology
BMP	Best Management Practice
CAL-EPA	California Environmental Protection Agency
CAL-OSHA	California Occupation Safety and Health Association
CMP	Corrugated Metal Pipe
CFR	Code of Federal Regulations
DSA	Disturbed Soil Area
ESA	Environmentally Sensitive Area
FEMA	Federal Emergency Management Agency
L:W	Length versus Width
MSDS	Material Safety Data Sheet
OSHA	Occupation Safety and Health Association
PCC	Portland Cement Concrete
PVC	Polyvinyl Chloride
RE	Resident Engineer





RWQCB	California Regional Water Quality Control Board	USDA	United States Department of Agriculture
SSP	Standard Special Provisions	USDOT	United States Department of Transportation
SWMP	Storm Water Management Plan		
SWRCB	California State Water Resources Control Board	US EPA	United States Environmental Protection Agency
V:H	Vertical versus Horizontal	USLE	Universal Soil Loss Equation

## Definition of Terms

**Active Construction Area:** Construction areas where soil-disturbing activities have already occurred and continue to occur or will occur during the ensuing 21 days. This may include areas where soils have been disturbed as well as areas where soil disturbance has not yet occurred.

**Antecedent Moisture:** Amount of moisture present in soil prior to the application of a soil stabilization product.

**Best Management Practice (BMP):** Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

**Construction Activity:** Includes clearing, grading, or excavation and contractor activities that result in soil disturbance.

**Construction Site:** The area involved in a construction project as a whole.

**Contamination:** An impairment of the quality of the waters of the state by waste to a degree that creates a hazard to the public health through poisoning or through the spread of disease including any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.

**Contractor:** Party responsible for carrying out the contract per plans and specifications. The Standard Specifications and Special Provisions contain storm water protection requirements the contractor must address.

**Degradability:** Method by which the chemical components of a soil stabilization product are degraded over time.

**Desert Areas:** Areas within the Colorado River Basin RWQCB and the North and South Lahontan RWQCB jurisdictions (excluding the Mono and Antelope areas, East and West Walker River, East and West Carson River, and the Truckee and Little Truckee River).

**Discharge:** Any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semi-solid or solid substance.



**Disturbed Soil Areas (DSAs):** Areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction activities

**Drying Time:** Time it takes for a soil stabilization product to dry or cure for it to become erosion control effective.

**Environmental Protection Agency (EPA):** Agency that issued the regulations to control pollutants in storm water runoff discharges (The Clean Water Act and NPDES permit requirements).

**Erosion:** The wearing away of land surface primarily by wind or water. Erosion occurs naturally as a result of weather or runoff but can be intensified by clearing, grading, or excavation of the land surface.

**Erosion Control Effectiveness:** The ability of a particular product to reduce soil erosion relative to the amount of erosion measured for bare soil. Percentage of erosion that would be reduced as compared to an untreated or control condition.

**Exempt Construction Activities:** Activities exempt from the General Permit, including routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility; and emergency construction activities required to protect public health and safety. Local permits may not exempt these activities.

**Existing vegetation:** Any vegetated area that has not already been cleared and grubbed.

**Fair Weather Prediction:** When there is no precipitation in the forecast between the current calendar day and the next working day. The National Weather Service NOAA Weather Radio forecast shall be used. The contractor may propose an alternative forecast for use if approved by the Resident Engineer.

**Feasible:** Economically achievable or cost-effective measures, which reflect a reasonable degree of pollutant reduction achievable through the application of available nonpoint pollution control practices, technologies, processes, site criteria, operating methods, or other alternatives.

**General Permit:** The General Permit for Storm Water Discharges Associated with Construction Activity (Order No. 99-08-DWQ, NPDES Permit CAS000002) issued by the State Water Resources Control Board.

**Good Housekeeping:** A common practice related to the storage, use, or cleanup of materials, performed in a manner that minimizes the discharge of pollutants.

**Local permit:** An NPDES storm water permit issued to a District by the RWQCB having jurisdiction over the job site. Requirements of the local permit are generally similar to, but supersede the requirements of the General Permit. The District Storm Water Coordinator should be consulted to identify and to incorporate variances between the local permit and General Permit.

**Longevity:** The time the soil erosion product maintains its erosion control effectiveness.



**Mode of Application:** Type of labor or equipment that is required to install the product or technique.

**National Pollutant Discharge Elimination System (NPDES) Permit:** A permit issued pursuant to the Clean Water Act that requires the discharge of pollutants to waters of the United States from storm water be controlled.

**Native:** Living or growing naturally in a particular region. Compatibility and competitiveness of selected plant materials with the environment.

**Non-active Construction Area:** Any area not considered to be an active construction area. Active construction areas become non-active construction areas whenever construction activities are expected to be discontinued for a period of 21 days or longer.

**Non-Storm Water Discharge:** Any discharge to a storm drain system or receiving water that is not composed entirely of storm water.

**Permit:** The Caltrans Statewide NPDES Permit (see Statewide Permit), General Construction Permit, or local permit, whichever is applicable to the construction project.

**Pollution:** The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water. An alteration of the quality of the water of the state by waste to a degree, which unreasonably affects either the waters for beneficial uses or facilities that serve these beneficial uses.

**Rainy Season:** The dates of the rainy season shall be as specified: use dates in the local permit if a local permit is applicable to the project site and rainy season dates are specified therein; or, if the local permit does not specify rainy season dates and/or in areas of the state not subject to a local permit, the rainy season dates shall be determined using Figure 2-1.

**Receiving Waters:** All surface water bodies within the permit area.

**Regional Water Quality Control Board (RWQCB):** California agencies that implement and enforce Clean Water Act Section 402(p) NPDES permit requirements, and are issuers and administrators of these permits as delegated by EPA. There are nine regional boards working with the State Water Resources Control Board.

**Resident Engineer (RE):** The Caltrans representative charged with administration of construction contracts. The RE decides questions regarding acceptability of material furnished and work performed. The RE has "contractual authority" to direct the contractor and impose sanctions if the contractor fails to take prompt and appropriate action to correct deficiencies. The following contractual sanctions can be imposed by the RE: (a) withholding payments (or portions of payments), (b) suspending work, (c) bringing in a separate contractor to complete work items (the contractor is billed for such costs), (d) assessing liquidated damages including passing along fines for permit violations, (e) initiating cancellation of the construction contract.



**Residual Impact:** The impact that a particular practice might have on construction activities once they are resumed on the area that was temporarily stabilized.

**Runoff Effect:** The effect that a particular soil stabilization product has on the production of storm water runoff. Runoff from an area protected by a particular product may be compared to the amount of runoff measured for bare soil.

**Sediment:** Organic or inorganic material that is carried by or suspended in water and that settles out to form deposits in the storm drain system or receiving waters.

**Statewide Permit:** The National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waster Discharge Requirements (WDRs) for the State of California Department of Transportation (Caltrans). Order No. 99-06-DWQ, NPDES No. CAS000003.

**State Water Resources Control Board (SWRCB):** California agency that implements and enforces Clean Water Act Section 402(p) NPDES permit requirements, is issuer and administrator of these permits as delegated by EPA. Works with the nine Regional Water Quality Control Boards.

**Storm Drain System:** Streets, gutters, inlets, conduits, natural or artificial drains, channels and watercourses, or other facilities that are owned, operated, maintained and used for the purpose of collecting, storing, transporting, or disposing of storm water.

**Storm Water:** Rainfall runoff, snow melt runoff, and surface runoff and drainage. It excludes infiltration and runoff from agricultural land.

**Storm Water Inspector:** Caltrans staff member who provides support to the Resident Engineer. Coordinates activities and correspondence related to WPCP and SWPPP review and implementation.

**Storm Water Pollution Prevention Plan (SWPPP):** A plan required by the Permit that includes site map(s), an identification of construction/contractor activities that could cause pollutants in the storm water, and a description of measures or practices to control these pollutants. It must be prepared and approved before construction begins. A SWPPP prepared in accordance with the special provisions and the Handbooks will satisfy Standard Specifications Section 7-1.01G - Water Pollution, requirement for preparation of a program to control water pollution.

**Temporary Construction Site BMPs:** Construction Site BMPs that are required only temporarily to address a short-term storm water contamination threat. For example, silt fences are located near the base of newly graded slopes that have a substantial area of exposed soil. Then, during rainfall, the silt fences filter and collect sediment from runoff flowing off the slope.

**Waste Discharge Identification Number (WDID):** The unique project number issued by the SWRCB upon receipt of the notice of intent (NOI).

**Water Pollution Control Program (WPCP):** A program that must be prepared and implemented by the construction contractor under Standard Specifications Section 7-1.01G - Water Pollution.



## Appendix B

# Selection of Temporary Soil Stabilization Controls

There are many treatments available to provide soil stabilization. A group of criteria was developed to allow for comparison and differentiation among the product types that are available. These criteria include installed cost, erosion control effectiveness, drying time, and others. For some criteria, values have been assigned by characteristics: an example would be mode of application (e.g., hydraulic seeder, water truck, and hand labor). For other criteria, actual numeric values should be considered based on available data, such as drying time in hours. Refer to Table B-1 for a summary of selection criteria information and ratings for temporary soil stabilization BMPs.

### B.1 Antecedent Moisture

This criterion relates to the effect of existing soil moisture on the effectiveness of a soil stabilization method. While antecedent soil moisture conditions can have an effect on the performance of some methods, (e.g., hydraulic soil stabilizers, temporary seeding) other methods, such as erosion control blankets or impervious covers, are not affected – except perhaps in their ease of installation.

Suppliers of manufactured soil stabilization products affected by antecedent soil moisture specify the conditions under which their products are to be applied. For example, some products clearly benefit from having the soil “pre-wetted” before application of the hydraulic soil stabilizer and as a result, some manufacturers recommend application of water by itself as a first step. Conversely, the binding action of some adhesives on soil particles (and thereby their erosion control effectiveness) can be affected by excessive soil moisture. Therefore, some manufacturers recommend that their products not be applied when the soil is visibly saturated or when standing water is present.

### B.2 Availability

A critical aspect of product specification and use is whether or not a soil stabilization product is readily available. While local sources may be preferable, the seasonal nature of soil stabilization work can create localized shortages of materials. In these cases, usually the material that can be delivered to the job most quickly is the material that is selected for application.

### B.3 Ease of Clean-Up

This criterion applies primarily to the hydraulically-applied soil stabilization materials, but there may be clean-up issues associated with some of the other categories as well (e.g., packaging materials, disposal of excess product, etc).

All of the approved hydraulic soil stabilization products are typically applied using water as a carrier, and to varying degrees, these products can be removed from application machinery and overspray areas with the application of clean water as well. However, cleaning must occur before the material sets or dries, otherwise stronger cleaning solutions of detergent, a strong alkali solution, or a petrochemical solvent must be used. A prudent contractor will take precautions when working

with hydraulic products that have some clean-up limitations, and must follow the BMPs in the SWPPP or WPCP for cleaning of equipment on site.

Regardless of which approach is used for temporary soil stabilization, site clean-up can be problematic due to the following:

- Added time to dispose of waste materials
- Added time to clean hydraulic equipment before the material sets or dries
- Additional quantities of water needed for cleaning operations
- Impact of quick-setting materials on overspray areas such as sidewalks, roads, vehicles
- Contractor resistance to products that require excessive clean-up
- Additional operation and maintenance costs included in contractor's bid.

#### **B.4 Installed Cost**

The estimated installed cost (the cost of the material itself, plus the cost associated with its installation) has a value that corresponds to cost in dollars per hectares, which are used for estimating and bidding. This approach allows for the direct comparison of approaches.

#### **B.5 Degradability**

Degradability relates to the method by which the chemical components of a soil stabilization product are degraded over time. As might be expected, the way in which a product degrades is related to longevity, which is another selection criterion. Both degradability and longevity are sometimes key issues in temporary soil stabilization and long term erosion and sediment control planning.

Soil properties, climate, existing vegetation as well as slope aspect contribute to the degradation of soil stabilization materials. Knowing something about the physical and chemical properties of a product and how these characteristics might interact with site conditions is important when selecting a particular material.

#### **B.6 Length of Drying Time**

Not all materials require drying time, and the drying criterion may be used to differentiate categorical approaches as well as a final screen for the various types of materials within a class of approaches.

Determining when a soil stabilization material is dry or completely cured is a subjective exercise that relies a great deal on manufacturer-published information. In setting standards for this criteria, where drying or curing time is necessary for a particular method to become erosion control effective, manufacturers' recommendations have been followed.

#### **B.7 Time to Effectiveness**

Not all soil stabilization products are immediately effective in controlling erosion: some take time to dry (e.g., hydraulic soil stabilizers) and others take time to grow (e.g., temporary seeding).



However, when some treatments are applied (e.g., rolled erosion control products, plastic sheeting, and straw mulch) they are immediately effective.

### **B.8 Erosion Control Effectiveness**

This criterion measures the ability of a particular product to reduce soil erosion relative to the amount of erosion measured for bare soil. Erosion control effectiveness is described as a percentage the erosion would be reduced as compared to an untreated or control condition.

### **B.9 Longevity**

This criterion simply considers the time that a soil stabilization product maintains its erosion control effectiveness.

### **B.10 Mode of Application**

The mode of application criterion refers to the type of labor or equipment that is required to install the product or technique.

### **B.11 Residual Impact**

This criterion relates to the impact that a particular practice might have on construction activities once they are resumed on the area that was temporarily stabilized. Some examples include:

- Temporary vegetation covers or standard biodegradable mulches might create problems with achieving final slope stability or compaction due to their organic content, and therefore would require removal and disposal.
- Applications of straw or hay fibers might keep soil from drying out as quickly as it might if it was bare.
- Plastic sheeting, netting or materials used in a soil stabilization product might persist longer than needed on or in the soil.

### **B.12 Native**

This criterion relates primarily to selection of plant materials and is important from the standpoint of environmental compatibility and competitiveness.


### **B.13 Runoff Effect**

This criterion measures the effect that a particular soil stabilization product has on the production of storm water runoff. Similar to the erosion control effectiveness criterion, runoff from an area protected by a particular product may be compared to the amount of runoff measured for bare soil and is presented in the matrix as a percentage of the runoff that would occur in an untreated, or control condition.



**Table B-1  
Temporary Soil Stabilization Criteria Matrix**

CLASS	TYPE	Antecedent Moisture	Availability	Ease of Clean-Up	Installed Cost Per Ha	EC Effectiveness (%)	Degradability	Length of Drying Time (hrs)	Time to Effectiveness (days)	Longevity	Mode of Application	Residual Impact	Native	Runoff Effect
Straw Mulch	Wheat Straw	D	S	H	\$5,200	90-95	B	0	1	M	L/M	M		+
	Rice Straw	D	S	H	\$5,200	90-95	B	0	1	M	L/M	M		+
Wood Fiber Mulch	Wood Fiber	D	S	H	\$2,200	50-60	B	0-4	1	M	H	L		+
Recycled Paper Mulch	Cellulose Fiber	D	S	H	\$2,100	50-60	B	0-4	1	S	H	L		+
Bonded Fiber Matrix	Biodegradable	D	S	H	\$13,600	90-95	B	12-18	1	M	H	M		+
Biodegradable	Jute Mesh	D	S	H	\$16,000	65-70	B		1	M	L	M		+
	Curled Wood Fiber	D	S	H	\$26,000	85-90	P/B		1	M	L	M		+
	Straw	D	S	H	\$22,000	85-90	P/B		1	M	L	M		+
	Wood Fiber	D	S	H	\$22,000	85-90	P/B		1	M	L	M		+
	Coconut Fiber	D	S	H	\$32,000	90-95	P/B		1	L	L	M		+
	Coconut Fiber Mesh	D	S	H	\$77,000	85-90	B		1	L	L	M		+
	Straw Coconut Fiber	D	S	H	\$27,000	90-95	P/B		1	L	L	M		+
Non-Biodegradable	Plastic Netting	D	M	H	\$5,000	<50	P		1	L	L	H		+
	Plastic Mesh	D	M	H	\$8,000	75-80	P		1	L	L	H		+
	Synthetic Fiber with Netting	D	M	H	\$86,000	90-95	P		1	L	L	H		+
	Bonded Synthetic Fibers	D	M	H	\$121,000	90-95	P		1	L	L	H		+
	Combination with Biodegradable	D	M	H	\$79,000	85-90	P		1	L	L	H		+
High-Density	Ornamentals		S-M	H	\$1000 - \$4000	50-60			28	M-L	H	L-M	N/E	+
	Turf species		S	H	\$900	50-60			28	L	H	M-H	N/E	+
	Bunch grasses		S-M	H	\$750 - \$3200	50-60			28	L	H	L-M	N	+
Fast-Growing	Annual		S	H	\$900 - \$1,600	50-60			28	L	H	L-H	N/E	+
	Perennial		S	H	\$800 - \$2000	50-60			28	L	H	M	N/E	+
Non-Competing	Native		S-M	H	\$700 - \$4000	50-60			28	L	H	L-M	N	+
	Non-Native		S-M	H	\$1000 - \$1200	50-60			28	L	H	L-H	E	+
Sterile	Cereal Grain		S	H	\$1,200	50-60			28	L	H	L	E	+
Plastic	Rolled Plastic Sheeting		S		\$17,000	100	P		1	M	L	H		-
	Geotextile (Woven)		S		\$14,800	90-95	P		1	M	L	H		-
(PBS) Plant Material Based- Short Lived	Guar	D	S	H	\$1,000	80-85	B	12-18	Same as Length of Drying Time.	S	B	L		0/+
	Psyllium	P	S	H	\$1,000	25-35	B	12-18		M	B	L		0
	Starches	D	S	H	\$1,000	25-30	B	9-12		S	H	L		0
(PBL) Plant Material Based- Long Lived	Pitch/ Rosin Emulsion	D	S	M	\$3,000	60-75	B	19-24		M	B	M		-
(PEB) Polymeric Emulsion Blends	Acrylic polymers and copolymers	D	S	M	\$3,000	35-70	P/C	19-24		L	B	M		+/-
	Methacrylates and acrylates	D	M	M	\$1,000	35-40	P/C	12-18		S	W	L		0/+
	Sodium acrylates and acrylamides	D	M	M	\$1,000	20-70	P/C	12-18		S	H	L		+/-
	Polyacrylamide	D	M	M	\$1,000	55-65	P/C	4-8		M	H	L		0/+
(PRB) Petroleum/ Resin-Based Emulsions	Hydro-colloid polymers	D	M	H	\$1,000	25-40	P/C	0-4		M	H	L		0/+
	Emulsified Petroleum Resin	D	M	L	\$3,000	10-50	P/C	0-4		M	B	M		0/-
(CBB) Cementitious Based Binders	Gypsum	D	S	M	\$2,000	75-85	P/C	4-8		M	H	L		-

 = not applicable for category, class or type  
 UNK = unknown

Source: *Guidance Document – Soil Stabilization for Temporary Slopes*, URS Greiner Woodward Clyde, November 1999.





**Table B-1 (continued)**  
**TEMPORARY SOIL STABILIZATION CRITERIA MATRIX**

<b>Antecedent Moisture</b>	<b>D</b>	Soil should be relatively dry before application
	<b>P</b>	Soil should be pre-wetted before application
<b>Availability</b>	<b>S</b>	A short turn-around time between order and delivery, usually 3-5 days
	<b>M</b>	A moderate turnaround time, between 1-2 weeks
<b>Ease of Clean-Up</b>	<b>L</b>	Require pressure washing, a strong alkali solution, or solvent to clean up
	<b>M</b>	Requires cleanup with water while wet; more difficult to clean up once dry
	<b>H</b>	May be easily removed from equipment and overspray areas by a strong stream of water
<b>Installed Cost</b>		Dollars per hectare
<b>Erosion Control Effectiveness</b>		Percent reduction in soil loss over bare soil condition.
<b>Degradability</b>	<b>C</b>	Chemically degradable
	<b>P</b>	Photodegradable
	<b>B</b>	Biodegradable
<b>Length of Drying Time</b>		Estimated hours
<b>Time to Effectiveness</b>		Estimated days
<b>Longevity</b>	<b>S</b>	1 - 3 months
	<b>M</b>	3 – 12 months
	<b>L</b>	> than 12 months
<b>Application Mode</b>	<b>L</b>	Applied by hand labor
	<b>W</b>	Applied by water truck
	<b>H</b>	Applied by hydraulic mulcher
	<b>B</b>	Applied by either water truck or hydraulic mulcher
	<b>M</b>	Applied by a mechanical method other than those listed above (e.g., straw blower)
<b>Residual Impact</b>	<b>L</b>	Projected to have a low impact on future construction activities
	<b>M</b>	Projected to have a moderate impact on future construction activities
	<b>H</b>	Projected to have a significant impact on future construction activities
<b>Native</b>	<b>N</b>	Plant or plant material native to the State of California
	<b>E</b>	Exotic plant not native to the State of California
<b>Runoff Effect</b>	<b>+</b>	Runoff is decreased over baseline (bare soil)
	<b>0</b>	No change in runoff from baseline
	<b>-</b>	Runoff is increased over baseline